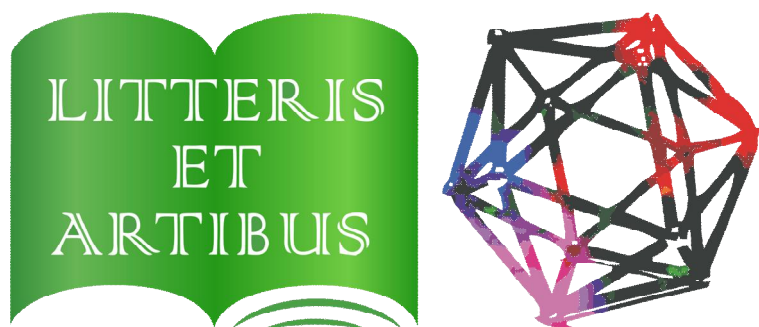


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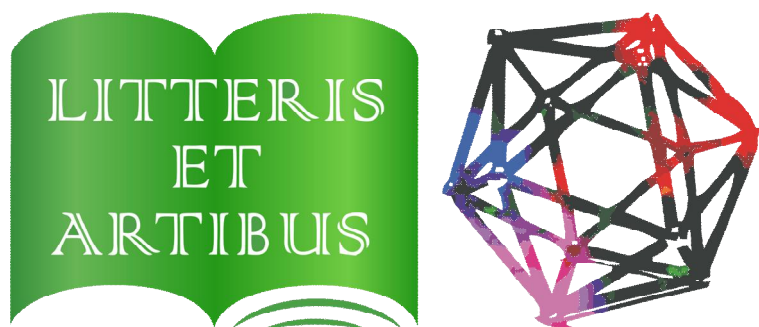
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«LITTERIS ET ARTIBUS»
&
13TH INTERNATIONAL CONFERENCE
«YOUNG SCIENTISTS TOWARDS THE
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**VIII МІЖНАРОДНИЙ
МОЛОДІЖНИЙ НАУКОВИЙ ФОРУМ
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&

**13-та МІЖНАРОДНА КОНФЕРЕНЦІЯ
«МОЛОДІ ВЧЕНІ ДО ВИКЛИКІВ
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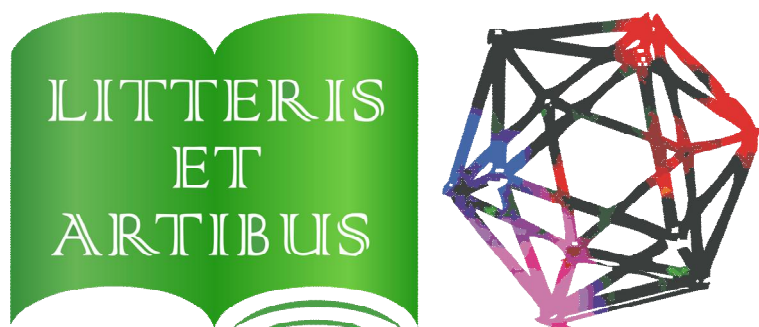
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**10th INTERNATIONAL ACADEMIC CONFERENCE
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Software complex for realization of mathematical models, methods and algorithms of estimation of time of execution of complex problems in multiprocessor computer systems

Yuriy Klushyn

Computer Engineering Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 28a,
E-mail: vladina_t@ukr.net

Abstract – To solve the problem of forecasting, a complete software package was developed based on mathematical models, methods and algorithms of direct stochastic modeling and multilevel stochastic modeling, which are used to estimate the execution time of complex software systems in multiprocessor computer systems.

Keywords: parallel computing systems, complex of interconnected works, direct stochastic modeling, Markov process, function of distribution of random variable.

I. Introduction

At present, the efficiency of using computers and, in particular, parallel computing systems (CS), is estimated in some cases not so much by traditional performance parameters (speed of various operations, their mixtures, typical computing procedures), as the execution time of specific tasks or their sets.

Such an approach is important for evaluating computing systems that operate in control loops, where the main criterion for the quality of a CS is its ability to solve a problem in a certain time. The study of the effectiveness of parallel computing systems for responsible applications of this kind is based on an analysis of the structure of the interrelationships of parallel-sequential tasks (fragments) of a given set [1 - 3] and parameters of its parallelism [4].

In connection with the use of parallel computing systems in real-time control systems, the problem of a priori assessment of the "suitability" of such aircraft for solving a specific set of tasks, which is set by the user, for the required time becomes obvious.

With regard to parallel computing systems, this problem is called the prediction of the execution time of complex software systems; the latter are usually defined by graph models and are considered as complexes of interrelated works (CIW) - tasks and / or their parallel-sequential fragments (subtasks, processes, program modules).

The development of accurate mathematical models and algorithms for analyzing the functioning of parallel computing systems on CIW, which the user sets, with a random execution time of each work (process) would solve the actual problem of reliable analytical evaluation of the execution time of each specific CIW on the computing system.

II. Block - diagram of the software package

The program complex consists of five modules:

- module for setting the structure of the graph;
- module for determining the states of the breaking Markov process (BMP);
- module of transformation of the matrix Q to a block triangular form;
- module for calculating the average time;
- module for calculating the distribution function.

In Fig. 1 shows a block diagram of the links of all the modules listed.

III. The module sets the structure of the graph CWR

This module is used to enter the initial data into the program and consists of two submodules - A and B.

The submodule A is used to enter the initial data using the algorithm described in [5,7]. As the initial data are used:

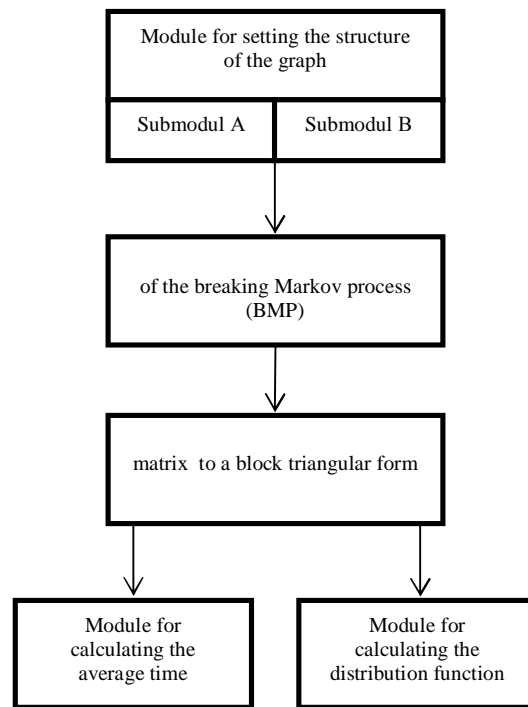


Fig. 1. Block - diagram of the software package.

- connection table of the vertices of the graph, which describes the graph of a given CIW)
- parameters characterizing the given CIW (see below);
- parallel parity parameter - the number k of servicing devices (processors KS);
- parameter cr , which specifies the dispatching criterion.

Parameters characterizing a given CIW are:

- N - the total number of all jobs specified by the CIW;
- μ_j - intensity of service for each job;
- b_j is the degree of connectivity of each work of this CIW, which determines the number of successors
- r_j - the rank of work in the given CIW.

The parameter cr , which specifies the scheduling criterion, can take the following values:

- 0 - dispatching according to the rank criterion: " r_j ";
- 1 - dispatching according to the criterion of the connection level of the vertices " r_j / b_j ";
- 2 - dispatching according to the criterion "the choice of work with the smallest number";
- 3 - dispatching according to the criterion "choice of work with the largest number".

Submodule B serves to set the source data using algorithms for buoyant stochastic modeling [5]. In this submodule, the method of uniform distribution of works of a given CIW in terms of tiers [7] is also used. The source data is the connection table [7] and the above parameters (N, μ_j, b_j, r_j).

IV. Module of determining the states of the breaking Markov process (BMP) when performing a specific CIW

The module implements the algorithms described in Section 2, as well as in [5, 7].

Sets the initial state of the system.

State of the system:

Pool work = $N-1$

Work buffer = 0

Operating device operation = 1

Number of States = 1

Current state = 1

The module uses three working arrays:

- array $Q(s, s)$, which determines the matrix Q of the transition intensity of the considered BMP;
- arrays $X1()$ $X2()$, elements of which is the state of the system $xp(m, iw, jn)$

It should be noted that in direct stochastic modeling, the dimension of the array $Q(s, s)$ can, in principle, be estimated using Eg. (1).

$$S^* = 2 + \sum_{l=1}^k C_{N-2}^l, \quad (1)$$

where k is the number of servicing devices, $k = \overline{1, N-2}$; $C_{N-2}^l = \frac{(N-2)!}{(N-2-l)!l!}$.

This is advisable for CIW with a small amount of work, when the number of states of weapons of mass destruction is deliberately small. For large dimensions of the model, there is a sharp increase in the amount of computation required for processing the matrix Q , and hence an increase in the cost of computer memory. Therefore, to reduce the amount of computer memory used, it is desirable to determine the actual dimension of the array $Q(s, s)$, which is one of the results of the implementation of the algorithms for determining the states of the BMP in this software module. An additional opportunity to save computer memory when implementing the proposed methods is a special numbering and state order in the process of constructing the matrix $Q(s, s)$ [5,7].

V. Module of transformation of the matrix to a block triangular form

This program module not only transforms the matrix Q of the intensities of transitions to a block triangular form, but also forms this matrix in a compressed form, which simplifies and speeds up the implementation of algorithms for obtaining numerical characteristics of the system under study.

To bring the matrix to a triangular shape, it is necessary and sufficient to order the elements of the state vector X .

To reduce the amount of used memory and accelerate the calculation, a special representation of the lower triangular matrix Q of dimension $n * n$ is used in the form of two arrays:

- array $wq(m, p)$ values of zero elements in the row of the matrix Q ,
- array $iq(m, n)$ of numbers of nonzero elements in the row of the matrix Q .

Since in the matrix Q all diagonal elements are nonzero, in the array $iq(m, n)$ the first column is used to indicate the type of row in which the nonzero elements described in it are located. The module also uses an array $num(p)$ of the number of nonzero elements in rows of various types and an array $vec(n)$ of the probability vector of the initial states of a system of dimension s .

VI. Module for calculating the average value of CIW execution time

With the help of this module, the average value of CIW T execution time is calculated on homogeneous resources parallel computing systems. In this case, the module uses one working array $T(s, 4)$, in which the current value T is remembered.

VII. Module for calculating the distribution function

With the help of this module, the distribution function of a random variable T is calculated - the execution time of the complex of interrelated works of a parallel KS. The algorithm for finding the distribution function of a random variable is described in [6].

VIII. Conclusions

Based on the analysis of mathematical models, methods and algorithms of direct stochastic modeling and belt-based stochastic modeling, as well as studies, a software package designed to solve the problem of predicting the execution time of complex branched tasks on parallel

computing systems in full. The given software package calculates the average value and the distribution function of the execution time of a set of interrelated tasks on homogeneous resources of a parallel computing system, and consists of five software modules, which are interconnected. The interconnection of the modules is shown in Fig.1.

Its characteristics on the test example:

- the total amount of computer memory used for processing the transition intensity matrix, corresponds to the implementation of a set of interrelated works on $N < 100$ jobs - about 260 kB;
- the construction of a matrix of transition intensities on a computer of average power is about 7 minutes;
- when calculating the model as a whole - about 16 minutes.

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Context-aware decision support software service

Vadym Sahanovskyi¹, Oleksii Bochkarov²

1. Department of Computer Engineering, Lviv Polytechnic National University, UKRAINE, Lviv, 28a S. Bandera street, E-mail: vadym.sahanovskyi@gmail.com

2. Department of Computer Engineering, Lviv Polytechnic National University, UKRAINE, Lviv, 28a S. Bandera street, E-mail: alb2@ukr.net

Abstract – Considered the problem of using decision support system based on context-aware computing with internal and external economic context. A structural diagram of the algorithm of its work and the chart classes.

Keywords – decision support system, context-aware computing, internal and external economic context.

Introduction

With the fast growing of industrialization and service sector of the economy, the issue of "choice" is becoming more and more relevant, since in today's dynamic world, with the constant uncertainty of economic, political and social factors, making the right decision is not a simple task.

After invention of the first personal computers, humanity began to actively engage in research and development of various systems, which, in one way or another, could simplify the life of people. One of them is the decision support system. Modern decision support systems are systems that are highly adapted to the challenges of day-to-day management, and are an instrument designed to assist decision makers [1].

The interest in decision support systems as a perspective direction in the use of computer technology, as well as in the toolkit for improving the efficiency of economic management is constantly increasing. With the help of these systems, which are included methods of mathematical modeling and management theory, a decision can be made even in unstructured and weakly structured problems, including multi-criteria ones. Therefore, decision support systems are usually multilevel and include theories of databases, artificial intelligence, interactive computer systems, simulation techniques, etc. [2].

Condition of the problem

It is quite obvious that important economic decisions, like all others, have their consequences, but the process of making economic decisions is highly complex, and in the conditions of informatization and globalization that characterize today, this complexity is increasing.

The answer to the difficulties and responsibilities in making these decisions was the emergence in the XX century of a new computer system - decision support system (DSS). DSS is an application that analyzes data in areas of its usage and interprets them in such a way that could make it easier for the user to choose the best option [2].

Any DSS, regardless of its purpose, internal structure and design patterns, implements a number of conceptions. The base concept of intellectualization of the DSS is the integration into it tools and systems of artificial intelligence, expert systems, knowledge bases, etc. [3]. Implementation of this concept allows to receive information from expert systems on specific issues of decision-making, to weaken the formalism of user communication with DSS through the using systems of interpreting the natural language in them.

Real-time context analysis is one of the main tasks of any decision support system, since in certain situations there is a risk of significant loss in decision making based on outdated data. Context awareness processes data of the environment in which DSS should work. For example, global economic trends in the region, its political and geopolitical situation and certain social processes at the moment of the decision-making [3]. The internal context of the person which makes the decision should also be analyzed, such as current and general economic situation, the status of the person in the hierarchy of the society, his physical presence in one place or another, the period of the year and the concrete time, etc.

Formulation of the problem

To propose an approach to solving the problem of decision-making in unstructured and weakly structured problems, including multi-criteria using data systems which includes the methods of mathematical modeling and control theory. Develop a structural scheme, describe the algorithm of the system and give a class-diagramm.

Proposed solutions

To solve this problem, three main and large areas of information technology and economy were combined. The field of monitoring the financial status of a person, decision support systems and context-aware computing.

The algorithm for the analysis of events and the search for regularities using the associative rules method is taken as the basis and combined with the modeling method using the "What If?" analysis.

The algorithms of associative rules allow to find patterns between dependent events. The purpose of the analysis of determining the dependence like "if the transaction met a set of elements X, then we can conclude that another set of elements of Y should also appear in this transaction" [4].

The analysis "What If?" allows solving the optimization problem based on the inverse problem [4]. This type of analysis allows you to search for the values of factors (input variables), in which the desired value of the dependent variable (output variables) will be obtained. The content of the analysis is to answer the question: "What will be obtained if the values of the input variables are given?" For the analysis of the data, it is necessary to construct a model that will simulate the considered dependence. Various algorithms can be used to construct such a "black box" model [4]. Such algorithms can be chosen neural networks, decision trees, linear regression, and others.

The structure of the context-aware decision support software service (Fig. 1) includes three basic subsystems: the user interface, the main function of which is to enable the ODR to interact with the system, using different methods of inputting information and its output formats; subsystem of work with data, the main function of which - saving, management, sampling and analyze data; subsystem of work with models, the purpose of which is to save, manage and select models to give user the answers for his requests [4].

The algorithm of the context-aware decision support software service (Fig. 2) consists of the following main steps: user authorization - login with social networks or create new account; synchronize data with a cloud database and obtain a history of banking transactions; obtaining a current economic context - request data from World Bank Open Data open API; calculation of the index of the user's economic status; building the model of the context based on the received data on trends in economic development; computing a prediction model using "What If?" and

linear regression analysis method; building of the decision model and its extrapolation in a graphical plane based on computed results.

To implement the context-aware decision support software service, the Java programming language, the Android platform as the client part and the Spring Framework for the server part were selected. The database is Firebase Realtime Database, because it allows you to flexibly synchronize data between the client and the server and automatically create backup data and encrypt them, which, in case of work with financial data, has become a decisive factor.

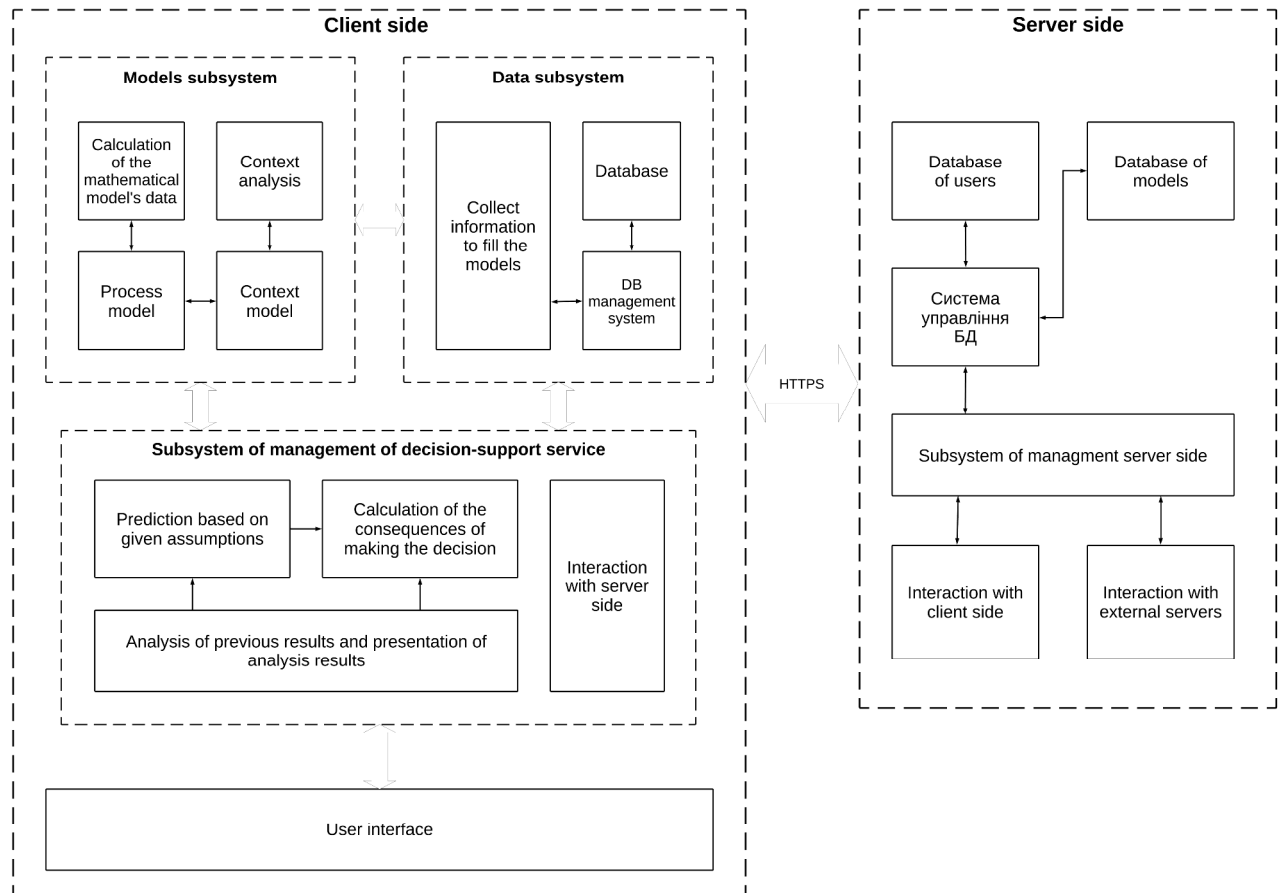


Fig.1. Structure scheme of the context-aware decision support software service.

The client part is designed according to the principles of the so-called "Clean Architecture" [5], according to which the division of the software service into three interrelated levels occurs: the level of presentation, the level of data and the level of business logic that communicates with each other using predefined interfaces according to the design pattern " Inversion of Control " [5].

Conclusion

In this paper, the context-aware service decision support software service is developed. A structural scheme and the algorithm of system are described and presented.

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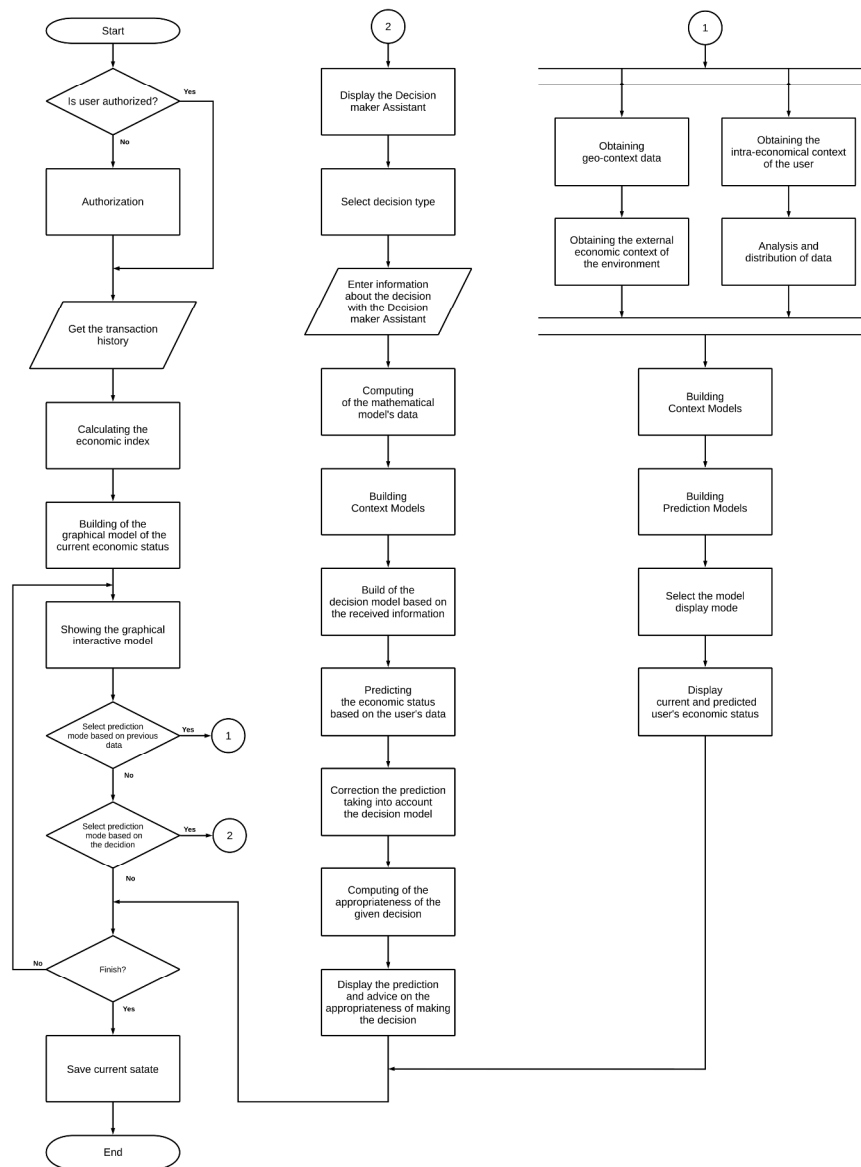


Fig.2. Algorithm diagram of the context-aware decision support software service.

Development of Online Taxi Ridesharing Application

Alina Popova¹, Vasyl Lytvyn²

1. Information Systems and Networks Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera str. 12, E-mail: alaina.popova@gmail.com

2. Information Systems and Networks Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera str. 12, E-mail: vasy17.lytvyn@gmail.com

Abstract – the paper highlights the main principles and modalities for developing a mobile application for sharing the ride via online taxi based on the use of innovative software elements and logistic flow management models. The proposed approach for the development of application is based on the latest marketing course, the use of logistic models and the elimination of analogues.).

Keywords – ridesharing, sustainable development, taxi, alternative commuting means of transport, ecological awareness.

Introduction

Today public transportation services are very common for modern society, whether it is a traditional taxi or newer mobile-powered startup like Uber. Using these kinds of public transportation is not environmentally friendly, and does not reduce the car number on the roads or the amount of air pollution generated by vehicle engines. People are fully aware of the “smart cities”; infrastructure that relies upon digital information and communication technologies to make city living more efficient, more ecologically aware, and healthier [2].

One of the main ways in which that could be accomplished is through innovations designed to reduce road traffic congestion. The concept of ridesharing online taxi application is providing us with an opportunity to reduce pollution, implement sharing economy in the terms of sustainable development.

Smartphones have proven to be game-changers in the recent rise of urban transportation alternatives. Connecting via smartphone with online taxi ridesharing company by downloading an application with maps and route-planning tools. This type of communication is efficient and instant. With ecological awareness at an all-time high, these factors have combined to make ridesharing an increasingly prominent part of the contemporary transportation conversation [3].

The aim

The main aim of this article is to introduce the idea of contemporary environmentally aware online taxi ridesharing application that is suggested as one of the solutions for modern “smart world”.

Problems set-up

Despite numerous environmental problem cautions there is still a lack of promising approaches to effectively change peoples’ transportation mean towards sustainable solutions. By introducing the project in order to settle the process of ride sharing for commuting travel, this work will contribute to address the problem of single occupancy driving.]By implementing an online taxi ridesharing application for commuter travel in real-life circumstances this work views ride sharing from a new perspective and thereby aims to gain new insights and to attempt to get one step closer to solve the problem of consumer behaviour change.

Essence of research

Development fundamental factor of such a service is its unique combination of carpooling and ridesharing analogues like Blablacra and Uber respectfully.

In substantiating the topics of the project, the market of the transportation industry was taken into account by making comparisons with analogues. The information which was obtained during the research showed high competitiveness in the market and compliance with the general requirements of the characteristics, criteria for evaluation, comparison, and quality requirements.

Compliance with general requirements:

- *unification*: the software product is unified by one system;
- *interoperability*: the system is open only for interactions with internal systems, and systems that interact only with elements of the developed software;
- *mobility*: the software has the ability to ship from one operating system to another;
- *user interface*: a user-friendly interface is available with many options.

The quality requirements of FURPS + give high praise to the project as a justification for its implementation.

One of the advantages of this system is the ability to combine many genres into one system thereby increasing the customer market and attracting more users from different genres in one system.

The development of the project is based on purchases, and subscriptions to the developed system. Attracting funds is a system of donates is also one of the ways of development through attracting additional funds.

The developed project is a combination of a login application logon, which protects your personal data, and the main platform. An application itself as a startup system for a developed project selects a test version or a paid subscription. When using a paid subscription, it is possible to use the system in its entirety without functional limitations in the test version.

Within the framework of the developed project, the following main processes will take place:

- *user registration*: if the user information in the database is not available, the system invites him to register to continue to work on the site with the help of Facebook or Google accounts.
- *ordering*: the system creates a new entry in the Order database and automatically brings to it all the details of the order received. Within this process we distinguish:
 - a) customer location data : the user enters his address or indicates his location on the map;
 - b) destination data: the user enters the destination address or marks it on the map;

The project is more innovation oriented towards both the software aspect, the marketing component and the logistics model. Innovative marketing aspect and economic progress in reaching a large number of users from different areas of interest, with the use of various routes of the gaming industry. This, of course, has a direct relationship with current ridesharing trends. As people continue to come together in new ways, transportation itself will keep changing and innovating.

It took the technological revolution, and the brand-new ways of thinking about the man-nature balance to bring it back in a big way. But it's back, and it's here to stay. As traffic congestion, urban pollution and social disconnectedness continue to pose major challenges which this project aims to solve. The design of the processes will equitably split the cost of the ride among the passengers as well as to fairly distribute the economic benefits of ride sharing between the drivers and the passengers. Finally, it is actually helping bring people together in "never before seen" ways and reawakening communities and the sense of interconnectedness that is so vital to life satisfaction.

Conclusions

The project is innovative in various aspects, which gives a high distinction from analogues, which is not a negative feature, but rather a high indicator of competitiveness and uniqueness.

The work on such elements is unique both in technical terms and in terms of ideas, marketing process and the project as a whole.

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Selection of optimal path finding algorithm for data transmission in Distributed Systems

Zakhar Mozil, Yevhenii Vavruk

1. Computer Engineering, Lviv Polytechnic National University, UKRAINE, Lviv, Stepana Bandery 28A,
wormik358@gmail.com

2. Computer Engineering, Lviv Polytechnic National University, UKRAINE, Lviv, Stepana Bandery 28A,
evv1@ukr.net

Abstract - Considered typical structure of the distributed system. Also considered problem of data transmission in a multilevel distributed system. The criteria for optimal pathfinding algorithm are selected and the optimal algorithm is chosen. There is described Bellman-Ford algorithm for finding the path in the graph.

Keywords – shortest pathfinding problem, optimal pathfinding, distributed system, graphs, Bellman-Ford algorithm.

Introduction

One of the main tasks that are solved when designing multi-level distributed data processing systems is to provide the speed of exchange between the nodes of the system. The speed depends on the structure of the system, data transfer protocols and selected algorithms for information transmission. Moreover, system performance depends on chosen pathfinding algorithm.

Therefore, the problem of choosing an algorithm which provide the best way to transmit data is relevant. For this purpose in the article are considered basic pathfinding algorithms in graphs, the basic criteria are determined and the optimal algorithm is chosen.

Distributed System structure designing

So, as the problem of finding an optimal path does not exist in one-level distributed systems - the structure of the system should be multi-level. Let's assume that the weight of the graph is the delay of data transfer between the nodes (one byte data transmission time (ms)), this will allow to determine the optimal path, even consider on the nodes that are overloaded.

Designed structure is multi-level, it has 3 levels. So, any node pair has path between no more than 2 intermediate nodes. In general, the system has 8 nodes. Designed structure is shown in Fig. 1.

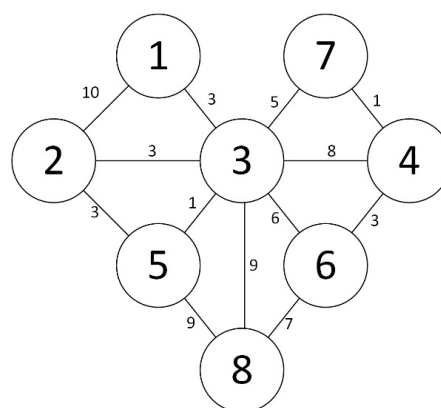


Fig. 1. Designed structure

Pathfinding algorithms

There is a generalized algorithm for finding the optimal path in the graph, the essence of which is as follows: in the weighted graph all the possible combinations of the passage from the initial to the final node are selected, after which for each combination the total weight of all the edges is determined and between all combinations is chosen the one which has the least weight. .

Using a generalized algorithm is not an optimal solution, because of its complexity of calculations. To find the optimal path in the graph, there are other algorithms. A list of algorithms for finding the optimal path and the tasks they solve are presented in Table. 1

All algorithms for finding the optimal path are divided into three categories:

- determining the optimal path between a pair of nodes;
- definition of the optimal path between all pairs of nodes;
- determining the optimal path between a given node and all other nodes.

Table 1

List of algorithms for finding the optimal path in the graph

Name	Problem
Dijkstra	Single source
Bellman-Ford	Single source. Weights can be negative
A*	Node pair
Floyd-Warshall	All node pairs
Johnson	All node pairs. Weights can be negative
Terry	Node pair
Lee algorithm	Node pair
Dantzig algorithm	All node pairs

Criteria for optimal pathfinding algorithm selection

The time complexity of algorithms for finding the optimal path depends on the number of nodes in the graph; accordingly, algorithms for finding the optimal path between all pairs of nodes are not suitable because of the use of a large amount of memory for storing data about paths between nodes and longer time calculations than in other algorithms.

Some algorithms for finding the optimal path on one pairs of nodes use a heuristic function to reduce the time complexity of the algorithm, but algorithms that use the heuristic function do not guarantee that the path between nodes will be optimal. Accordingly, the use of such algorithms is impossible, since it is necessary to calculate the optimal path for data transmission in the distributed system.

As previously mentioned: the weight of a node is a delay in data transmission between adjacent nodes, so the algorithm should work with graphs in which the scales between adjacent edges may differ significantly.

In addition to the above criteria, you also need to have the ability to process the nodes independently of each other, to speed up the search speed of the optimal path. That is, the ability to process a node should not depend on the results of previously processed nodes.

Thus, the search algorithm for the optimal path must meet the following criteria:

1. Solve the problem of finding an optimal path with one pair of nodes or between a given node and all other nodes;
2. Do not use heuristic functions;
3. Have the ability to work with graphs in which the weights of adjacent edges can vary significantly;
4. The ability to process a node should not depend on the results of previously processed nodes.

Optimal pathfinding algorithm selection

Taking into account the above criteria for selecting the algorithm, the list of algorithms from Table. 1 can be reduced.

Such algorithms as: Floyd-Worceshl, Johnson and Danzig do not meet the first criterion.

The algorithm A * uses a heuristic function, therefore, does not meet the second criterion.

The wave algorithm can only work with graphs that have a single length, respectively, the algorithm does not meet the third criterion.

The processing of the next node in the Terry algorithm depends on the result of the previous processed node, so the algorithm does not meet the fourth criterion.

Thus, the following criteria are satisfied by the chosen criteria: Deikstri, Bellman-Ford. Unlike the Dietcaster algorithm, the Bellman-Ford algorithm admits negative weights of edges in a graph. In addition, the complexity of the Bellman-Ford algorithm is $O(V^2E)$, when the complexity of the Deikstry algorithm in the classical realization is $O(V^2E)$. Therefore, the Bellman-Ford algorithm was chosen to implement data transfer in a distributed system.

Bellman-Ford algorithm

The algorithm uses the principle of relaxation, which consists in the fact that each time the node is processed, it records the distance to the nearest node, respectively, at the end of the algorithm, each passed node will contain a distance to the nearest neighbor node.

Let's find the path from point S to point F. The algorithm processes each node in the graph. The node that processes the algorithm is V. The algorithm chooses a node that is adjacent to the current node, denote it U. After that, the relaxation process takes place: if $\text{distance}(S, V) + \text{distance}(V, U) < \text{distance}(S, U)$, then there is an update of the distance from S to U. $\text{distance}(S, U) = \text{distance}(S, V) + \text{distance}(V, U)$. The Bellman-Ford algorithm guarantees the optimal path to each graph node for $V-1$ iterations, where V is the number of vertices in the graph.

The pseudo-code for the algorithm is presented below.

```
function BellmanFord(list vertices, list edges, vertex source)::distance[], predecessor[]
// graph initialization
for each vertex v in vertices:
    distance[v] := inf
    predecessor[v] := null
distance[source] := 0

// relaxation on every vertex
for i from 1 to size(vertices)-1:
    for each edge (u, v) with weight w in edges:
        if distance[u] + w < distance[v]:
            distance[v] := distance[u] + w
            predecessor[v] := u
return distance[], predecessor[]
```

Conclusion

As a result of the analysis, the structure of the distributed system was developed. The criteria for selecting the optimal path search algorithm in the graph were selected. The Bellman-Ford algorithm is chosen to find the optimal way of transmitting data in a distributed system.

In further research it is planned to develop a graph generator according to the given criteria (number of nodes, number of levels of the system, etc.). Develop a Bellman-Ford algorithm based on CUDA technology. The constructed graphs are used to find the optimal path to the developed algorithm and to investigate the speed and memory sizes for different types of graphs.

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Hardware and software complex of intellectualized orioptor-type systems

Roman Diachok¹, Halyna Klym²

Department of Specialized Computer Systems, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E - mails: 1. rodyachok@gmail.com, 2. klymha@yahoo.com

Abstract- *The problem of the development of a miniature, cost-effective, unmanned aerial-terrestrial orioptor for military applications is considered. Solutions from leading foreign and domestic companies and research laboratories on the design and testing of aircraft systems are analyzed. The hardware complex was built as a small-sized orioptor using state-of-the-art electronic components such as the Ardupilot Mega 2.6 chip and GSM module to provide autonomy and orientation in space capability. By increasing the load capacity of the device, it is possible to install additional modules, in particular a photo or video camera and an OSD module that will allow you to overlay the telemetry settings on the image transferred from the camera. Controlled stable hovering will minimize the negative impact of vibrations that arise during the model's wings movement and save battery life.*

Keywords - unmanned aerial vehicle, design, hardware and software complex, microcontroller, orioptor.

Introduction

In an unstable and security-oriented environment, developers are increasingly focusing on the use of defense-based technologies based on small, remotely-managed mobile platforms or can be programmed for autonomous use without the immediate presence of a person within a range of combat activities or on the territory, which monitoring should be carried out [1].

In the field of defense, real-time observation from a close distance has long become an important necessity, which contributes to the study of various methods of "live" communication on the battlefield to provide the necessary support to the troops. For this purpose, unmanned aerial vehicles (UAVs) are often used - miniature devices that follow the flight, in particular birds.

These aircraft are ideal platforms for a variety of tasks, including monitoring and control systems, where the tidal fleet "flock" will be invisible and will have better access to inaccessible places than large aircraft. These systems are widely used in the field of defense during intelligence and surveillance of enemy territory without the detection of the device and without causing suspicion.

Usually real UAV developments include a microcontroller, a set of sensors for determining the required parameters and a surveillance camera for transmitting video information to the receiver in real time. Important attention is paid to optimization of load-carrying capacity, stability during an accident and the ability to repair in field conditions. Thanks to miniaturization of electronics and the emergence of new composite materials, commercial companies, military units and research laboratories are working on the development of numerous unmanned machines and entire platforms for their research and implementation [2].

The most widely used propeller vehicles and fixed wing vehicles. However, these devices have a number of disadvantages and are expensive. Along with them the distribution of other types of devices with non-standard approaches to the construction and working principles. Such devices are UAVs like oriopters, which use wing swings to create lift and traction forces. Small oriopters using wing wings to create aerodynamic forces have a number of advantages over fixed and propeller wings. They are safe to operate because they do not have rotary parts and fuel tanks. It is assumed that by simulating the agility and agility of living flying creatures, oriopters can be multi-purpose UAVs.

The aim of this work is development of own model of the hardware and software complex of UAV ornithopter-type systems using the Ardupilot Mega module and GPS to provide autonomy and orientation in space, as well as the development of flight modes of the ornithopter software.

Results and Discussion

In the projected UAV, all elements of the system are connected to the Ardupilot Mega 2.6 chip. The selected platform is positioned as a flight controller, which includes both a regular microcontroller and a fully-fledged autopilot.

Ardupilot is based on ARM 2.x (DIY Drones), the project contains open source code. The control board combines not only the computing power to control the controllers of engines or servo drives, but also a set of sensors (accelerometer, gyroscope, barometer), based on which indications can be adjusted flight algorithm. The advantage of the board is the availability of autopilot function, which allows the machine to move independently on the given trajectories without external intervention. Various configurations can be used to connect an APM autopilot. In this paper, an airplane type connection is used, which allocates channels for controlling the power plant (Turnigy 2615 EDF Outrunner) and servo drives (Hitec HS-65MG) that are responsible for the control surfaces (elevators, elephants). Used configurations using model of elevator, ailerons and stub and only elevators.

In the developed ornithopter model, the main control surface is the tail, which can control pitch movement up and down and mixed control - a combination of tail movements from side to side, along the axis of the roll, and up and down for dislocation (the hybrid elephant is realized).

Two models of servomotors are used to control the direction of the model, one of which (for controlling the elephant) will bend along with the tail while moving up and down. The servo drive on the pitch is fixed on the fuselage, and for the board on the roll - fixed on a frame that comes back along with the tail.

On the lever of this servo, the tail is fixed with two screws. In addition, in this model we implemented the principle of a flexible wing. The fuselage has a fixed movement mechanism (engine, gearbox and two cranks), from which traction with ball pointers goes to the front edges of the wings. Also, in the mechanism of the swing of the wings provides for the possibility of securing a certain position to ensure the planar flight of the ornithopter as presented in [3].

The electric motor through the two-stage gear reduces the movement of the wings. The configuration connection is organized in such a way that the inputs of the autopilot cards are connected to the four ports of the radio signal receiver. One of them is used to control the engine's turns, the second one - to choose the flight mode, and two more - to control the servo drives. Structural and functional connection diagrams are shown in Fig. 1 and Fig. 2, respectively.

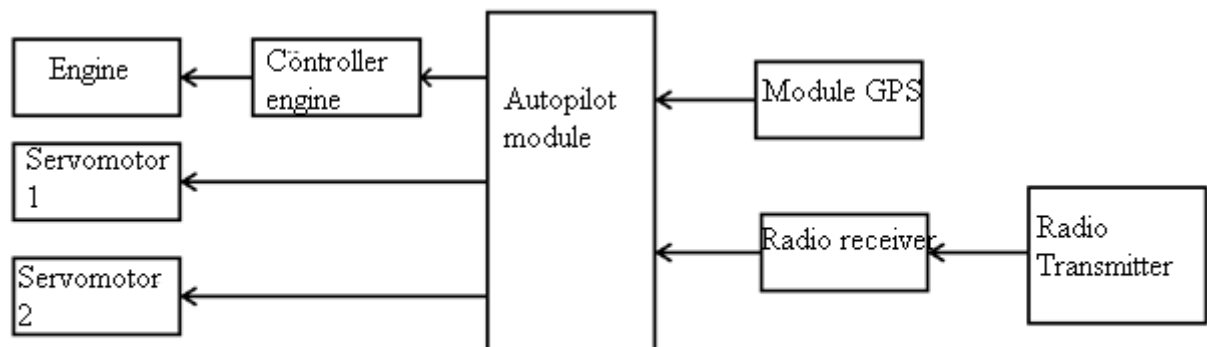


Fig. 1. The block diagram of connecting the main elements of a projected UAV ornithopter-type.

Autopilot outputs are connected to the servo drives and to the motor (via the ESC circuit - the speed controller). Power is fed through the controller of the revision at the same time on all elements of the system. Also, the GPS module is connected to the corresponding port. The module itself autopilot is mounted on the fuselage. To recognize autopilot the directions of motion and correct positioning, it is mounted on a special stand to reduce the negative impact of vibrations on gyroscopes and accelerometers.

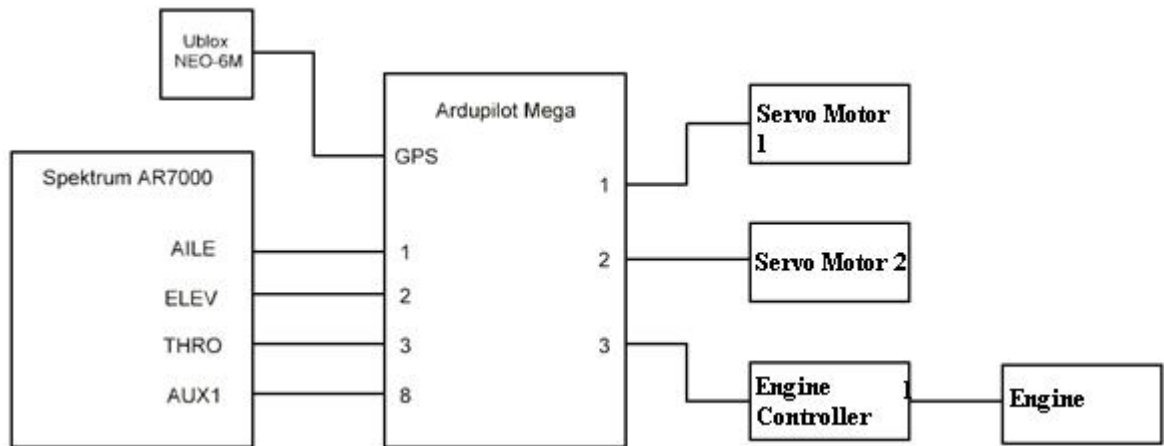


Fig. 2. Functional scheme of connecting the main elements of a projected UAV ornithopter-type.

With this configuration, one of the levers of the control panel will be responsible for controlling the speed of the engine and, accordingly, the speed of the model, and the second - for managing the servo - that is, the direction of movement of the device. One of the available switches will be responsible for switching flight modes.

The work of the designed ornithopter can be arranged in 12 modes of work available for this software, both for manual, and for autonomous control of the device. In this work, the Mission Planner worked out manually, Stabilize, Stabilize, RTL, and AUTO points (Fig. 3).

The configuration and programming of the board is implemented with the use of the Mission Planner [4], which additionally allows you to change the sensor display, build a flight plan, simulate flight for manual control skills, view the so-called "logs" (a separate memory chip in the board). for "logging" of flight data, so-called "black box"), etc.

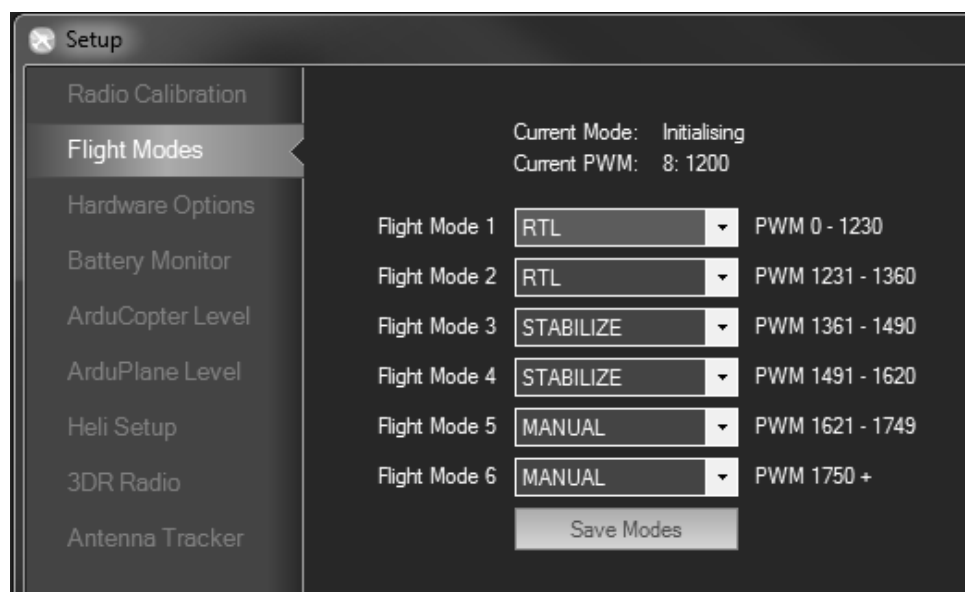


Fig. 6. Configure the flight modes of the ornithopter.

Switching modes was implemented with the switches on the remote control (transmitters) [5]. A certain position of the switch is brought in a certain mode. It is also possible to switch modes through a ground control station - a computer, for this it is mandatory to install a radio modem module, the availability of which will allow not only to switch modes, but also to obtain telemetry data (Fig. 4).



Fig. 4. Receiving telemetric data by the Mission Planner program, fixed by the projected ornithopter.

Conclusions

Thus, the hardware-software complex developed in this paper - a small-sized UAV type of ornithopter can be used to monitor the territory of both military operations and areas of civilian significance. By increasing the capacity of the device, you can install additional modules, such as a photo or video camera and an OSD module, which will allow you to apply telemetry parameters to the image transmitted from the camera. Controlled stable hovering will minimize the negative impact of vibrations that arise during the model's wings and save battery life. Changing and optimizing autonomous flight modes can improve handling and enhance the functionality of the ornithopter.

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Creating a virtual tour of the main building at Lviv Polytechnic National University

Antonii Rzheuskyi¹, Nataliia Veretennikova², Rostyslav Laba³, Nataliia Kunanets⁴

1. Information Systems and Networks Department, Lviv Polytechnic National University, UKRAINE, Lviv, Bandery Street 12, E-mail: antonii.v.rzheuskyi@lpnu.ua

2. Information Systems and Networks Department, Lviv Polytechnic National University, UKRAINE, Lviv, Bandery Street 12, E-mail: nataver19@gmail.com

3. Information Systems and Networks Department, Lviv Polytechnic National University, UKRAINE, Lviv, Bandery Street 12, E-mail: rostiklaba@gmail.com

4. Information Systems and Networks Department, Lviv Polytechnic National University, UKRAINE, Lviv, Bandery Street 12, E-mail: nek.lviv@gmail.com

Abstract – The technological process of creating a virtual tour of the main building at Lviv Polytechnic National University is revealed.

Keywords – virtual tour, Internet network, higher education institution, Google Street View, user.

Introduction

Nowadays, the visualization of the surrounding space on the Internet plays an important role to increase the comfort level of information perception. There is a tendency to create different forms of promotional multimedia products such as presentations, video, virtual tours by various educational and cultural institutions. We believe that positioning on the Internet should become a priority for Internet marketing of higher educational institutions.

The purpose of this paper is to open up the process of creating a virtual tour of the main building at Lviv Polytechnic National University.

Main part

A virtual tour is a subject of research by a lot of domestic scientists. So, O. Kamushkov and V. Yazin consider the virtual tour as one of the most effective means of presenting information on the Internet [1]. N. Anipko, O. Falendish, D. Stasiuk think that virtual tours and excursions are an integral part of virtual tourism [2]. In this case, we have identified the main tasks for creating a virtual tour, namely:

- determining the locations to be presented in the virtual tour;
- taking and processing photographic materials for these locations;
- forming a navigational map and a tree of transitions around the excursion on the basis of definite locations;
- testing virtual tour software;
- introducing created photo and other materials in a virtual tour;
- integrating the virtual tour and its individual locations with the university's website.

To create a virtual tour, the specialized software is required [3]. This project will be created by means of Google Street View, as it has a significant number of benefits:

- 1) Ability to play the virtual tour by the Google Street View app, a browser or a mobile device.
- 2) The resource will be available both on the site of Lviv Polytechnic and on the Google Street View site, which means that this tour will be viewable by all users of Google Street View.
- 3) Correctly works with all devices and browsers.
- 4) No need for constant support of the project.
- 5) High speed photo upload.

- 6) Better quality transitions between panoramas.
- 7) Improved system of transitions (Fig. 1).

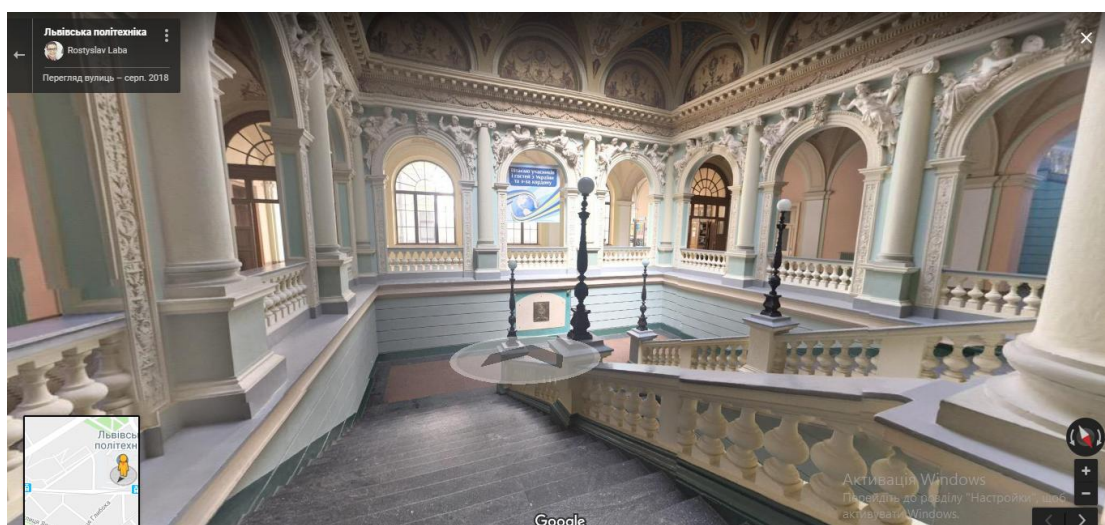


Fig.1. A fragment of the virtual tour of the main building at Lviv Polytechnic National University.

Conclusion

Having analyzed the presented virtual tours, we have come to the conclusion that higher education institutions of Ukraine have largely not paid any attention to self-presentation on the Internet with the help of multimedia content, including virtual tour. Thus, the technological process of creating a virtual excursion by the main building of Lviv Polytechnic National University is described.

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Computer system for video-based Traffic Violation Detection

Guk B.A.¹, Morozov Y.V.²

1. Computer department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera street 12, E-mail:

bogdanguk@gmail.com

2. Computer department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera street 12, E-mail:

urimor@polynet.lviv.ua

The problem of road rules violation detection based exclusively on visual information from road cameras is considered in this paper. Methods of vehicle speed violation detection are analyzed. Structural scheme, algorithm and practical realization method are proposed.

Keywords: computer vision, video processing, realtime vehicles speed estimation.

Introduction

According to statistics released on the website of the Corestone Corp analytical group [1], Ukraine is among the top ten European countries in terms of mortality rates in traffic accidents.

One of the key issues for traffic accident reduction is detecting traffic violations. Current solution is traffic cops and laser speed guns TrueCam. Although these solutions are quite enough and have already proven themselves, their use is limited in countries with poor economic status, where there is no balance between the number of vehicles and infrastructure, in connection with the high price of equipment and payment for police officers. Furthermore, RADAR or LIDAR systems can identify only speed failure. Another way is to use traffic cameras and microcomputers for only video-based motoring offences detection.

The problem is to suggest a method for determining vehicle speed which does not require complex and expensive equipment and will only use video information for detecting license plates and speeding. The basic idea of this method is to use geometric information from the surveillance camera to evaluate the speed of vehicles.

Solving the problem

To solve the problem, we assume that a camera is mounted centrally over the road (Fig. 1).

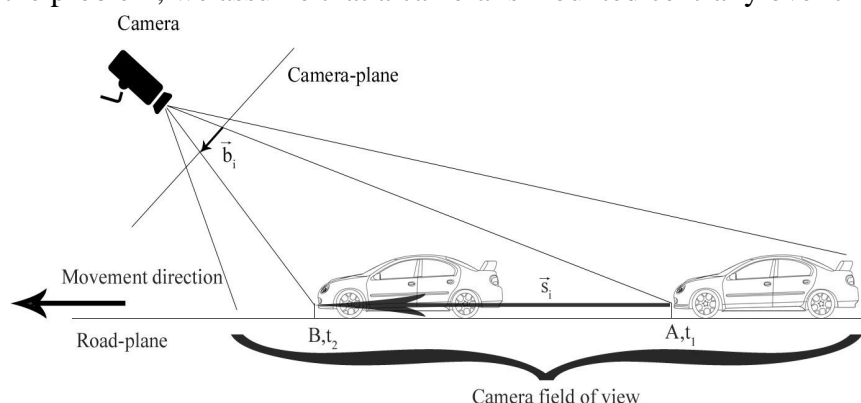


Fig. 1. Diagram of a video-based system for motoring offences detection

An important assumption for developing an algorithm is that the road surface can be reflected on the plane of the camera's photosensitive element, and hence the path that passes the car on the road and the way that its image passes between the frames will be proportional.

When a vehicle enters the camera field of view, the camera detects it. Afterwards, it was decided to look for vehicle license plates using the Viola-Jones algorithm due to its high speed [4]. The essence of the algorithm is that the image moves the "window" of the established size,

and for each area over which the “window” passes the values of the Haar attribute, the presence or absence of the desired object is determined by the difference between the learning threshold and the acquired values of the sign.

Previously it was believed that Viola-Jones's method could not be used to recognize text [5]. This statement was refuted in the paper [6]. The basis of the method laid the following principles:

- 1) Use images in the integral representation
- 2) Use the signs of Haar fig.2
- 3) All signs enter the classifier entry, which gives the result "True" or "Not true"
- 4) Use cascade of signs for rapid rejection windows where no license plate was found.

In the integral representation of images, a matrix of size $width \times height$ is formed, coinciding in size with the input image [7]. Elements of the matrix are calculated by the equation Eq.1, where $I(i,j)$ is the pixel brightness of the input image.

$$L(x,y) = \sum_{i=0,j=0}^{x,y} I(i,j)$$

Eq. 1. Matrix element calculation

The advantage of an integral representation is the ability to quickly calculate the total brightness of any rectangle in the image, while the calculation speed does not depend on the size of the rectangle.



Fig. 2. Possible variants of Haar signs

The result of the license plates for two consecutive frames of the video stream will be the displacement vector $\vec{E}_i = U_i(t_2) - U_i(t_1)$, where $U_i(t_1)$ - the position of the license plate mark on the image at the time moment t_1 , and $U_i(t_2)$ at the time moment $t_2 = t_1 + \Delta t$, respectively, where Δt - the time interval between successive frames.

The algorithm for determining the speed of a vehicle is based on bias vectors obtained by identifying license plates and tracking their positions between frames. With bias vectors, we can determine the speed at a specific time interval, where the time between successive frames is known to us and represents the inverse of the frequency with which the camera takes off, for example, for 30 frames per second = 1/30 sec. The main task of the algorithm is to shift the displacement from pixels to kilometers per hour.

To provide an acceptable processing time, the image can be taken from a video stream at a rate of 2 frames per second, which gives the image processing 500ms. This time should be enough for embedded ARM-based solutions such as Raspberry-pi B +.

Conclusion

In this paper, the principle of constructing a computer system for detecting violations of traffic rules, as an example of exceeding the speed regime is considered. A method for determining speeds that does not require complex and expensive equipment and uses only video

information for detecting license plate numbers and speeding is proposed. The basic idea behind this method is to use geometric information from the surveillance camera to evaluate the speed of vehicles.

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Monitoring and analysis of air indicators from sensors of various types in the cyberphysical system “ Smart home”

Ruslan Bachynskyy¹, Mykhailo Stefanivskiy²

1. Computer Engineering Department, Lviv Polytechnic National University, Ukraine, Lviv, Stepan Bandera str., 12,
Email: bac_ruslan@ukr.net

2. Computer Engineering Department, Lviv Polytechnic National University, Ukraine, Lviv, Stepan Bandera str.,
12, Email: muxailo717@gmail.com

The problem of the choice of technology, on the basis of which can be developed, is considered system of processing and display air indicators in indoors. The advantages of selected technologies are considered and technology is proposed for solving the problem

Key words - Internet of Things, client-server system, temperature indicators.

Introduction

The system for processing and displaying indicators in the building at this moment is the best option for remote monitoring of the premises.

More recently, the notion of IoT (Internet of Things) has emerged - a network concept consisting of interconnected physical devices with built-in sensors, as well as software that allows the transmission and data exchanging between the physical world and computer systems, using standard communication protocols. The prospect of development of this concept is enormous, since the system built on the basis of the IoT, allows remote monitoring of various indices in the room, which in turn allows quick detection of possible problems.

Condition of the problem

The world of technology doesn't stand on the spot, which means that you always need to improve your product. There are several details that need to be improved in building IoT systems that are popular nowadays: the ability to track all data in real-time, the timely notification of users about the exceeding of a particular parameter over the allowed range, and the development of a more user-friendly interface.

In the XXI century, this topic is very relevant, because such systems contribute to increasing the safety of people in the building, and significant cost savings, due to the possible problems rapid detection.

The aim of the work is to develop a system for processing and displaying building indicators, which will be convenient for use and will contain the necessary functionality.

Formulation of the problem

Choose the technology that is most suitable for the processing and display of air indicators of a various type. Consider the trends of the chosen technology and suggest a possible implementation.

Solving the problem

Comparison of technologies for the processing and display of temperature indicators.

One of the most popular room monitoring systems is Microsoft Azure. Users of this system can monitor the different sensors state in real-time, or for a certain time range. Monitoring becomes possible after authorizing the Azure system, and creating your own review page. The main advantage of such services is the possibility of remote control over the entire premises, and therefore, the prevention of possible breakdowns or failures in the system of heat supply, power supply, and others.

Microsoft Azure is a cloud-based platform and Microsoft infrastructure designed for cloud computing applications developers and designed to simplify the process of creating online applications.

The concept of cloud computing is using computing power, disk space and communication channels "computing cloud" for the implementation of laborious tasks. The load between the computers in this cloud is distributed automatically. Most cloud applications work in the browser. The main advantages of such approach are: user-friendly interface, ability to create a project page for monitoring the premises and select indicators to be monitored.

1. The concept of the Internet of things. Internet of Things - One of the most popular concepts in modern futurology. And moreover, one of those few who are no longer concepts and are embodied in life.

According to the most widespread formulation, Internet of things are the concept of a computer network of physical objects (that is, things, actually) that are equipped with such technologies to interact with each other.

The concept suggests that Internet of things can seriously affect society life, since it allows automating a lot of processes. Internet of Things (IoT) is a global network of physical devices connected to the Internet - "things" that are equipped with sensors, sensors and data communication devices. These devices are united by connecting to information control and processing centers. In a separate direction, IoT, apparently, stands out in the middle of zero when the number of devices connected to the World Wide Web exceeded the number of users.

IoT combines real things into virtual systems that are capable of solving completely different tasks. The key idea of the concept is to connect all the objects that can be connected to network.

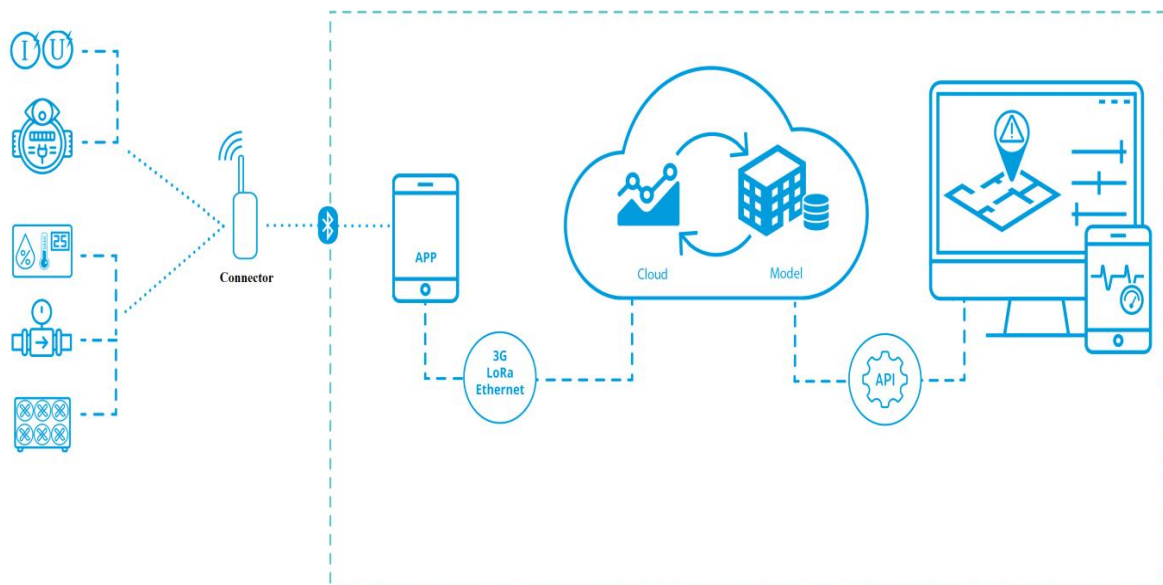


Fig.1. IoT system

The advantages of such system can be considered to be that due to automation, people will have more free time. Connected devices on the Internet will also give people more opportunities for rational resource management. Already today, they help to optimally spend heat, water, light and save on payment of utilities. It is important to note that not only the lives of individuals, but also entire industries will change. One of the most susceptible industries to change will probably

be a telecom, as mobile operators will gradually change their business models from network providers to smart service providers and applications.

2. Principles of functioning. To implement IoT requires an ecosystem that would include "smart things" - various devices equipped with sensors; access network and information transmission (mobile or fixed - not important); as well as platforms for managing the network, devices and applications.

Today, there are several specialized standards for data transmitting between "smart" devices. The eMTC (enhanced Machine-Type Communication) standard is deployed on the basis of mobile LTE networks, and the EC-GSM-IoT (Extended Coverage - GSM - Internet of Things) runs over the GSM network. But the most popular is the standard NB-IoT (Narrowband IoT). Its feature is that it can be deployed, either on GSM or LTE networks, and independently, on a separate network.

You can conventionally divide all IoT projects into two groups, depending on the type of device communication: massive (Massive MTC) and critical (Critical MTC). Each type has its own tasks, and each of them has its own requirements for the network. Massive IoT projects are "smart" homes, counters, solutions for tracking freight or agriculture, and so on.

Such solutions involve the transfer of a small amount of data from a large number of sensors. Also, these decisions are characterized by the uncertainty of the guaranteed transmission-receiving information. Losing some parts of information from the counter is not critical, because the data will be updated during the next session.

The basic requirements here are the low cost of devices and their minimum power consumption. Partly these projects can be implemented on the basis of GSM networks, but most truly massive solutions are built on the basis of LTE infrastructure. With regard to solutions based on "critical" machine communications, they have completely different inquiries. First of all, it is ultra-low signal transmission delay (less than 5 milli-seconds) and ultra-high reliability of the network.

Not for nothing, such applications are called "critical", because they are dependent from the work of the network, what could have influence the safety and even the people life. Examples of such applications can be autonomous cars, traffic management, remote surgery or industrial equipment management. These solutions still exist in the form of prototypes or test samples, since they require the next generation networks of 5G to implement them.

3. Technologies used for realization.

To combine everyday things with the network the following should be taken into account:

- Object identification. Only unique identification system can provide correct collecting and accumulating information about a particular object in the network.
- Data processing. For sensors data processing and accumulation, a built-in processor(computer) (such as Raspberry Pi, Intel Edison) should be used.
- Data transmission without wired connection. Wireless technology (Wi-Fi, Bluetooth, ZigBee, 6LoWPAN) can be used to exchange information between devices which are mobile and autonomous.

An important element in building the Internet of things is also an architectural template. To solve this problem, the best architectural template is Model-View-Controller (MVC). It is an architectural template that is used when designing and developing software.

This template involves dividing the system into three interrelated parts: a data model, a view (user interface), and a control module. It is used to separate data (models) from the user

interface (view) so that changes to the user interface minimally affect the operation of data, and changes in the data model could be carried out without changing the user interface.

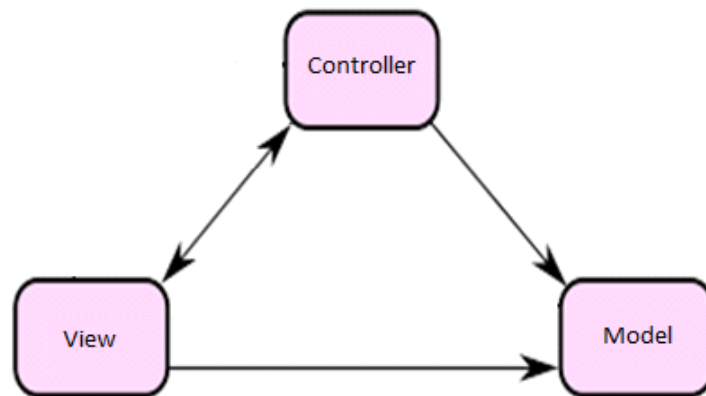


Fig.2. MVC pattern

Client-server architecture. This architecture is the dominant concept in creating distributed network applications and involves interaction and sharing of data between them.

This architecture includes the following main components:

- a set of servers that provide information;
- a set of clients who use services provided to servers;
- Network - provides interaction between clients and servers.

Servers are independent of each other. Customers also function in parallel with each other. One server can process queries simultaneously from different clients.

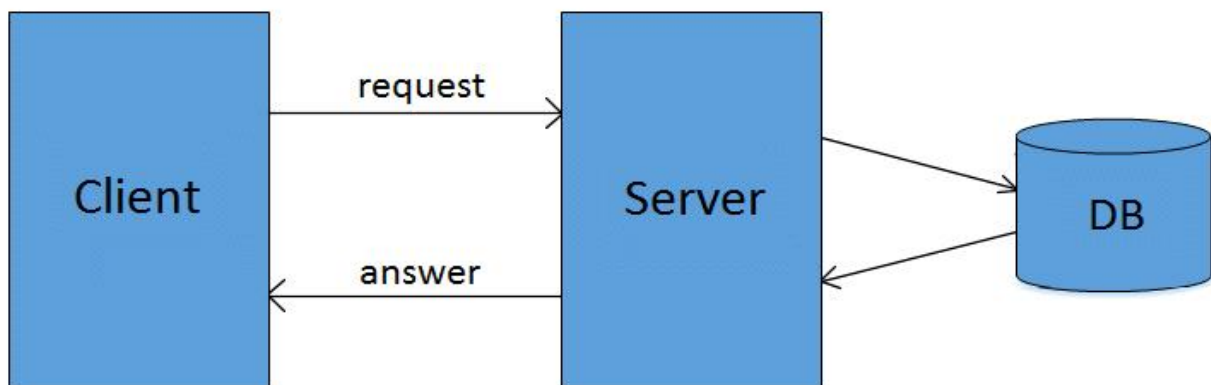


Fig.3. Client-server model

Description of the system

The system must collect data from sensors of various types. After receiving an array of data, the system must process them by generating the input data that must be submitted to the graphs. After the graph is drawn, it is necessary to specify units of measurement, which also come in the array.

Graph - is graphic display of indicators from different types of sensors. It is also need to implement the ability to view metrics in online mode with the help of WebSocket. The system should also be able to analyze the data obtained. For example, if the room temperature has started to drop sharply, it is necessary to notice it on time, and do it programmatically (without human help) by including an additional heater. For this, it is necessary to make possibility to set

the minimum and maximum range of the sensor values. Also, when sensor exit a certain figure for a valid range, system must inform the user (using SMS / mail/ message on user interface).

Conclusion

The concept of the Internet of things, principles of functioning and technology for its construction were considered and chosen as technology for implementing processing and displaying air indices in a building system. Microsoft Azure cloud was chosen as central part of the system for data processing and user informing. The architecture of the client-server, the kind of system use is considered.

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Functional model of information system of facility's business activities

Anna Synko¹, Yevhen Burov²

1. Department «Information systems and networks», Institute of Computer Science and Information Technologies, Lviv Polytechnic National University, St. Bandera street 12, 79013, Lviv, Ukraine, e-mail: anna46075@gmail.com.
2. Department «Information systems and networks», Institute of Computer Science and Information Technologies, Lviv Polytechnic National University, St. Bandera street 12, 79013, Lviv, Ukraine., e-mail: yevhen.v.burov@lpnu.ua.

This article contains the guidelines on how to automate the facility's business activities utilizing information technology and new solution methods.

Keywords – facility, business activities, manufacturing, automatization, product, date, information system.

Introduction

The deepening of Ukraine's political and economic ties with Europe, entering the European and global market by Ukrainian manufacturers lead to the formation of the modern manufacturing and to the product quality improvement and meeting global standards. Currently this is the main task of a company in any industry.

The data processing technologies use the widest and the most advanced range of technical means, especially computers and electronic means of communication. The new computing systems and networks are being created on the basis which enables to automate specialists' workplaces to the maximum extent.

The deepening of approach towards the enhancement of the facility's business activities requires the development of the present and design of the new organizational and economic solutions which should improve the facility's efficiency to the maximum extent, increase its competitiveness and lead to resources savings.

There is, therefore, a need for development of the efficient model of full comprehensive accounting of material assets, costs, end product sales of light manufacturing facility, as well as for creating of the efficient management model for facility's business activities utilizing information system and technologies in a stiff competition environment. Thus, the chosen article topic is actual.

As is known, at present many manufacturing facilities have no or have partial work automation. Hence, the workers have to do the everyday routine activities which could be completed by the computers. The new information technologies give the possibility to automate management operations, to obtain analytic information for decision making.

This article gives the answer on how to improve product sales, costs accounting, and how to automate the process of tasks distribution among the workers.

Aim of the research

The aim of this article is to develop the efficient model of full comprehensive accounting of material assets, costs, end product sales of light manufacturing facility. The aim of this article is to develop the efficient model of full comprehensive accounting of material assets, costs, end product sales of light manufacturing facility.

To achieve the above mentioned aim we have to complete the following tasks:

- study the system of indicators for facility's costs and sales accounting in order to introduce the automatic accounting;
- identify the issues and disadvantages of costs accounting system and of end product sales process;
- justify the usage of information technologies for analysis and for management decision making in the business activity;

- develop the database that would contain the information about leads (for further communication to them), facility's products (for production cost calculation);
- give the guidelines for usage of information system and technologies with an emphasis on customer's need and arranging of goods production.

The functional model of information system

We created the Data Flow Diagram (DFD) to graphically display the automated facility's operation. The DFD is one of the functional models, because it uses the operation as the main unit, while the data acts as the interfaces which connect the operations between themselves. The DFD is widely used to graphically display the data movement and processing.

This model was created using CASE-procedure ERWin (Fig.1).

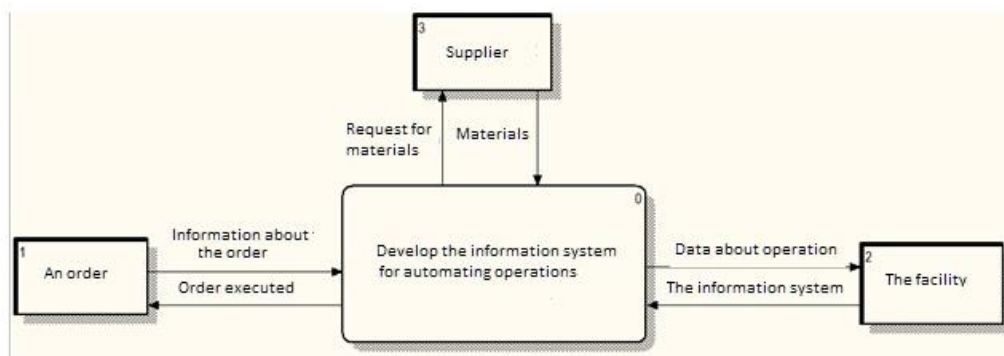


Fig.1. The context diagram of the facility's accounting information system (IS).

The operation «To develop the automated facility's accounting system» takes all the information about the orders which are received by the facility from external entity «Orders». After that the system calculates the number of materials necessary to fulfil the given order. In case of insufficient amount of some material the automated request to the external entity «Materials supplier».

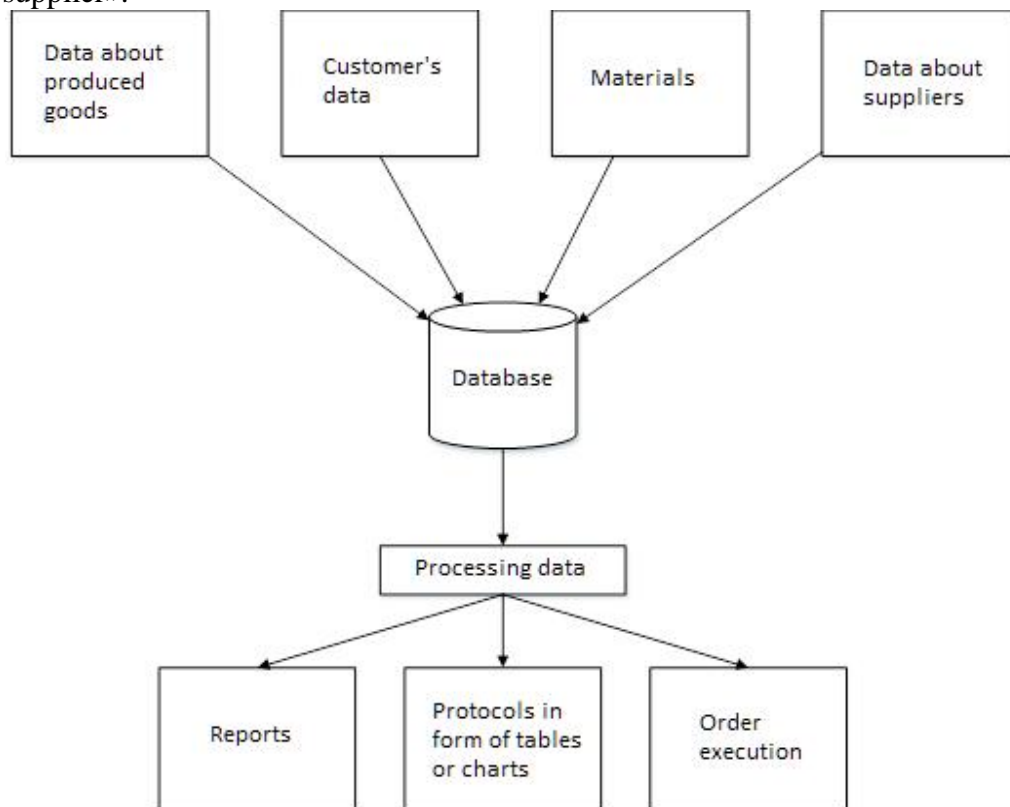


Fig. 2 The functional scheme facility's accounting system

The architecture of the information system of facility's business activities

The usage of information technologies allows to introduce such accounting system in which facility's workers take the minimum part in data processing, monitoring and report generation. The system is designed as a web resource in order to complete the operations in the fastest way.

Fig.2 displays the structural scheme based on the case of the clothing manufacture «Eva-Tekstyl-Ukraine». The information is stored in the database on the web server. The results of the process data are displayed on the web page. The delineation of access rights is implemented – there are several ranks of web system users with the personal cabinets for managers, administrators and the workers.

The web interface of information system analysis is based on CMS WordPress hosted at www.zzz.com.ua (table 1).

The analysis of the reference example

To test the work of the online resource lets take the reference example.

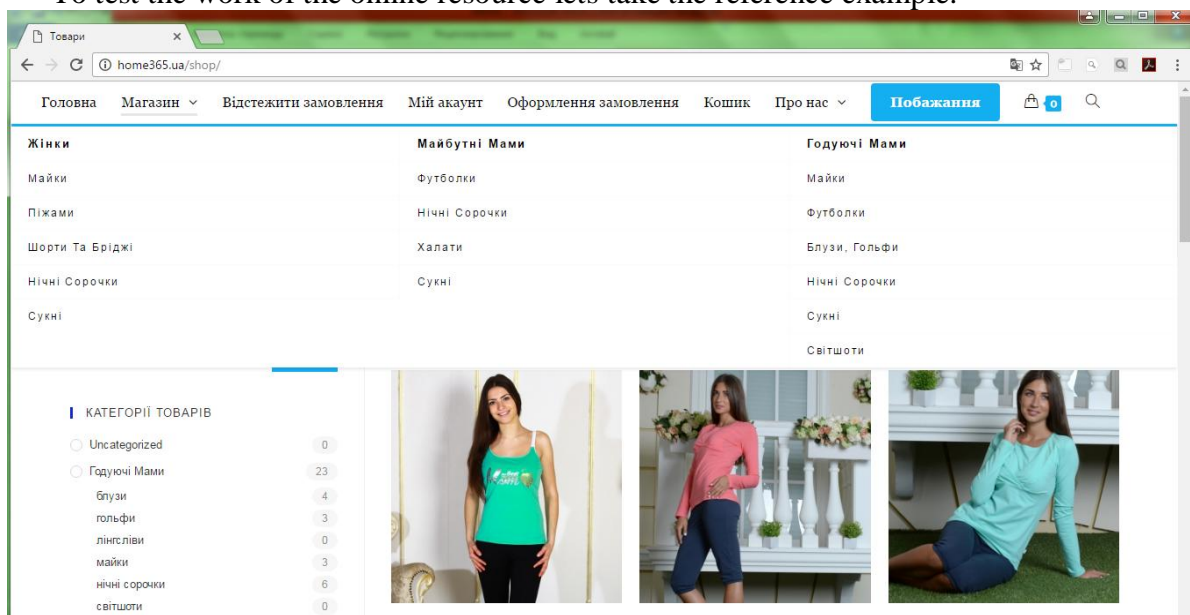


Fig. 3 Company's products

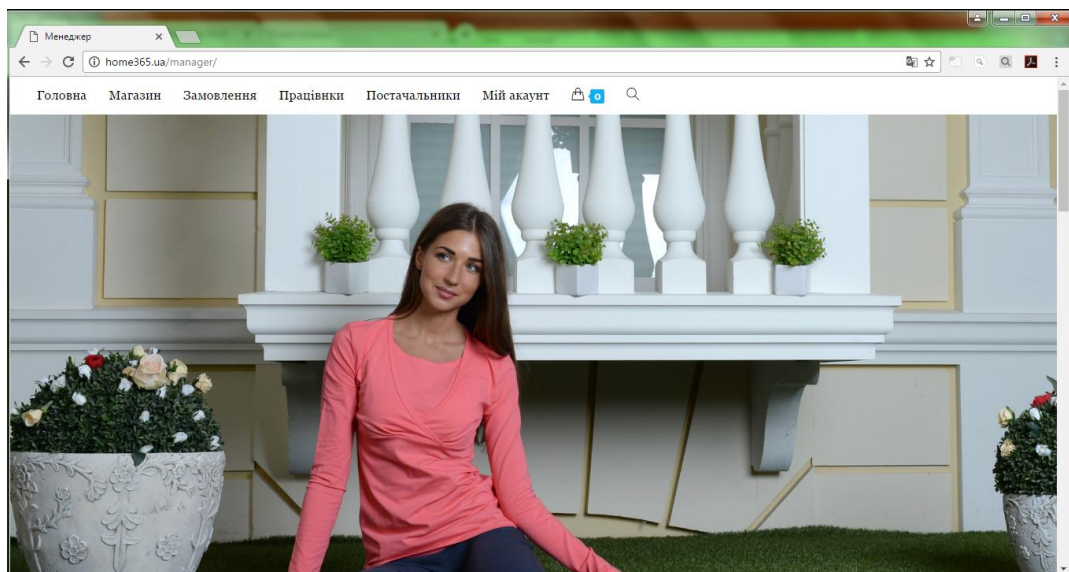


Fig. 4 Manager cabinet

System Software restrictions

Table 1

Web system hosting fetchers			
CMS	Web server	Database	Language
WordPress	Apache PHP-7-x64	MySQL-8.0.12 x64	PHP, HTML

The web system consists of the units which are connected between themselves with the help of WordPress content management system. «Authorization» unit is responsible for the delineation of the access rights. «Data input and edit» unit contains templates for entering the information collection of which is not automated at the moment. It also has the feature to edit the data and to correct the mistakes.

All data about the facility's operation is stored online and is given to the workers according to the positions assigned to different types of personal cabinets.

The workers use login and password to enter the personal cabinet. To protect the access to the cabinet the workers are not permitted to disclose this personal information and should log out of the cabinets at the end work day.

To access the online resource the user needs a PC, tablet or a smartphone with the Internet connection and web browser installed.

This resource can be used 24/7.

The restrictions based on the type, length of the data which are customized when the database is created help to avoid mistakes during data input.

Conclusion

The analysis of facility's costs and sales accounting was taken with the aim to organize the automated accounting.

The context diagram was created to display the architecture of the information system on a general level.

WordPress content management system was used as a base's for the development of the information system. MySQL was used as a DBMS. The reference example was given to show how the program works (product web page, manager cabinet).

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Specialized computer system for controlling microclimate through recuperation

Roman Dunets, Sviatoslav Chernetskyi, Andrii Slavytiak

Specialized Computer System Dpt., Lviv Polytechnic National University, Ukraine, Lviv, Stepan Bandera street, 28a

e-mail: roman.b.dunets@lpnu.ua

Specialized Computer System Dpt., Lviv Polytechnic National University, Ukraine, Lviv, Stepan Bandera street, 28a

e-mail: Sviatoslav1997@ukr.net

Specialized Computer System Dpt., Lviv Polytechnic National University, Ukraine, Lviv, Stepan Bandera street, 28a

e-mail: andriy.slavytiak@gmail.com

Abstract – The paper considers hardware and software of specialized computer system for controlling microclimate through recuperation.

Key words – Microprocessor, recuperation, microclimate, heat exchange, control system, software, hardware.

I. Introduction

Modern systems of inflow and exhaust ventilation are based on the principle of heat recovery - the return of heat energy from the exhaust air. The warm air coming out of the room, heats up the cold air coming from outside. Regeneration of heat is carried out in recovery heat exchangers - plate or rotary [1]. The effectiveness of the exchange process is expressed as a percentage and shows the amount of heat expended from the exhaust air to heat the fresh air flow. Typically, the efficiency of the recovery heat transfer is within the range of 60-90%, and depends on the difference in temperature between the room and the outside, with the greater the temperature difference, the lower is the efficiency [2]. Structurally, they consist of two modules: the first - the recuperator, along with the sensors and actuators, and the second - the control system. The general disadvantage of modern recuperators is that they do not provide additional heating of the tidal air in winter, and cooling - in the summer at a large temperature difference and, thus, do not allow to maintain the microclimate in the room within the specified limits. In this situation, in addition to the recuperators used, for example, air conditioners. In addition, the control systems of the recuperator often require to input or adjust additional information regarding operating modes, for example, the coefficients of PID regulators, which complicates the operation of users with the recuperator and requires special knowledge [3].

So, the aim of this work is to expand the functionality of the recuperators with the intellectual control of all heat transfer processes.

II. Controlling microclimate system: hardware

The basis of the system construction is a plate heat exchanger of the recuperator, as the most massive, with a thermal pump and with a control system based on a single-chip embedded computer system based on the RISC processor [4]. In addition, temperature sensors have been used to measure temperature using a digital serial interface, which allowed the sensor outputs to be combined with one line of communication, and as a result reduce the total number of lines of the communication channel between the control panel and the actuators of the system.

As a single-chip embedded computer system, I decided to opt the Arduino Mega 2560 microcontroller based on the AtMega processor, which fully satisfies the resources needed to implement this system [5]. One of the advantages of this microcontroller over others is the price, ease of programming, debugging and ease of use. Also, this microcontroller differs from others,

such as Raspberry Pi, so that my choice allows you to fully control the system: there are plenty of pins that will not require the use of additional expanders to which all devices can be connected, also a large set of interfaces is available, through which these devices interact.

To implement the control system, an LCD was used to display all the necessary information for the user, namely: the current room temperature, date and time. A matrix keypad was added to the control system. It allows to set the user the current temperature, engine speed and various system settings and modify them.

The real-time clock was connected using the I²C protocol [6]. Because after a certain period of time the clock begins to give an error, it was added the ability to re-configure it directly from the control system.

The microcontroller controls the system using a two-channel relay with switching voltage supply. This relay allows separately to include two nodes of the system: compressor and valve, which switches the mode of "heating-cooling".

The speed of the motors is regulated by pulse-width modulation using the PID controller [7]. Having set the correct coefficients allows you to fine-tune the speed of the engines to increase the life of their work. After all, when the temperature difference is small, there is no need to include engines at maximum speed.

The system has three operating modes: heating, cooling and air conditioning. Switching between these modes is based on temperature measurements from sensors. The system has four temperature sensors connected using the 1-Wire protocol [8]. This protocol allows you to connect all sensors to one port.

The block diagram of the device is shown in Fig.1.

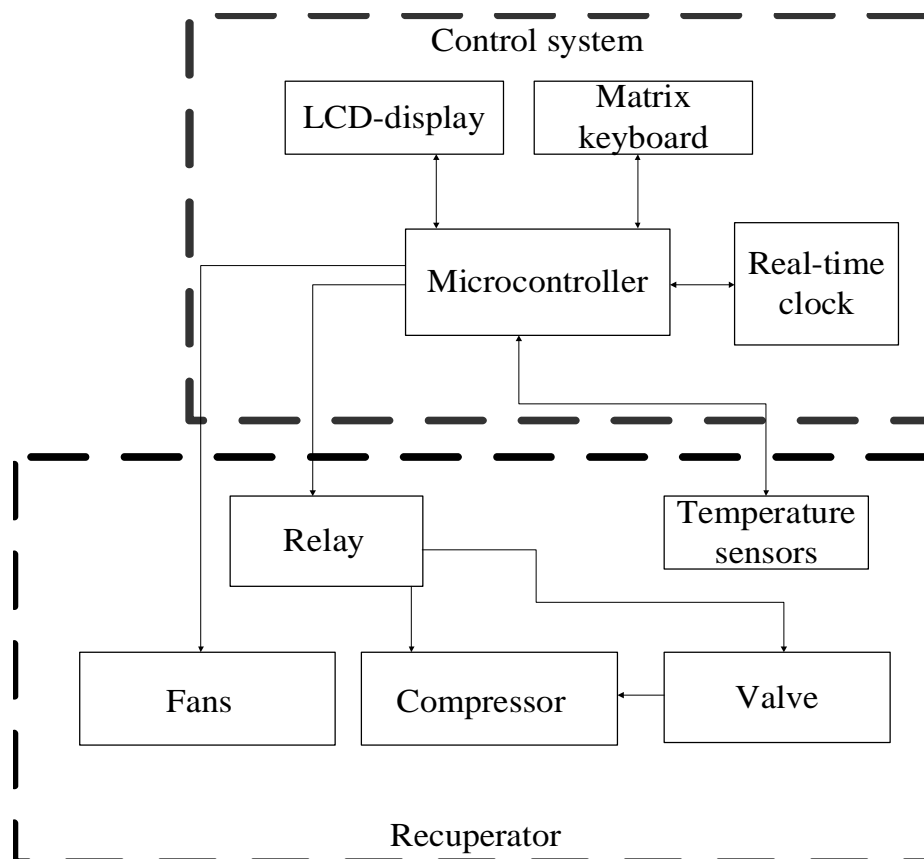


Fig. 1. The block diagram of the device.

III. Controlling microclimate system: software

Considering that the control system is implemented on the basis of the RISC processor, namely the microcontroller Arduino Mega 2560 on the basis of the ATmega processor, the programming language C was used.

The main software modules include:

- sensors reader module;
- RTC module;
- display module;
- keyboard operation module;
- system control module;
- PWM module;
- security module.

Sensors reading module includes a library for working with the 1-Wire protocol. The system has four temperature sensors that measure indoor temperature, input air temperature, air temperature after passive heat exchanger passage and air temperature at passive heat exchanger to prevent it from icing. The active sensor is selected using a unique MAC address.

RTC module includes a library for working with the I2C protocol. Also added ability to edit the date and time using control system.

The display module includes a library for working with liquid crystal displays. Keyboard operation module includes a library for working with a 4x4 matrix keyboard.

The security module includes protection against unauthorized access to the system with a password.

The system control module contains the basic algorithm for operating the system. It selects between three modes of operation (heating, cooling and air conditioning), and also controls the operation of the main hardware nodes.

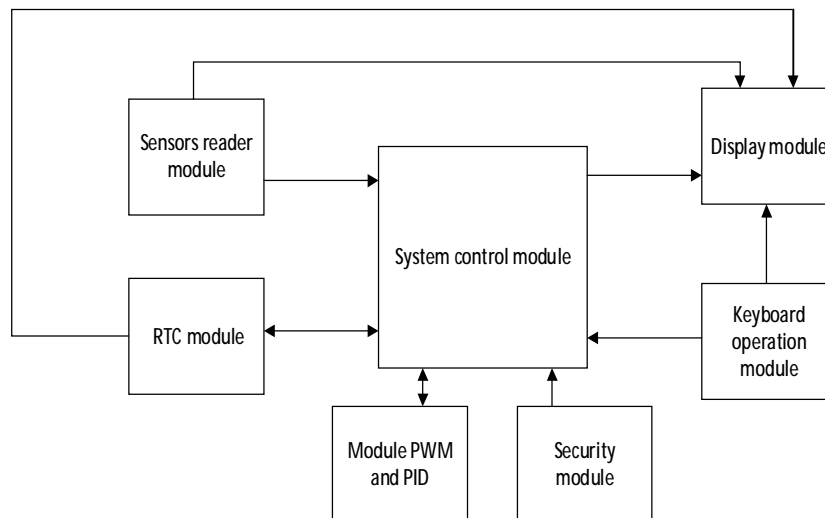


Fig.2. The block diagram of the software.

The block diagram of the software is shown in Fig.2.

The algorithm of the program includes the following steps. After turning on the system, it waits for the user to enter the desired temperature T_{inp} . After this, the system measures the temperature in the room T_1 . Then there is a T_1 comparison with T_{inp} . If $T_1 > T_{inp}$, then the cooling mode is activated. If $T_1 < T_{inp}$, then the heating mode is activated. And if $T_1 = T_{inp}$, then the mode of conditioning is activated. After that engines are switched on. The next stage is the measurement of the air temperature after passage of the passive heat exchanger T_2 . If T_2 is not equal to T_{inp} , then the compressor is switched on. After that the system operates in the set mode until the T_{inp} temperature is changed by user. The algorithm of the program is shown in Fig. 3.

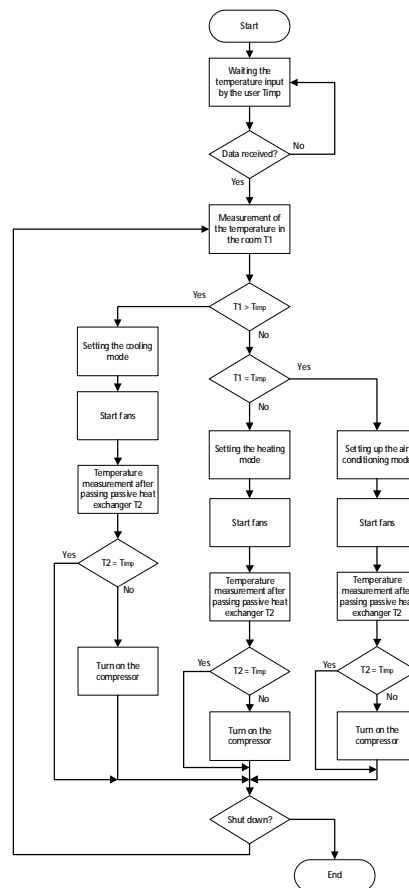


Fig.3. Algorithm of the program.

IV. Research

Research was conducted to determine the most effective way to control engine speeds depending on temperature. Three methods of control were investigated: without the use of PWM (pulse width modulation), using PWM and using PWM in conjunction with the PID regulator (proportional – integral – derivative controller). According to the results of research, the third method of management was chosen. Using PWM with the PID allows you to control engine speeds with minimal variations and thereby smoothly maintain the required indoor temperature. The range of temperature fluctuations depending on the way the engine is driven is shown in Fig. 4.

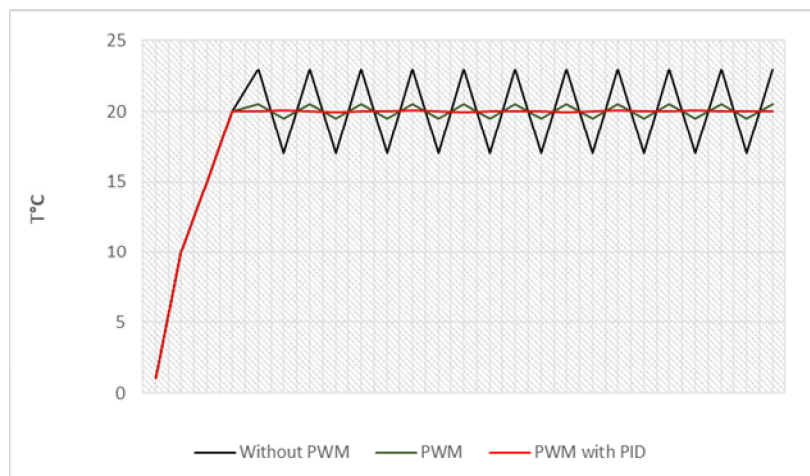


Fig.4. Range of temperature fluctuations depending on the way the engine is driven.

Fig. 5. shows the temperature chart in the channels heat exchanger. At the beginning of the system, the air temperature in all channels of the recuperator is equal to the room. From the graph, we can conclude that the time of recovery of the recuperator to the stationary mode of operation is about 40 minutes. Thus, the experimental data confirm expediency study characteristics of the recuperator in the stationary. Considering, since the transition period in the recuperator takes time, insignificant in comparison with the periodicity of external changes conditions.

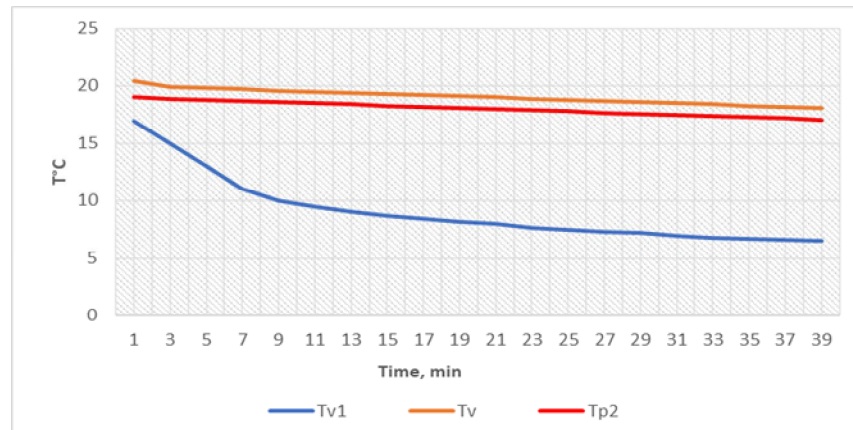


Fig. 5. Temperature change from time to time

T_{v1} - is the temperature of the air being removed, T_v - is the temperature of the room indoors, T_{p2} - is the temperature of the inflow air after recuperation.

Experimental investigations of the developed model of the control system of the recuperator with the productivity of 300 m³/h have been carried out. The efficiency of the operation and the possibility of further modification are shown.

Conclusions

Thus, the developed system build on Arduino Mega 2560 microcontroller based on the AtMega processor, showed the efficiency of controlling the working recuperator with the ability to expand the functionality of the system without significant hardware changes. Also, the developed software allows to quickly and efficiently manage the work of the entire system and effectively perform tasks for the intelligent application of the system. It is implemented in a programming language C using additional libraries to work with various system modules.

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Basic approaches to designing the structures of embedded systems

Andriy Grebenyak¹, Denys Lykhotop²

1. Department of Electronic Computing Machines, Lviv Polytechnic National University, UKRAINE, Lviv, Stepan Bandera street, 28A, breskyl@gmail.com

2. Department of Electronic Computing Machines, Lviv Polytechnic National University, UKRAINE, Lviv, Stepan Bandera street, 28A, walden@meta.ua

Abstract – *The principles of designing embedded systems are described. The advantages and disadvantages of a centralized and decentralized approach to solving the problem of designing such systems are presented.*

Keywords – embedded systems, centralized systems, decentralized systems, mesh network.

Introduction

Designing space (residential buildings, apartments, industrial premises, etc.) more and more includes various intelligent systems (security, automation and management, etc.). Suppliers of equipment offer both individual modules and finished products that have certain advantages and disadvantages in terms of organization of work and structure of the system. There are also problems in maintaining systems from different suppliers because they are not always compatible with each other, which leads to the impossibility of installing this or that equipment in the existing system, in terms of its structure of operation.

Description of the problem

At present, centralized structures of embedded systems prevail. In such systems, the central node of switching plays a key role, and this may be a fire alarm block, a security alarm block, a microclimate control unit, etc. [1]. Sensors and actuating modules are connected to such a unit Fig.1. The configuration and settings of this system's parameters occur only through interfaces at the central switching node. The main advantages of such systems are the simplicity of implementation and rapid design, as well as easy configuration.

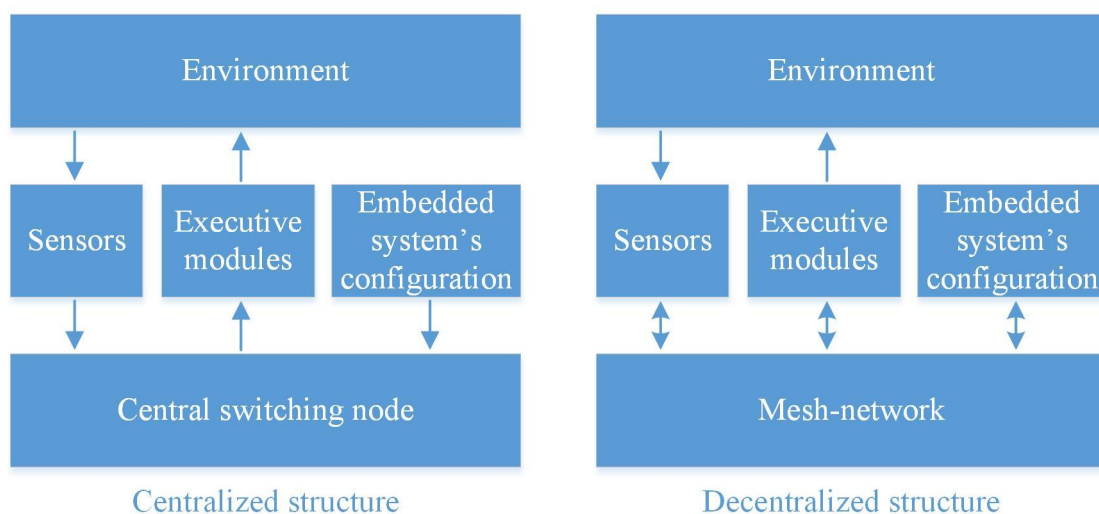


Fig.1. Structures of embedded systems

Nowadays, there is a high probability that the most up-to-date systems will completely become obsolete in a few years. They will be replaced with cheaper and at the same time thought over, decentralized systems with less power consumption, fault tolerance and protection.

After analyzing the structure of the functioning of existing systems, we can conclude that the standard topologies of networks with a central node are not appropriate. In case of failure of this node, other nodes lose contact with each other. Even if the system provides automatic reconfiguration of nodes, the centralized system is inferior to the radius of the decentralized mesh network Fig.1 [2,3]. Therefore, when designing the structure of the embedded system, it is proposed to use the Mesh network as a basis.

Mesh network is a multi-threaded network, whose devices (Mesh stations, MP, Mesh-Points) have router functions and can use different routes for forwarding the package [4]. This technology is especially needed in the absence of wired infrastructure for connecting stations. In this case, packages are sent from one Mesh station to another.

The system under development should easily accept all amendments, change, rebuild and increase. The option of gradually adding new modules to ultimately get a single intellectual space, where everything works with maximum comfort for the user, is needed. In essence, it is a specialized distributed system that responds to everything that happens and dynamically changes its behavior. Many devices, each executing its part of the general algorithm, all interact with all, react to the external environment, transmit data, signals and determine their behavior, depending on the information received. The lack of a single center increases the reliability of the system and allows you to increase the capabilities and intellectual potential by simply installing additional modules.

Conclusion

The decentralized structure of embedded systems has several advantages over existing construction methods. Such advantages include the reliability of the system since there is no vulnerable central node. The increase in the number of final nodes in the network with the centralized way of organization leads to an increase in the number of failures, because there are not enough central node resources to ensure the functioning of the system. A decentralized solution will not have such a disadvantage, as computing resources also increase with network expansion. The disadvantages that are present in a decentralized solution, namely, the complexity of the software and the increased demands on the computing resources of the end nodes, will level over time.

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Problems of privacy and security in cyber physical systems of intellectual houses

Bohdan Havano¹

1. Computer engineering, Lviv Polytechnic National University, Ukraine, Lviv, Bandery str., E-mail: havano.bohdan@gmail.com

In this paper, is presented an overview of the privacy and security challenges directed towards the smart house domain. Also, were identified constraints, evaluated solutions, and a number of challenges and research issues where further investigation is required. I have identified four significant challenges that need to be solved: identity management, risk assessment methods, information flow control approaches, and security management methods.

Keywords – smart house, cyber physical system, IoT, privacy, security.

Introduction

A smart connected house can be defined as a residence incorporating a range of sensors, systems, and devices that can be remotely accessed, controlled, and monitored via a communication network. However, the increasing deployment of Internet-connected devices in the house expose the residents to privacy and security risks as personal information becomes remotely accessible in different ways.

Research directions

Several critical security and privacy issues might go unnoticed or poorly addressed by researchers as the commercial side of this paradigm is evolving at high pace. It discusses some prominent areas where further investigation is required.

Identity management: Devices, especially when connected to the Internet, and allow for the operation and control by third parties require strong authentication and authorization controls. Designing an effective identity management solution requires the design of secure key management protocols. However, this is hard to implement for wireless sensor network setups [1], and is further complicated by the disparate sometimes non-interoperable technologies, and the lack of global ID schemes. Another challenging aspect is that authentication procedures can be complicated for particular individuals and may raise additional privacy concerns.

Risk assessment methods: It is hard for the house owner to estimate the financial value of his/her private data. This is because they might not be aware of which personal data that is collected and whether that data has been divulged to parties that they are not aware of. Also, they may not necessarily understand how easy it is to extract such data and use it for nefarious purposes. The need for empirical risk evaluation methods for use within smart connected houses have been identified as an important security and privacy requirement [2].

Information flow control approaches: The aggregation of sensed data can provide intimate data on the behaviors and activities of residents. Easier-to-understand user interfaces that can help display privacy risks more intuitively, and at the same time offer configurable functions to control subsequent uses and dissemination of such data are needed. This is also a challenging requirement to meet as IoT devices may be designed to act autonomously without any manual guidance from users. Similarly, there is a need to develop effective measures that allow for securely deleting stored data especially to meet regulatory requirements.

Security management methods: Information security management methods including better approaches to patching, updates, and provisioning of information to households are missing [3].

Similarly, it was observed [2] that a need for the integration of security in design and of sound secure management processes is typically not included in the development of smart connected houses. Moreover, there is a shortage of privacy by design measures in the smart house space [3].

Conclusion

A house is the place where privacy must be respected. In comparison to traditional digital systems, most smart house devices have processing power, memory, and energy limitations. This makes the development of effective security and privacy measures harder to implement in the smart house environment. Moreover, privacy concerns are intricate and not always readily evident. Even so, enforcing privacy and security in houses must be considered a prioritized task. I have surveyed the most pertinent security and privacy challenges of smart connected houses. Additionally, we have identified mitigation approaches at different architecture levels, and proposed areas where further research is required. As a common observation, several initiatives are currently forming to implement security and strengthen user privacy. Despite this, i have identified four significant challenges that need to be addressed: identity management, risk assessment methods, information flow control approaches, and security management methods. Such challenges are amplified in the domain of smart houses but are also common to other IoT application areas.

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Software Application for Intelligent Dialog Systems Maintenance

Taras Chipko¹, Leonid Berezko²

Department of Electronic Computing Machines, Lviv Polytechnic National University, UKRAINE, Lviv, 12
Bandera street, 1. E-mail: taraschipko@gmail.com 2. leonid.o.berezko@lpnu.ua

Abstract – *In this paper we consider the problem of functioning and adjustment of chatbots – systems which use artificial intelligence for human speech simulating and processing. We propose a structural scheme and algorithm of the chatbots' maintenance system.*

Keywords – artificial intelligence, natural language processing, chatbots, dialog systems, software.

Introduction

Research in the field of artificial intelligence (AI) involves solution of problems such as automated software development, information retrieval, automated translation, document generation, organization of a natural dialogue between human users and computers.

AI has gained widespread use in chatbots [1], systems used in NLP (natural language processing), i.e. processing and imitation of human speech. Today the number of chatbots is growing exponentially, in particular, the number of chatbots on the *Facebook Messenger* platform has reached 300,000. There are other popular instant messenger platforms, e.g. *Slack*.

Chatbots are used in various fields, such as healthcare, digital economics, law, real estate, customer care and others. Depending on the industry, each chatbot will have a functionality aimed at meeting the needs of this industry. From the list of use areas, we can conclude that the incorrect operation of a chatbot can cause negative and even disastrous consequences. Thus, the question of ensuring the correct operation of chatbots is one of the most important in the process of their creation, configuration and use.

Formulation of the problem

We aim to develop a software system for maintenance of chatbots, created using the Dialogflow service [2]. We will suggest methods for chatbots checking, configuring and training as well as the structural scheme and algorithm of the system.

Proposed solution

To solve the problem we developed a structural scheme (Fig.1) and an appropriate algorithm (Fig. 2). The algorithm provides an opportunity to check the *Agent*, a system of understanding the natural language, focused on processing a specific set of user queries, according to three criteria.

The first one is to check for repetition of *User Says* (user queries) in different *Intents* (intentions-queries). The second one is checking for empty *Intents*. Third: duplication check of *User Says* within one *Intent*. Also, this algorithm allows correcting found errors in the *Agent*.

The algorithm of the chatbot maintenance system consists of the following main steps:

- connecting the *AI Agent* to our system (this agent is an autonomous AI element which is guided by certain intentions and accordingly responds to a change in their state);
- downloading the data, fetching data from the database;
- checking for empty *Intents*;
- checking for repetition of *User Says*;
- checking the correct *Intents* settings (duplication check of *User Says* in different *Intents*).

When creating the maintenance system, the object-oriented Java programming language was selected. We chose MySQL RDBMS for storing the data on *Intents* and *User Says*.

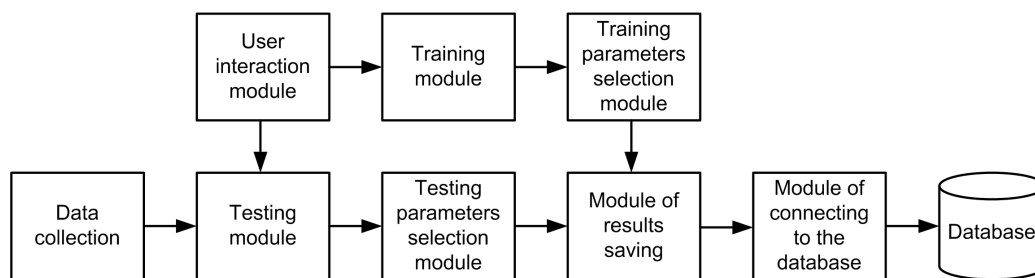


Fig. 1. Structural scheme of the maintenance system.

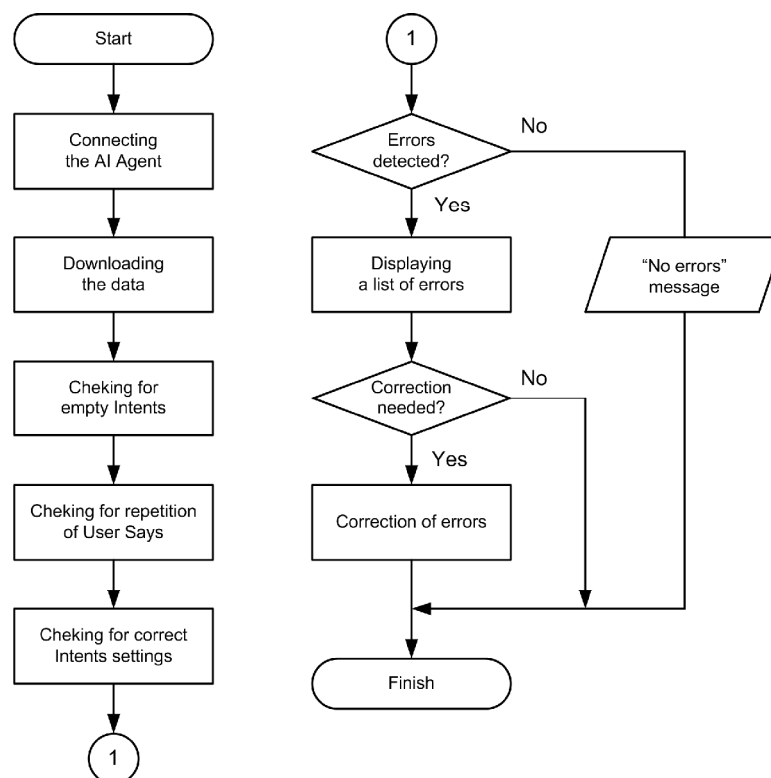


Fig. 2. Structural scheme of the maintenance system.

Conclusions

The paper proposes a way to solve an important task – ensuring the correct functioning of chatbots – intellectual means of simulation and processing of human speech. A software maintenance system for chatbots checking and setting up has been developed. In the paper the structure of the system and the algorithm of its work are presented.

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System for license plates recognition based on viola-jones algorithm

Ruslan Bachynskyy¹, Bohdan Pankiv²

Computer Engineering Department, Lviv Polytechnic National University, Ukraine, Lviv, Stepan Bandera str., 72,

1.E-mail: bac_ruslan@ukr.net 2. E-mail: panya05061996@gmail.com

Abstract - Described system for license plates recognition. Analyzed algorithms of classification and recognition. The system architecture is described and compared to the similar systems.

Keywords : machine learning, pattern recognition, client-server system.

Introduction

Images recognition became extremely popular today. Pattern recognition is closely related to the discipline of machine learning.

Typical statements of pattern recognition tasks:

1. The task of identification, which is to erase a particular specific object among its similar.
2. Classifying object to one or another class. This may be, for example, the task of recognizing letters or deciding whether there is a defect in some technical detail.
3. Cluster analysis, which consists in the distribution of a given set of objects into classes. This task is often called a classification without a teacher, because, unlike task 2, classes are not given.

Object of study

The object of research is the license plates recognition system. Such systems are usually used by various private firms to control cars that have the right to be on the site of a protected object. In general, the structure of such a system is as follows:

- high-quality camera
- server that in real time receives data stream from the camera and processes it.
- A client with whom security guards work. When the server recognizes a license plate, the information about the owner of the car is transmitted to the client.

Analysis of existing solutions

One of the existing analogue of the plates recognition system is the system "Oberig". It is a hardware and software complex designed for reading and recognizing state automobile license plates.

Scope of use:

- stationary and mobile traffic police stations
- international checkpoints and objects under the supervision of customs authorities (IUC, STZ, etc.)
- parking facilities, entry / exit facilities

Main features:

- read state road vehicle license plates up to 255 km / h
- recognition of more than 300 types of license plates (all types of Ukrainian numbers, CIS countries and the Baltic States, 20 European countries, 5 countries of Latin America and the USA)
- Managing and storing recognized numerical logs in the database (supported by DBASE - DBASE, MS ACCESS, MS SQL Server, MySQL, PostgreSQL, ORACLE)

Therefore, the user should be authorized, before being able to work with the system. To authorize, user must enter his username and password. After that, the user will be able to observe

the video stream from the camera. If the system can recognize a car number in the image from the camera - user will see information about the owner of the car.

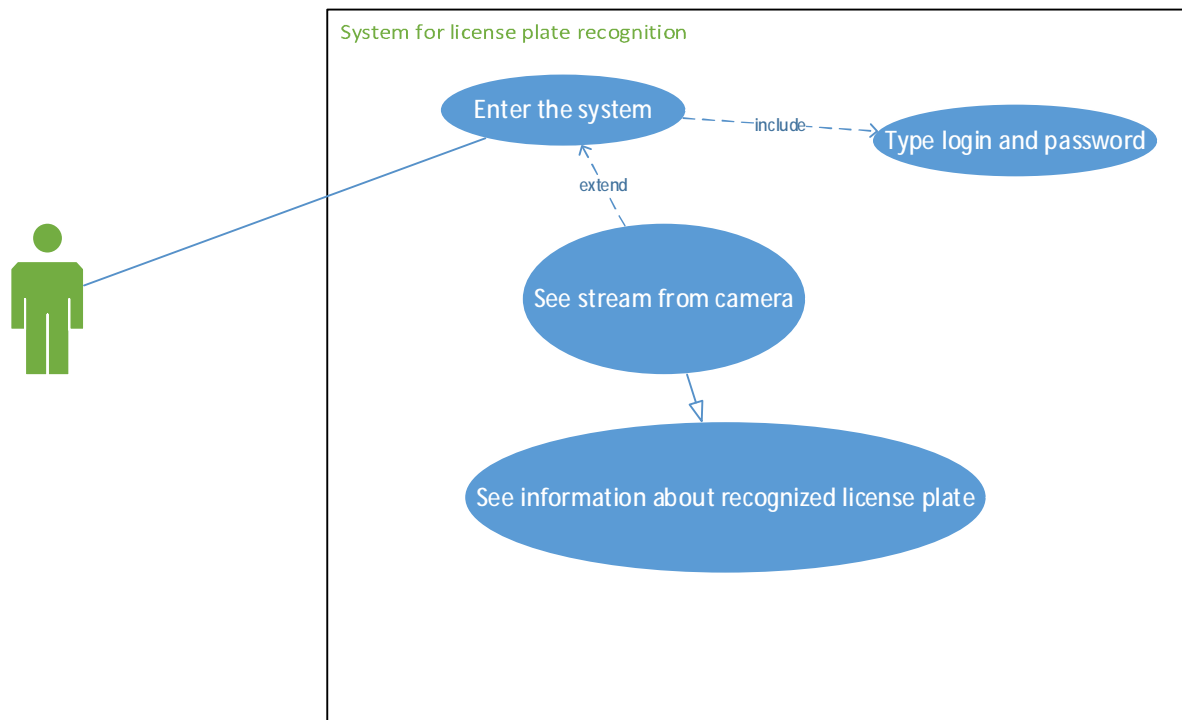


Fig. 1 Use case diagram of system

The system is based on the classic client-server architecture with a thick client. The client in this case is an application on the terminal. To obtain access to use the system, the trustee must be authorized. The server will operate under the HTTP protocol.

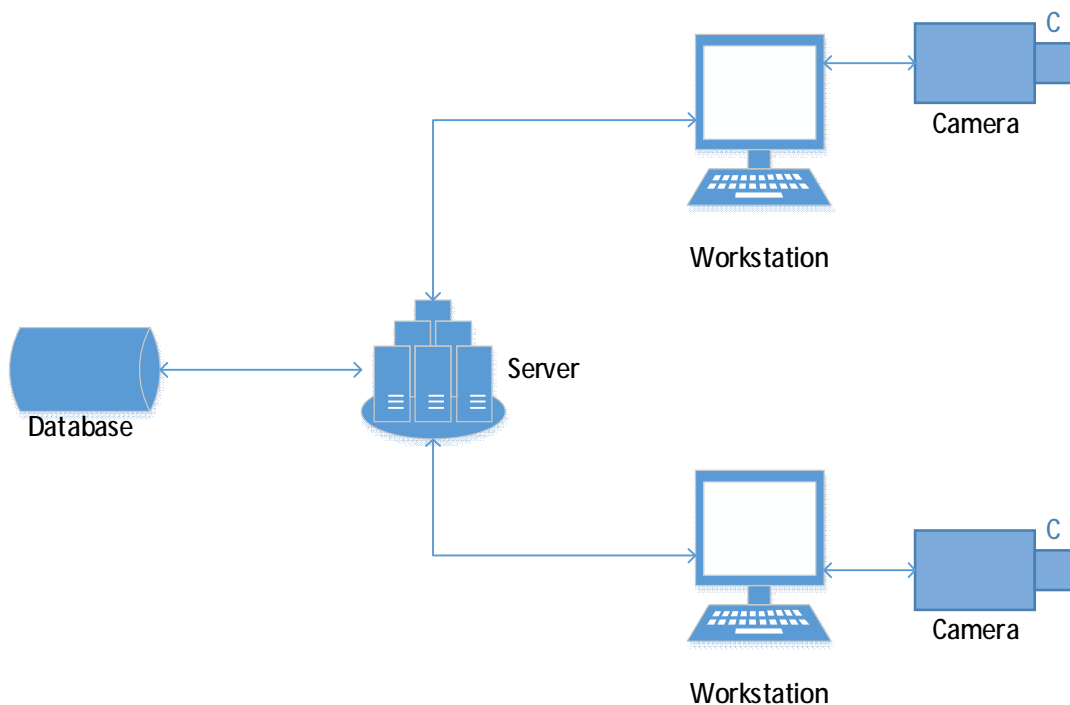


Fig. 2 Structure diagram of the system

Basic workflow of the web server:

- Verification of user authorization
- Find information on the car owner in the car number
- Saving information about the recognized number in the database

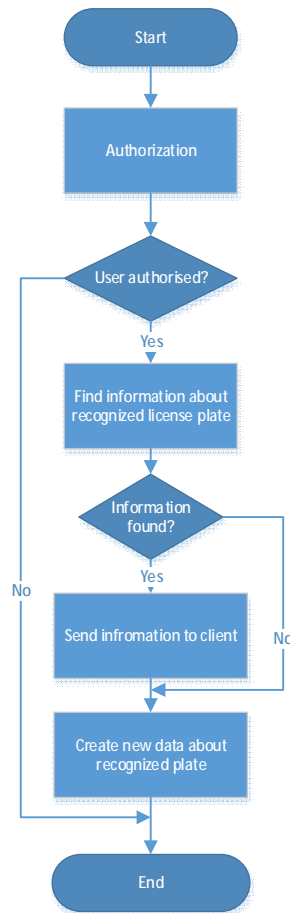


Fig. 3 Block-scheme of server workflow

Analysis of algorithms used for recognition

The Viola-Jones method is an algorithm that allows you to detect objects in real-time images. It was proposed by Paul Viola and Michael Jones in 2001.

The basis of the Viola-Jones method is the Haar's primitives [1], representing the partition of a given rectangular area. The Haar's primitives can be seen in Fig. 4.

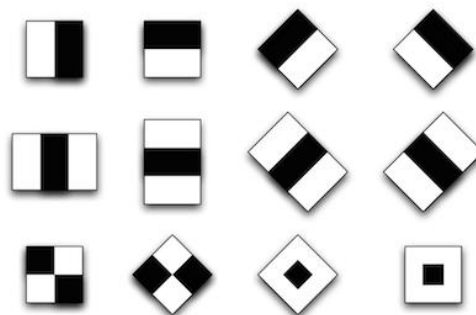


Fig. 4 Haar's primitives

In the original version of the Viola-Jones algorithm, only the horizontal and vertical primitives were used. Later 45-degree slopes and asymmetrical figures were offered. Also,

instead of calculating the usual difference, it was suggested that each primitive will be assigned a certain weight, and the value of the sign is calculated as a weighted sum of pixels of different types of regions.

From the values of a pair of pixels, it is difficult to make some meaningful information for classification, while from the two Haar's primitives is built, for example, the first cascade of the system for pattern recognition, which has a well-meaning interpretation.

The complexity of calculating a sign and obtaining a pixel value is $O(1)$ [1].

The algorithm is a meta-algorithm, in the process of learning builds a composition of the basic learning algorithms to improve their efficiency. AdaBoost is an adaptive boosting algorithm in the sense that each subsequent classifier is built on objects that are poorly classified by previous classifiers [2].

AdaBoost causes a weak classifier in a loop. After each call, the weight distribution is updated, which corresponds to the importance of each of the study sample objects for classification. For each iteration, the weight of each incorrectly classified object increases, thus the new classifier "focuses its attention" on objects.

The method of support vectors [3] is a set of related teaching methods with a teacher, which are used for classification and regression. Having a set of training examples, each of which is noted as belonging to one of two categories, the algorithm of training the method of reference vectors builds a model that predicts whether a new example falls into one category or another. In machine learning, the method of support vectors is a data analysis method for classification and regression analysis using models with controlled learning with associated learning algorithms, which are called support vector machines. For a given set of training samples, each of which is marked as belonging to one or other of two categories, the training algorithm of the SVM builds a model that relates new samples to one or another category.

Conclusion

Analogues of the system are analyzed, their weaknesses and strengths are revealed. The Viola-Jones method and the method of support vectors are analyzed. Use case diagram and the structural scheme of the system were developed. Analyzed technologies used for realization.

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Solving the dynamic travelling salesman problem with the use of evolutionary computation

Mulyarevich Oleksandr, Turchynskyi Stanislav

1. Computers Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera street 12, E-mail: mvalex@i.ua

2. Computers Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera street 12, E-mail: S.Turchynskyi@gmail.com

The subject of travelling salesman problem is always a hot topic. Analyzed ways to solve travelling salesman problem for a acceptable time. It was implemented system with the base on general algorithm of evolutionary computing.

Keywords – travelling salesman problem, genetic algorithm, evolutionary computation, REST technologies.

Introduction

The paper considers the feature of using evolutionary computing in solving travelling salesman problem. The traveling salesman problem has attracted much attention from mathematicians and programmers because it is easy to describe this task but it is difficult to effectively solve it. Simplicity of the task of salesman is misleading - the problem is one of the most intensively studied problems in the field of computational mathematics. The importance of solving the travelling salesman problem lies in the fact that it is used in very diverse areas, such as: routing vehicles, designing microprocessors, production planning, data clustering, reconstructing curves.

Routing of vehicles is a particularly important area for today, as the number of online purchases has increased significantly and the number of deliveries has increased accordingly. It is therefore important to maximize the time and distance of deliveries, which in turn reduces fuel consumption and emissions of harmful substances into the atmosphere.

Applying the travelling salesman problem in designing microprocessors allows you to increase the density of elements on the crystal, which in turn opens two development strategies: reducing heat loss by reducing the area of the microprocessor but in this case, the performance remains at one level; otherwise you can increase the performance by leaving the area of the microprocessor stable.

Genetic algorithm

In many areas of application of the travelling salesman problem there are additional restrictions: resources or time that makes finding a solution to a task much more difficult. In the theory of complexity of calculations, the salesman problem is classified as a class of NP-complete problems. Thus, it is assumed that there is no ideal algorithm for solving this problem. In other words, the running time of any algorithm that solves the salesman problem exponentially increases with the increase in the number of cities.

For application of the travelling salesman problem, the use of precise methods is not feasible. Therefore, the best way to solve this problem is to use evolutionary algorithms, since they allow a short time to find a solution that will be close enough to the exact one.

Genetic algorithm is a heuristic search algorithm used to solve problems of optimization and modeling by random selection, combination and variation of selected parameters using mechanisms created on the basis of biological evolution.

The algorithm of the program system is depicted on Fig. 1.

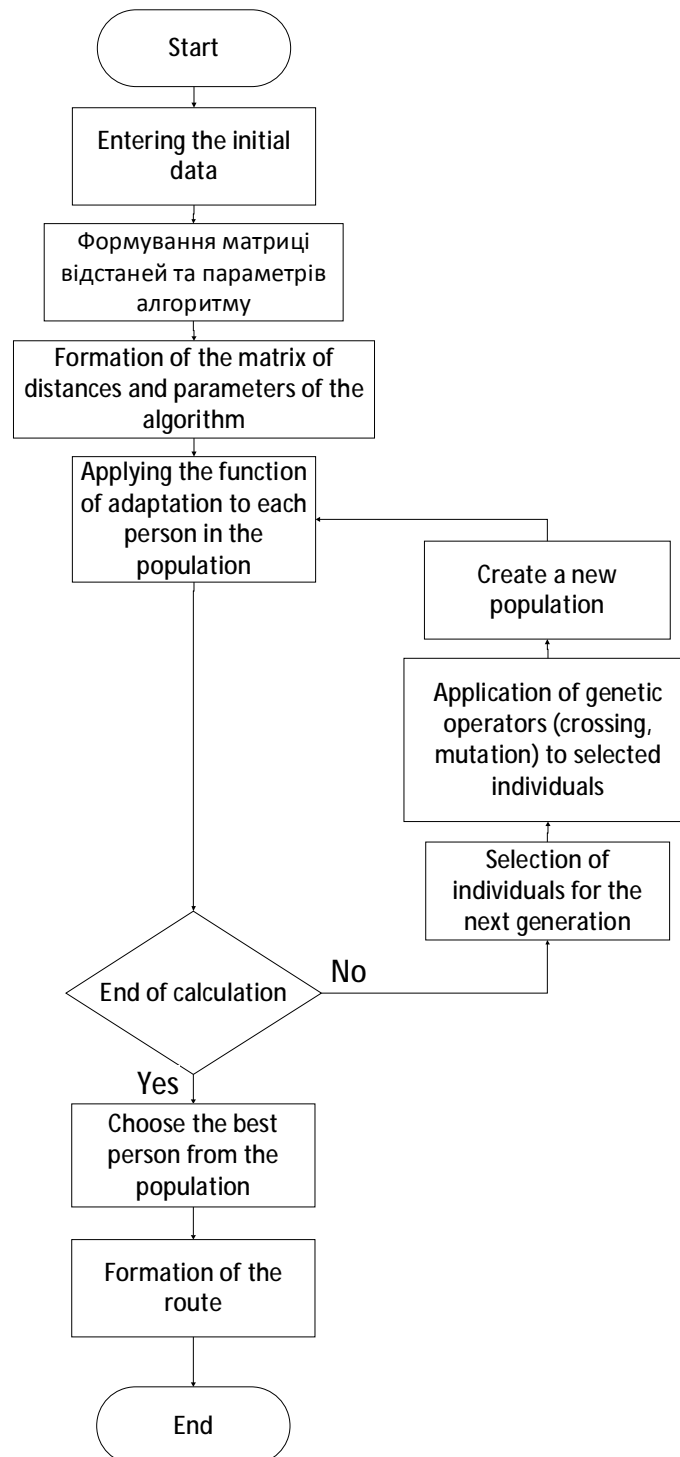


Fig.1. Block diagram of the system's algorithm.

The advantages of the genetic algorithm over other algorithms used to solve the salesman problem are its simplicity, ability to work with many parameters and flexibility in implementation. The simplicity of the algorithm lies in the fact that it actually reflects the natural evolution of problem-solving methods.

The software system will allow you to calculate the salesman's task using a genetic algorithm at an acceptable time.

The structure of the system for solving the salesman problem with the use of the genetic algorithm can be divided into two subsystems.

The first subsystem, the subsystem of the calculation, is designed to find the best route between user-defined points using a genetic algorithm using genetic operators and a function of the device to determine the length of the route using the distance matrix created using the data initialization subsystem. The subsystem is depicted in Fig. 2.

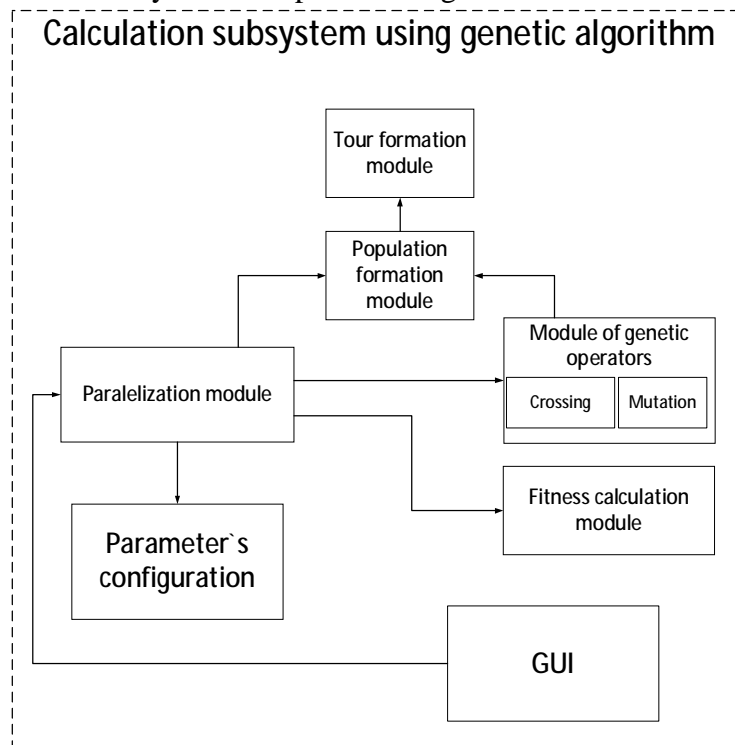


Fig.2. Subsystem of calculation of the software system.

The second subsystem, the subsystem of initialization of data, is responsible for creating the matrix of distances and geocods by generating requests to the Google Maps API and passing the results to storage in the corresponding object in the computing subsystem. The subsystem is depicted in Fig. 3.

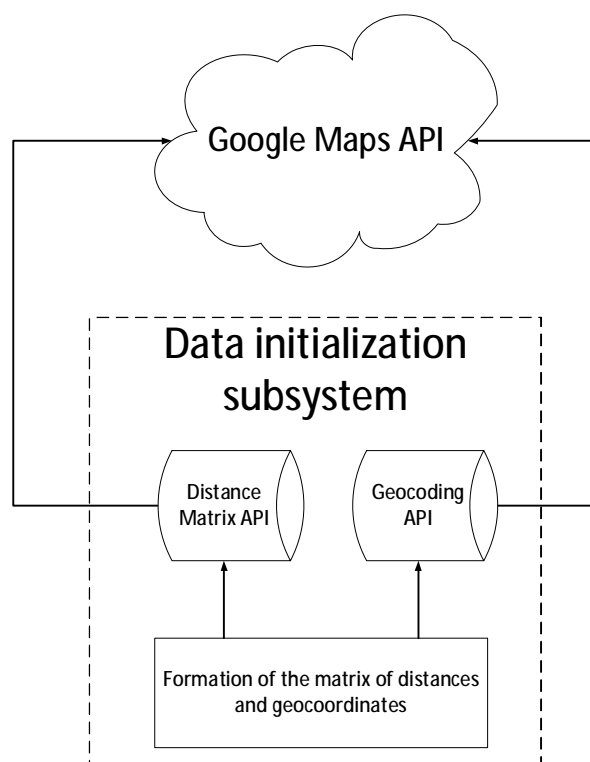


Fig.3. Subsystem of data initialization.

Conclusion

In this paper the analysis of the travelling salesman problem is carried out. The solution of the travelling salesman problem with the use of the genetic algorithm is proposed. The analysis of the travelling salesman problem and an overview of the application of the travelling salesman problem in various fields are carried out. The software system for solving the problem is developed.

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Recognition of road signs in video images

Mulyarevich Oleksandr¹, Bohdan Benovskyi²

1. Computers Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera street 12, E-mail: mvallex@i.ua
2. Computers Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera street 12, E-mail: benovskiy1994@gmail.com

The problem of recognition of graphic information using convolutional neural networks is considered. The methods of graphic information dissemination and the allocation of necessary information are analyzed. The structural scheme of the system, the algorithm of its work are offered.

Keywords – recognition of graphic information, computer vision, neural networks, convolutional neural networks.

I. Introduction

In general, the problem of recognizing graphic information is very relevant, which is confirmed by a wide discussion both at the professional level and at the level of scientific interests of technical specialists. To date, the level of development of technical services, both mobile devices and stationary solutions, allows us to implement achievements and solutions in this area in our everyday lives. An important role in the collection of information technology is played by a combination of methods for recognizing various kinds of information and identifying the necessary data. Traditionally, the tasks of recognition of information belong to the problems of the sphere of artificial intelligence [1].

In general, to solve the issue of image recognition there is a whole scientific direction - the theory of pattern recognition. This direction is a section of cybernetics and provides a scientific and practical basis, the theoretical foundations and methods of classification and identification of phenomena, objects, signals that have a certain set of properties or attributes.

In connection with the above described solution to the problem of recognition of information and the development and use of alternative methods of recognition of graphic information is a very topical issue.

II. Description of the problem

Creation of graphic information recognition systems remains a complex theoretical and technical problem. In general, the need for this solution arises in various fields and finds its application in a wide range of areas - from military affairs and security systems to digitizing analogue information (books, documents, etc.).

A main role in the theory of image recognition is played by neural networks (artificial neural networks, connectionist systems). Artificial neural networks are grouped together in a set of connected nodes, which are often called artificial neurons [2]. With the help of neural networks, new methods, approaches and algorithms for graphic information recognition systems are created that allows more quickly, precisely and flexibly to solve recognition problems.

Existing problems in the practical application of the foundations of recognition of graphic information compel researchers to invent modern and highly effective solutions. To date, the development of the practical application of theoretical foundations of recognition of graphic information has a number of problems, such as: clear allocation of contours, automated selection of objects, variants of spatial arrangement of objects and their recognition, practical application of methodological research in the recognition of graphical information, qualitative classification of objects of recognition [3, 4].

An important role in solving the above problems is the creation of software systems and complexes, as well as mathematical apparatus, based on the application of neural networks, expert systems and cybernetics [5].

In general, the general principles of the organization of processing of graphic information were singled out, according to which, it is possible to achieve structuring of components of the system, simplification of interaction between them and achieve the necessary degrees of reliability and quality of results. The first principle is the multi-level processing - the distribution of functionality by levels, each of which specializes in solving clearly defined tasks. The second principle is the constructive hierarchy and management hierarchy - ensuring the interrelations between the levels of analysis to clarify the information coming from the lower levels. The third principle - recursive analysis of information - with the aim of unifying the algorithms of managing the process of solving the problem. The fourth principle - operational change of resolution - dynamic change in the degree of approximation with the redundancy of information and the degree of detail when the information is insufficient to obtain the components of the description of the objects being analyzed. The fifth principle - the transition from quantitative attributes to qualitative (linguistic) - for convenience. The sixth and last principle - the possibility of parallel processing - is based on the application of in-depth analysis and methods provided by the apparatus of convolutional neural networks.

III. System structure overview

The structure schema of analysis of graphic information is shown in Fig. 1.

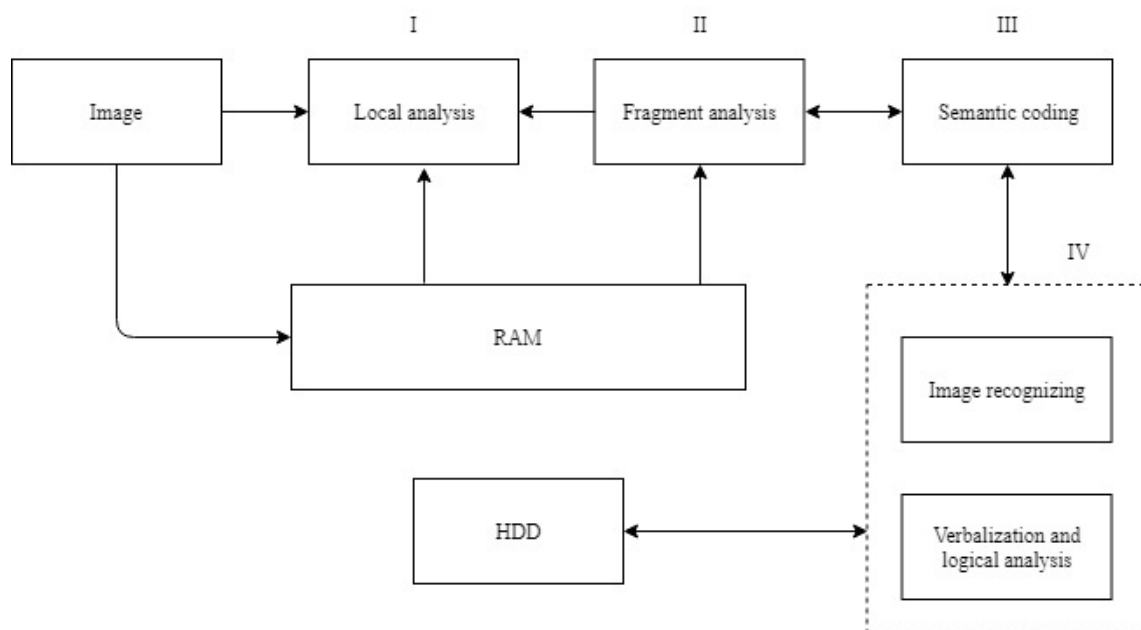


Fig.1 The structure schema of analysis of graphic information.

At the local analysis level, the rays of the quaternary pixel are analyzed within the limits of 3x3 or 5x5, the calculation of the direction of the displacement of the vicinity, the allocation of special points and signs of boundaries of objects on the plane. The whole process is carried out using the operator-analyzer of local areas, which is based on the neural model of the convolutional network. The statistical and integral characteristics of these areas are also determined.

The level of fragmentation analysis is responsible for the allocation of structural elements (parts) of the image in conditions of noise, shadows or insufficient resolution.

The level of semantic information encoding performs compression of the description of the image: the approximation of contours by straight lines, arcs; selection of a skeleton, color segmentation. In the course of approximation again, but already on the basis of the chains specific points are specified and recursively selected optimal points of inflection - the ends of the approximating segments. The semantic model of the image is formed in the form of a hierarchical information structure.

Level of recognition and verbalization. Recognition of graphic information presented in the form of fuzzy spatially loaded graphs consists in the original method of mapping images of images using a beam graph that takes into account the spatial orientation of the edges and the allocation of the associated subgraphs, which have the highest degree of similarity to any of the existing in the long-term memory.

IV. Algorithm of the system of recognition of graphic information.

The algorithm of the system of recognition of graphic information is shown in Fig. 2.

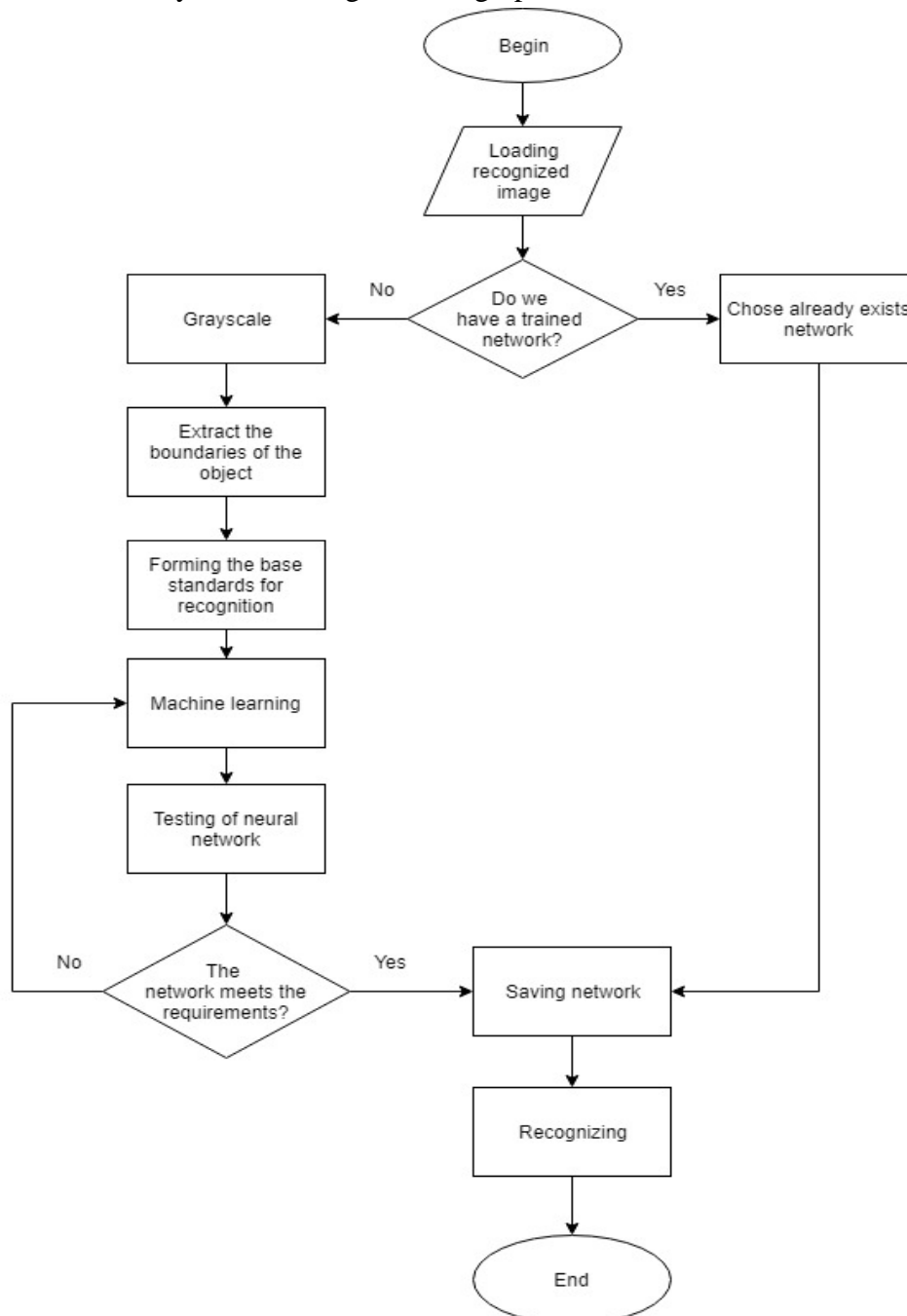


Fig.2 The algorithm of the system of recognition of graphic information.

Conclusion.

In this paper proposed ways to improve image recognition, highlighted the general principles of organizing the processing of graphic information, according to which, it is possible to achieve the structuring of components of the system. The program system of recognition of graphic information using convolutional neural networks has been developed. A structural scheme is developed and the algorithm of system operation is described.

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Corporate computer network with high level information security

Volodymyr Hrabovskyi¹ Yaroslav Paramud²

1. Computers Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera street 12, E-mail: volodya.grabik@gmail.com

2. Computers Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera street 12, E-mail: paramutys@polynet.lviv.ua

Abstract - We consider the problem of information security in the corporate computer network, provide means of security on different level OSI model, analyze encryption algorithm and present structural scheme of the network. Also implement extra information security base on algorithm asymmetric encryption.

Keywords: corporate computer network, information security, Open Systems Interconnection model (OSI), Transmission Control Protocol (TCP), Internet Protocol (IP), RSA.

Introduction

Nowadays, wide area networks, such as the Internet, have become extremely popular. Technologies for the construction of computer networks have also developed, which allows them to project, develop and maintain them in different ways. The development of Internet has led to the use of wide area networks for data transmission in various industries and in everyday life. When commercially using the Internet, as well as merging parts of organizations or companies, there is a problem with the access of external users to the corporate network and the protection of data passing through the network. The issue of protecting private data has led to the rapid development of network protection technologies.

Computer network security tools

The most protected data channel is an optical cable, through which it is impossible to listen to information, and make noise. Its bandwidth reaches several hundred Gb / s, and the length of the signal transmission without its amplification ranges from 10 to 40 km [3]. At short distances of up to 100m, a screened wired pair is used, but the most popular data channels are wired technologies and unprotected twisted pair.

At the data link layer, the problems of protection can be the substitution of MAC addresses of nodes, overload of data channels and other equipment. To resolve these problems, the following measures are used [2]:

- MAC - filtering, and binding switch port to MAC address;
- Using Dynamic ARP Inspection, DHCP Snooping;
- Using VLAN.

Table 1

Methods and technologies for protecting the network layer

Threat	Method of protection	Result
Replacing IP addresses	Binding IP – MAC - port	Create attachment list
Determine the internal structure of network	NAT	Replacing sender's IP addresses
Unauthorized access to nodes and services	ACL	Filtering packages that don't comply with the rules
External threats	Create list of banned routes to network	Filtering packages that match paths that are not allowed

At the transport level, SSL / TLS protocols can prevent interception and connection to open ports. To prevent loss of information at the application level, use the Statefull Inspection mechanisms and the use of intermediary servers. These technologies control the connection, but do not analyze the contents of packages, which allows viruses and other spyware to enter the corporate network.

Structure of network

Existing traditional security mechanisms implemented in authentication servers, access differentiation systems, firewalls, are tools that only block attacks. To build a well-protected network, you need tools that not only detect and block attacks, but also warn them. Based on the requirements for a secure computer system, this work will consider existing methods of protecting the COP and offer additional protection at the application level [4]. Each specific computer network consists of elements characteristic of it, but each of them can be distinguished four levels [1].

- Level of application software
- Level of database management system
- Operating system level
- Network level

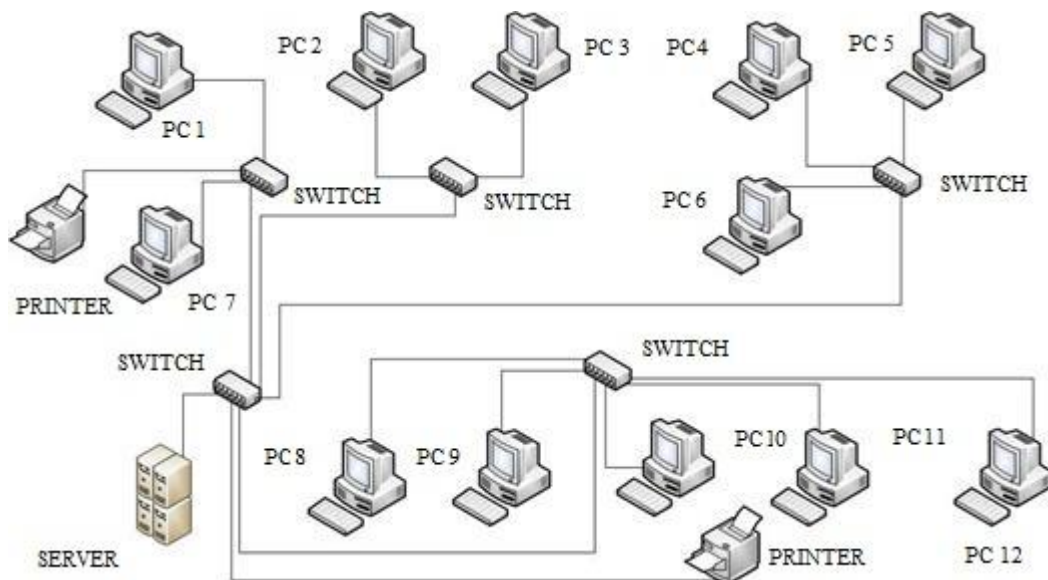


Fig.1. Corporative computer network structure

Table 1

Structuring the IP network

Subnet IP address	192.168.0.0
Subnet mask	255.255.255.0
Minimum IP address	192.168.0.1
Maximum IP address	192.168.0.254
Broadcast IP address	192.168.0.255

Extra protection for corporate network

The main disadvantage of the application layer is the open nature of protocols, which causes a large number of threats associated with the main problem of these protocols - the

transmission of information in unencrypted form. The use of procedures at the application level for authenticating and authenticating users with subsequent authorization also threatens the interception or selection of accounts and passwords. Significant threats also come from viruses and spyware that operate at the application level, DoS and DDoS attacks on information systems [4]. The extra protection of the corporate network is asymmetric encryption of messages which users exchanged.

RSA (Rivest–Shamir–Adleman) is one of the first public-key cryptosystems and is widely used for secure data transmission. In such a cryptosystem, the encryption key is public and it is different from the decryption key which is kept secret (private). In RSA, this asymmetry is based on the practical difficulty of the factorization of the product of two large prime numbers, the "factoring problem".

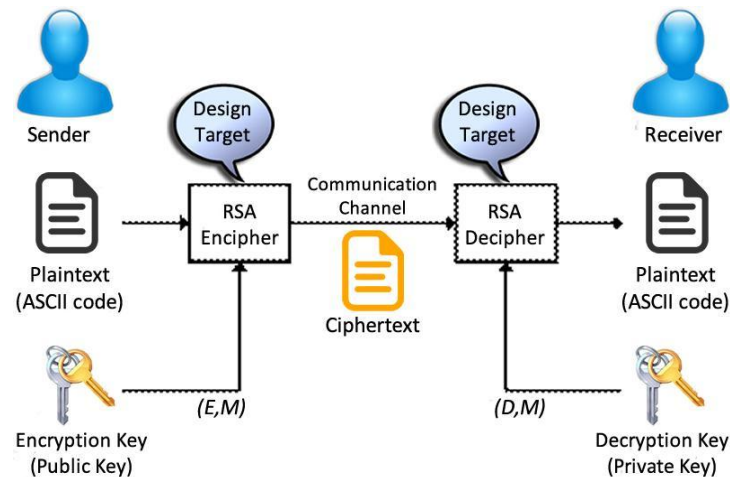


Fig.2. RSA algorithm

Conclusion

The corporate network security problem can be solved by using various security techniques and technologies that are implemented in modern computer equipment. Based on the most common threats to the transport (open ports connection and interception of information) and application (interception of information and DoS / DDoS attacks) of OSI levels, an analysis of the features of the technologies and methods of protection has been made. A corporate computer network with high level security information has been developed. The structure of the network scheme and the principle of additional protection work are presented.

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Microprocessor control system of Unmanned Aerial Vehicle

Roman Petsukh, Kytsun Hennadii

1. Department of Electronic Computing Machines, Lviv Polytechnic National University, Ukraine, Lviv, 28a Stepan Bandera Str., Building 5, Room 503, E-mail: petsukhroma@gmail.com

2. Department of Electronic Computing Machines, Lviv Polytechnic National University, Ukraine, Lviv, 28a Stepan Bandera Str., Building 5, Room 503, E-mail: kytsun.hennadii@gmail.com

The problem of building UAV microprocessor systems and basic directions of its development are considered. The ways of their improvement and construction of new systems with better technical characteristics are analyzed. The standard structure and nodes which is necessary for basic usage of unmanned aerial vehicle are offered.

Keywords – UAV, microprocessor systems, drone, quad, controller, nodes.

Introduction

The UAVs is one of the fastest growing IT directions. Unmanned aerial vehicles does belong to the aviation sector that develops very quickly and has great potential for growth and job creation. The term "unmanned aerial vehicle" includes all large aircraft similar to the size and complexity of a manned airplane as well as the small electronic devices for personal use.

Because of the wide deversity of UAVs, their classification is very important. Based on the generalization of known classifications and tactical or technical characteristics of existing unmanned aerial vehicles, their classification is proposed, based on the main features: usage; type of control system; flight rules; class; type; wing type; way of take-off / landing; engine type; fuel system; type of fuel tank; number of uses; category (taking into account the mass and the maximum range of action); range of action; height; functional purpose.

In this work, a "Quadrocopter" UAV type will be considered. That exact branch is becoming more and more popular among people for the racing or video recording purposes. The market is already taken by such brands as DJI, Xiaomi, Syma, etc. These even managed to become some kind of giants in this field.

Methods

In recent years, the commercial UAVs has become more popular. However, today`s modern drones still got a bunch of serious problems, the existence of which raises the question about the expediency of such a massive conveyor production of these devices.

So, the Achilles` feel in modern drones is far from just one. Still there persist a few things to focus on. For example, connection security, payload and, most importantly, autonomy. Safety in this regard is extremely important, since control signals between the remote control and the device are usually transmitted through an unsecured communication channel. In turn, the development of new protection methods and their applying will only reduce low autonomy of these devices. In addition, over time, the elemental base of such devices does increases. That makes drones much more complex and more expensive to develop, but it opens up the new opportunities. For example, it forces the developer to look for ways of increasing the time, during which the drone may stay in the air.

Results

A decision was made to develop a microprocessor based computer system which is intended to control the drone. Consider the typical elements of such devices and choose the

optimal configuration for price and quality that will fully meet the needs of the pilot, as well as ensure that the device is safely positioned in the air.

Discussion

The flight itself is controlled not only by the remote control but also by the main unit of such a device which is the flight controller. The model range of such devices is tens of units, most of them are completely similar by their technical parameters, but many of them belong to the different price categories. However, they all combine the task of ensuring the stable execution of such tasks as the formation of stable communications, stabilization in the air, maintaining height, support for third-party peripheral nodes, etc. Absolutely accurate is the statement that some cheap controllers have the worst set of functionalities.

Table 1

Various controller characteristics

Controller	Flight stabilization	Height maintenance	Position maintenance	Checkpoints flight	Telemetry	OSD
MultiWii	+	+	+	+	+	+
ArduCopter	+	+	+	+	+	+
Rabbit	+	+	+	-	-	-
DJI Naza Lite	+	+	+	-	-	-
DJI Naza V1	+	+	+	+	+	+
DJI Naza V1/V2	+	+	+	+	+	+
DJI Wookong	+	+	+	+	+	+
Zero UAV X4/X6	+	+	+	+	+	-
XAircraft	+	+	+	-	-	-
Xaircraft SuperX	+	+	+	-	-	+
FY-DOS	+	+	+	-	-	-
FY-41AP	+	+	+	-	+	+
KK	+	-	-	-	-	-
MicroKopter	+	+	+	+	+	+
GU-344	+	-	-	-	-	-
Autoquad	+	+	+	+	+	+
Matek Sys	+	+	+	+	+	+

Equally important parts are the motors, the current controller, GPS, OSD (On Screen Display - the imposed interface to the FPV-camera image with parameters of height, speed, battery charge), video card, battery, remote control, etc. Previously it was decided to choose and combine the following essential elements:

Flight Controller Matek Systems Beta Flight F405-CTR. Controllers (Fig. 1) are used to provide multiple flight opportunities for the drone. As table 1 indicates, it can execute such operations as flight stabilization, gps navigation, telemetry, video link.



Fig.1. Matek Systems F405-CTR Controller

Turn regulators DYS XS 30A 3-6s Lipo BLheli_S. These are intended to control the current which heads to motors. Also they are playing a big security role for the aircraft.



Fig.2. DYS XS 30A 3-6s Lipo BLheli_S

Motors DYS Samguk Series Wei 2207 2300KV 2600KV. Quadcopters generally use two pairs of identical fixed pitched propellers; two clockwise (CW) and two counterclockwise (CCW). These use independent variation of the speed of each rotor to achieve control. By changing the speed of each rotor it is possible to specifically generate a desired total thrust; to locate for the centre of thrust both laterally and longitudinally; and to create a desired total torque, or turning force.



Fig.3. Motors DYS Samguk Series Wei 2207

Conclusion

The problem of building microprocessor systems of UAVs and the main directions of their development are considered in this article. The ways of their improvement and construction of new systems with better technical characteristics are analyzed. The standard structure and basic nodes necessary for comfortable execution of flights are offered.

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Mobile system for text recognition and translation with using Microsoft Cognitive API

Vavruk Evgen¹, Kushnir Dmytro².

1. Computers Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera street 12, E-mail: evv1@ukr.net

2. Computers Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera street 12, E-mail: dimakush1@gmail.com

The solution of handwritten and printed text processing problem with subsequent translation in such mobile platforms like Android and IOS is proposed. It was demonstrated method of fully cross-platform solutions development for large mobile systems. It was implemented system with the base on general algorithm of text recognition and processing using Microsoft Cognitive API.

Keywords – OCR, Xamarin, program interfaces, REST, machine learning, Microsoft cognitive API

Introduction

The paper considers the features of using program interfaces to obtain fully cross-platform mobile solution, using framework Xamarin in cases, when some function or libraries are impossible to make cross-platform. Another problem is to obtain best possible text recognition result, depending on such factors like: color, font, word spacing, language, type (printed, handwritten) of input text, gained from camera photo stream. Nowadays, idea of using machine learning to obtain such results become increasingly popular, because that technology allows to gain maximum result, using only web technologies to send/receive information, such as REST technologies. That is quite important, as modern text recognition systems require practically or completely 100% percent result of recognition (for example Visa center, number plate city system etc.). Taking into account all of the above, work in that direction is timely and relevant.

System structure overview

System for text recognition and translation is shown in fig. 1. That scheme implements all problems, raised above.

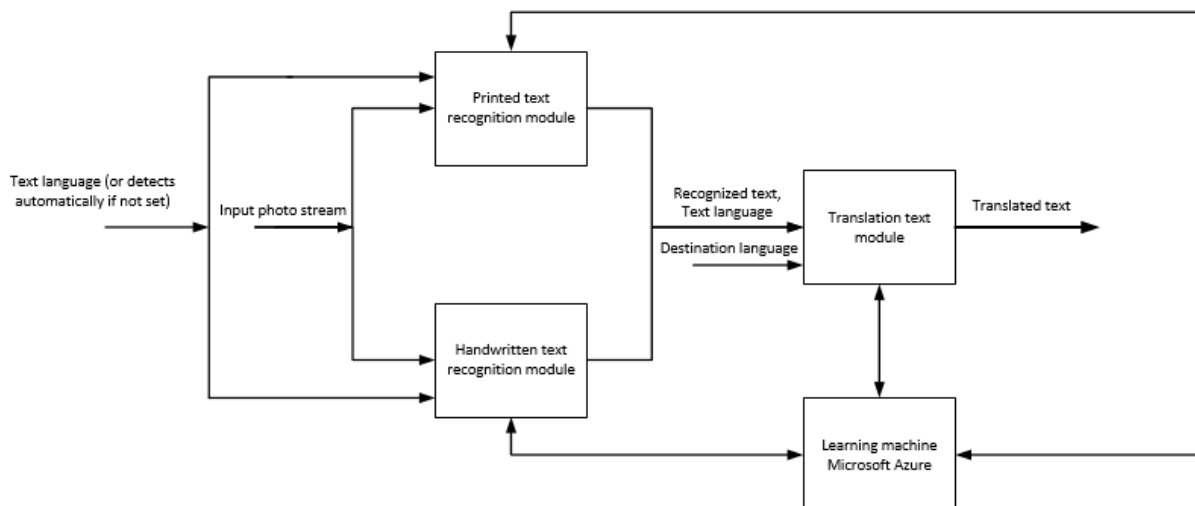


Fig.1 The general scheme of developed system

Generally, we are getting photo stream from our mobile device (Android or IOS), which are going to one of the recognitions modules, which in turn sends request data to learning machine server, using REST technologies. All description about main modules will be described below.

III. Fully cross-platform solution for native IOS and Android libraries

Xamarin platform allows one to create native apps for such mobile platforms like: Android, IOS, Blackberry, Windows, using C# programming language. In order to create full interpretation of .NET platform open source *Mono* project is used. With that project, apps, written in C# are able to execute on non-Windows systems (for example UNIX). [3]

As apps should be fully native, that means that way of compilation should be the same, as if it was their native environment. Xamarin allows to use separate compiler for each platform, using hardware resources of specific platform. Example of following compilation are shown below, see fig. 2.

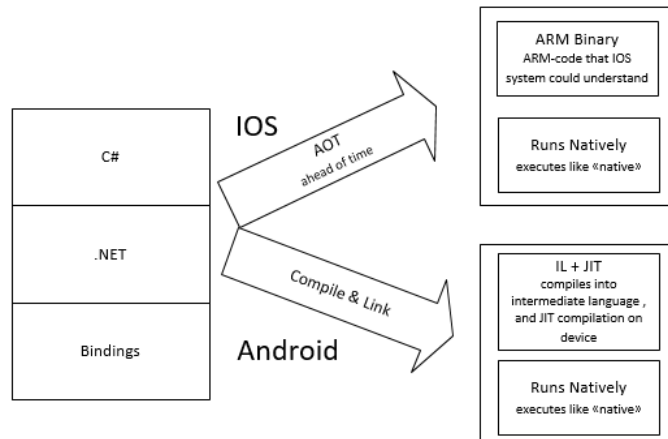


Fig.2 Mobile app compilation on separate platforms (Android, IOS)

Here, we run into problem of all native libraries support. The thing is, last version of Xamarin framework doesn't cover all native libraries. One reason for this is specificity of that libraries.

Solution for that is to write program interface, to redefine each class with problem libraries for every platform. Example of such interface are demonstrated in fig 3.

```
public interface PCL_Translator
{
    string Translate(
        string sourceText,
        string sourceLanguage,
        string targetLanguage,
        string key);
}

string translatedwords =
DependencyService.Get<PCL_Translator>().Translate(
    words,
    g_sourceLanguage,
    destLang,
    Utils.GenerateRandomKey(Data.translationKeys))
+ " ";
```

Fig.3 Program listing of realization(left) and call (right) of translation program interface

Each interface will be redefined according to target platform, that is running by compiler.

IV. Azure learning machine overview

Microsoft cognitive OCR (optical character recognition) API is based on machine learning, which is realized by Microsoft *Azure* project. [1] Such approach allows to use all benefits of make huge calculations that OCR requires (especially for large and complicated systems) remotely, which can't be done locally. To obtain data, using web services, one can use REST requests to Azure machine learning server. Example of such request for translation module with translating text from English to Ukrainian is shown in fig. 4.

```

POST https://api.cognitive.microsofttranslator.com/translate?api-version=3.0&from=en&to=uk

1 [
2   {"Text": "I would really like to drive your car around the block a few times."}
3 ]

1 [
2   {
3     "translations": [
4       {
5         "text": "Я б дуже хотів, щоб керувати автомобілем по всьому блоку кілька разів.",
6         "to": "uk"
7       }
8     ]
9   }
10 ]

```

Fig.4 Example of request and response from Azure server for translation API

The same algorithm is used for text recognition modules. All requests are wrapped in class functions to call it from mobile device (so internet connection is required).

Text recognition algorithm

The so-called «linear division procedure» divides the lines into words, and the words into separate letters; further, according to the principle of *IPA* (integrity, purposefulness, adaptability), a set of hypotheses is formed (that is, the possible variants of what is a symbol for which symbols are a broken word, etc.) and, providing each probability estimate, the result is passed to the input of the character recognition mechanism. [2]

In accordance with the first rule: the principle of the integrity of an object, which is always considered as a whole, consisting of a multitude of interrelated parts. The principle of purposefulness states that any interpretation of data must pursue a certain purpose. Thus, recognition is the process of putting hypotheses about the whole object entirely, and the purposeful verification of them. The third principle - adaptability, implies the ability of the system to self-study and the ability to use previously accumulated knowledge about objects. The information obtained during the recognition of information is organized, stored and used later in solving similar problems.

Character recognition.

For recognition of characters in Microsoft Cognitive OCR special mechanisms are used, called classifiers, which generate a list of hypotheses, which are then purposefully verified. [2] Input data for classifiers can serve not only graphical information, but also formed during the recognition of the list of hypotheses. In the latter case, the classifier does not put forward new hypotheses, but only changes the weights available, confirming or refuting them. This approach, which also clearly tracks the *IPA* principles, provides more intelligent image analysis and the most accurate document recognition. Scheme of follows is shown in fig 6.

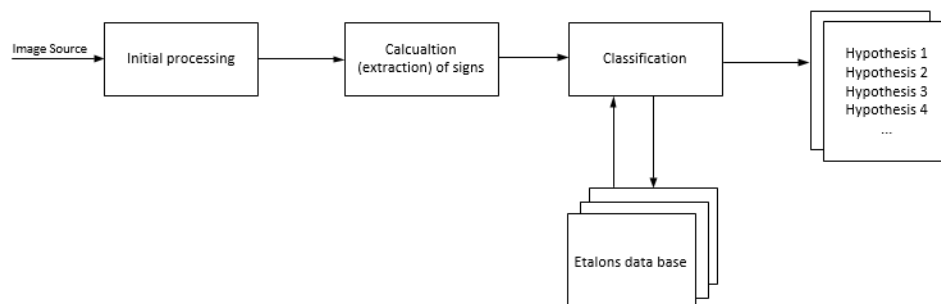


Fig.6 Block diagram of the algorithm of the adaptive binarization procedure

System work demo

An example of processing is shown in fig. 7. In this case, the input parameters are colored Ukrainian and English text, written in different fonts with different indents between letters. The result of the processing is Ukrainian text, which is then translated into English. The quality of the image is also influenced by the quality of the image, the rotation of the text on the image, the font, the distance between the characters, the language of the text, etc. Moreover, the Ukrainian-language and English-language text in the picture were placed in a mix.

As can be seen from the figure, the word "Polytechnic" was recognized with an mistake ("n" instead of "k"), but in the process of translation, this error was eliminated.

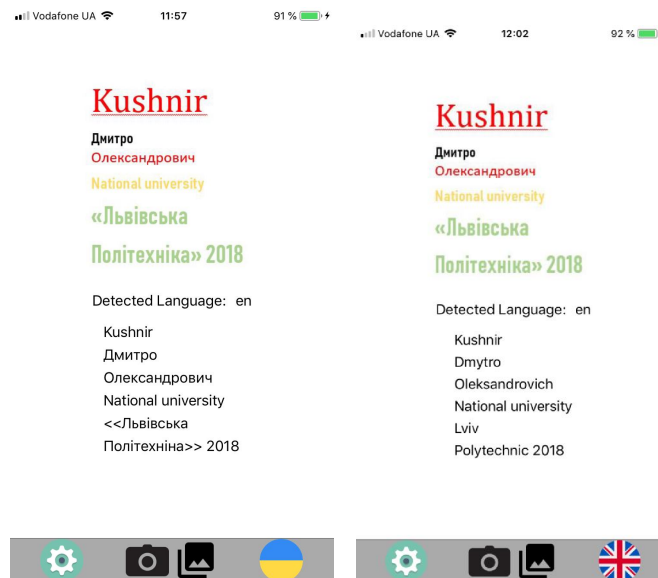


Fig.7 Processing of English and Ukrainian texts (left) and translation of both into English (right)

Conclusion

The analysis of the implemented cross-platform solutions is carried out. It is shown that some libraries and methods of making cross-platform are impossible and demonstrates the solution of this problem in the form of software interfaces.

The work of the module of processing of information is analyzed, and also the work of the Azure training machine from Microsoft is shown. The advantages and disadvantages of using a learning machine and REST queries compared to similar local machines are illustrated.

The algorithm of the Microsoft Cognitive OCR API text information handler is analyzed. The work of classifiers is shown, and the structure of hypotheses for each input phrase of the text is shown. The example of the system work is demonstrated, with demonstrating general system scheme.

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Prospects of information system project for organizing volunteering activities

Solomiia Dutkevych¹, Vasyl Lytvyn²

1. Department of Information Systems and Networks, Lviv Polytechnic National University, Ukraine, Lviv, Bandery str., E-mail: solika96@gmail.com

2. Department of Information Systems and Networks, Lviv Polytechnic National University, Ukraine, Lviv, Bandery str., E-mail: Vasyl.V.Lytvyn@lpnu.ua

Abstract - The paper deals with the main prospects of information system project for organizing volunteering activities. The increase of European values in Ukraine and the processes of democratization as the achievement of the Revolution of Dignity lead to a significant growth of the role of volunteer activity in society. Besides, there is a big popularity of creating mobile applications. This article includes the development of an information system accompanying the process of carrying out project for organizing volunteering activities, based on the current Internet resources analysis and test system design.

Keywords - conference, conference proceedings, paper layout, prospects, volunteering, project, information system, computer technologies, mobile application.

Introduction

To begin with, the rapid development of computer technologies allowed the creation of mobile applications that are necessary for the organization of work with electronic information (creation of an event, change, search, storage), as well as an interaction between volunteers is possible: sharing responsibilities, issuing tasks (instructions, orders) and control over them. Therefore, such a project of the information system is necessary for the implementation of a comprehensive automated management system and organization of volunteering activities.

The aim

The main objective of creating an information system is to establish a convenient communication between the volunteers and *volunteer organizers*. Managing volunteers is no small task, but with a little effort on your part, you can develop a volunteer program that's effective, engaging, and exceptionally fulfilling for everyone involved. [1]

Necessity to create a project for organizing volunteering activities

Due to the fact that the information and its automated processing, remains an important factor in improvement of the effectiveness of human activities, therefore, this IT-startup should be very useful.

Nowadays, there are many events in which you can take part in volunteering. But, unfortunately, a small percentage of people are aware of events occurring in a city or country. The creation of such an information system will increase the number of volunteers. The target audience will be everyone who is interested: students, event organizers, ordinary people who want to help.

There is a necessity to develop a system that helped to engage in volunteering not only persistent volunteers with vast experience but also newcomers in this field who only want to start their own volunteering path, showing them that volunteering is simply enough. The event organizer can publish on the platform a specific event and volunteers may take part in appropriate event.

In order to write a volunteer application that works, a full volunteer application form should be one of the first steps in your volunteer recruitment process. For a successful volunteer application that works, must be forms, which will have the following components: contact information, including an email address; birth date and social security number; emergency contact; the relationship of the contact, address and phone; previous work or volunteer experience; the highest education level reached; language's spoken; physical restrictions, current employer, other organizations where the applicant has volunteered; description of training or experience that may be relevant to the volunteer position desired; statement of and description of prior criminal convictions or offenses, certificates such as First Aid with dates of certification and expiration dates; valid driver license; references; skills check list (list of skills needed in the organization's volunteer positions such as computer, tutoring, clerical skills, phone calls, teaching, supervision, etc; preferred volunteer areas (list of regular volunteer jobs that the applicant can check if interested); reason for volunteering; signature; of the applicant and date of signature. [2] On the whole, volunteering is an important event that should consider a number of important elements.

Conclusions

Finally, the main advantages of software use for organizing volunteering activities: increasing interest, reducing time for an organization, access to information from anywhere in the world, information about volunteers, searching volunteers, and events.

The Volunteer Management software can engage their volunteers through a volunteer portal, where they can manage their personal information and to search as well as to apply for volunteering, meanwhile, it will be simply and interactive. The availability of automatic notifications significantly reduces the administration time, which is needed to communicate and correct any changes that occur. And the opportunity to monitor the development of volunteering in a city or country and obtained information about the activity of citizens of the city is the greatest necessity for organizing volunteering activities.

As volunteering keeps you in constant contact with others, it can also help you develop a strong resting base. Volunteering can also help restore mental health by helping you protect yourself from stress and depression.

In conclusion, I can say that nowadays there is an urgent necessity to develop an application for volunteering activities using the latest information technology methods.

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Intelligent system for forming behavior of actors in computer game

Bilskyi D.M., Katrenko A.V.

1. Information systems and networks, national university «Lviv polytechnic», UKRAINE, Lviv, Stepan Bandera street, E-mail: feroxd392@gmail.com,

2. Information systems and networks, national university «Lviv polytechnic», UKRAINE, Lviv, Stepan Bandera street, E-mail:

anatolkatrenko@gmail.com

Abstract - The paper deals with the use of artificial intelligence methods in computer games with a review of a variety of actors and decision-making features. Features of application of artificial intelligence in games of various genres and concerning requirements for intellectual system are analyzed. During the execution of the system was used "behavior tree" in the game engine Unreal engine 4.

Key words - artificial intelligence, actor, solution, tasks, behavior tree.

In modern games, artificial intelligence is very important and strongly affects the gameplay (the process of interaction between the player and the game), system requirements and the budget of the game. Therefore, developers balance between these requirements, trying to make an interesting and at the same time undemanding to the resources of artificial intelligence in the product with a low price, which causes the difference between the approach to the game AI and traditional SHI — widely used all sorts of simplification, deception and emulation. In science, AI works with a large number of calculations and information, which significantly distinguishes AI in science and games. For example: on the one hand, in first-person shooters, the unmistakable movement and instant aiming inherent in bots leaves no chance for a person, so these characteristics are artificially reduced. On the other hand, bots must ambush, act as a team, etc., for this purpose, "targets" are used in the form of control points located at the level, or random conditions for changing the location to move, and the like.

Video game characters are divided into:

non-player characters (persistent. Non-player character-NPC)-as a rule, these AI characters are friendly or neutral to the human player;

bots (English. Bot) - hostile to the player AI-characters approaching the capabilities of the game character; against the player at any given moment fighting a small number of bots. Bots are the most difficult in programming;

mobs (persistent. Mob)-enemy to the player "low-intelligence" AI characters. Mobs kill" players in large numbers for the sake of experience points, artifacts, or gaining territory.

the actor is the parent class of all characters (in unreal engine 4) from which non-player characters, bots, and mobs originate. An actor is a generic name for a character in video games.

Some game programmers consider any technique used to create the illusion of intelligence, as part of the game AI. However, this view is controversial because it includes techniques that are widely used outside of the game AI engine. [1] For example, information about potential future collisions is important information entered into algorithms that help create bots that are smart enough to avoid collisions with objects. But the same collision detection techniques are necessary and one of the most important components of the physics engine. As the results of the examination direction of the bot view (Line of sight) of course there are important data that are entered into the system of aiming the bot; however, these data are widely used in rendering in the graphics engine.

Some players believe that the expression "artificial intelligence" in the term "game artificial intelligence" is an exaggeration, because the game AI does not describe intelligence, and uses

only some of the areas of academic science "Artificial intelligence". Whereas "real" AI addresses the industries of systems, self-learning, and decision-making that are based on arbitrary data entry, and even the ultimate goal of a "strong" AI that can think, game AI often consists of several empirical rules and heuristics that are sufficient to provide the player with good gameplay, feel, and game experience. [2]

The behavior tree (behavior three) is a mathematical model of plan execution used in computer science, robotics, control systems, and video games. The behavior tree describes how to switch between a finite set of tasks in a modular way.

Improving the understanding of academic AI by game developers and the growing interest of the academic community in video games raises the question of how and to what extent gaming AI differs from the classic. However, significant differences between different application areas of artificial intelligence mean that game AI should be considered as a separate sub-sector of AI. In particular, the ability to "legitimately" solve some AI problems in games by cheating forms an important distinction. For example, inferring the position of an invisible object from past observations can be a difficult problem when AI is applied to robotics, but in video games a non-player character can simply search for a position in a game graph. Such deception can lead to unrealistic behaviour and is therefore not always desirable. But its ability to serve to distinguish between game AI leads to the definition of time and place of use of deception. Also, the game industry is called the art of deception and fakes. That can only seem like something more, but give up and nothing more. This is necessary for greater optimization of the project, "the main task of AI is not to win against the player, but to succumb to it beautifully" and this is a big part of the truth of the modern game dev (video game development) [3].

The paper considers the use of modern methods of AI in computer games with a review of a variety of actors and features and decision-making. The innovative system of AI behavior tree in projects is described and it is proposed to classify AI according to the field of games, science and robotics [4].

Conclusion

The paper analyzes the importance of artificial intelligence in games, shows the difference between artificial intelligence in games and science, the interaction of the player and the game, classified types of actors in games and modern methods of artificial intelligence in the gaming industry. Detailed understanding of the AI and the game development.

The prospects of artificial intelligence in the gaming industry are explained by the needs of users of new products. Artificial intelligence is quickly introduced into a variety of practical applications. Many investors invest money in artificial intelligence for its development, improvement and training. Also, the influence of AI in recent years is growing faster in different industries.

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The Project of Information System on Organization of Tourist Trips

Ivanna Panchuk, Vasyl Lytvyn

1. Department of Information Systems and Networks, Lviv Polytechnic National University, Lviv, Bandera Str, 12, ivanka.panchuk@gmail.com
2. Department of Information Systems and Networks, Lviv Polytechnic National University, Lviv, Bandera Str, 12, vasy17.lytvyn@gmail.com

Abstract — This paper considers the process of organization of tourist routes and trips. In order to solve the problem and to satisfy the needs of consumers, the information system was planned and developed. The developed information system has the ability to preserve the data of a single route in database, to provide continuous access to the information, to perform wide range of data analysis.

Keywords — information systems, information technologies, tourism, independent travel, individual tour, data processing.

Introduction

One of the main features of the society and business development of the XXI century is the rapid evolution of information technology. Innovations, start-ups, promising projects are becoming an integral part of almost all spheres in our life. The tourist industry, unlike the economic and business sectors, is not so popular among information projects [2]. Accordingly, in modern conditions it is necessary to create a competitive information system that will provide services for organization and provision of tourist trips.

The scientific papers of famous scientists are devoted to the issues concerning the use and effectiveness of information technology in the tourism field, such as: G.P. Galuzinskii, MV Efremova, M. Zhelyeni, V.A. Kvartalnova, AV Levkova, SV Melnichenko, GA Papiryan, MM Skopen, T.I. Tkachenko, F. Ullah, M. Hammer, and others.

The Results of the Development

The purpose of this work is to develop an information system that will provide the user with data about the chosen travel route, combining the data from different sources in order to provide up-to-date travelling information, points of interest, available tickets, etc.

It is necessary to conduct the research on the effectiveness of the project, to assess possible risks, to design requirements, calculate resources and, finally, to create a plan for the information system development.

The information technology in modern world is developing with a high pace. Not only the number of projects grows, but also the qualitative characteristics of the created systems are improved. Modern information systems are commonly used in large companies and organizations, banks and government agencies, in transport and tourism spheres, that is where the speed of data processing and data transmission is an especially important element.

Almost 40% of travel agencies today provide an opportunity to book a tour online. In Europe, this tendency to book the hotel room and tickets independently, without the participation of travel agents, is gaining in popularity, which also helps to save the cost of the trip itself. That is why the influence of the information technologies development on the tourism sector has a significant positive impact.

The tourist sector is very popular among people of different age groups. In most cases, consumers choose their package tours at travel agencies. However, it does not provide the flexibility and autonomy of traveling, because they are "tied" to the selected excursions,

accommodations and attractions. Often, users are unaware of the ways they can arrange a trip by themselves. Such option helps not only in saving money, but also allows to make a unique travel route according to your chosen budget, the countries and cities people want to see, as well as the mode of travel and type of apartments they choose.

Unlike the individual tours that are provided by travel agencies, the developed information system will fix the disadvantages of existing software packages, since it will make the route absolutely free and will not require additional time — it is possible to select and book the tickets in 30 minutes. The creation of this information system will also help to solve the problem of unawareness of certain areas of the globe, since buying the tickets and organizing a trip is possible for every corner of the world.

Trends in information technology development are diverse in the way of development and the sphere where they are used. The modern projects fill in the area of social life where the flow of data is highly widespread. The tourism sphere is not an exception. Nowadays the diversity of tourist organizations is staggering.

However, consumers tend to be more independent and flexible in their choices, which causes the necessity for creation of tourist travel information system. Such project will provide a wide range of filters and options, thus making it possible to adjust travel to the consumer's lifestyle, its preferences, budget possibilities and impressions.

Conclusion

In this paper the main principles of information systems in the field of tourism are considered and the expediency of developing a project is substantiated. The main advantage of the developed system is the independence in choosing the route of travel, the simplicity and convenience of use. These characteristics determine the consumers to use the services of not only the traditional package tours, but also to start a new unique journey that is created independently with the help of information system for organizing tourist trips.

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Password Complexity Evaluation Instruments in Access Control Components of Cyber-Physical Systems

Anatoliy Ihnatovych¹, Vitaliy Pyvovar²

1. Department of Computer Engineering, Lviv Polytechnic National University, UKRAINE, Lviv, S.Bandery street 12, E-mail: ignatovicha@gmail.com

2. Department of Specialized Computer Systems, Lviv Polytechnic National University, UKRAINE, Lviv, S.Bandery street 12, E-mail: vitalya.pyvovar@gmail.com

Abstract – This paper describes usage of password complexity evaluation instruments as a part of access control components of cyber-physical systems. In particular, as password-based authentication remains the most widespread method of access control components today, we propose an instrument for password complexity evaluation, which can be used as a component of access control system of Cyber-Physical Systems.

Keywords – Password, Password Complexity, Cyber-physical system, Computer security.

Introduction

With recent developments of cyber-physical systems (CPS) assurance of cybersecurity of CPS during the process of their functioning in various subject areas is an actual task with growing importance. Security issues are particularly important at those CPS levels, where interaction with an individual takes part. As a rule such interaction happens at fifth level, where personal services usage has to be provided [1].

CPS architecture trends suggest that modern cyber-physics systems are created on the base of modular architecture. Besides, security components, as a rule, consist of several independent parts that can be connected and interact. Access control components are an important part of CPS cybersecurity infrastructure.

Significant approaches of access-control systems creation use identification methods based on biometrics – the recognition biological and/or behavioural characteristics of individuals. Although biometric and other innovative technologies are developing, password-based authentication is still considered to be the standard authentication mechanism for many services and components of CPS [2]. However, access control components based on password authentication are a weak point in cybersecurity despite many efforts [3]. Consequently, it is essential to use, create, modernize and explore tools for evaluation of passwords complexity for the access control components of CPS.

Formulation of the problem

We aim to develop a software solution for evaluating the complexity of passwords, which can be used as a component of access control in cyberphysical systems that are based on modular architecture.

Password Complexity Evaluation Module

For the purpose of solution of the described problem we propose to use password complexity evaluation module (PCEM) as a part of access control components of CPS. For calculating password complexity we are going to use a framework of threshold scores by checking whether password meets or does not meet a specific criterion. To define a set of criterions we explored existing systems for evaluation of complexity of passwords such as SeaMonkey Password Exporter, Password Strength Meter (jQuery plugin), Password Strength Checker (Cornell University), and Password Strength Tester (Rumkin.com project).

After analyzing disadvantages of the above mentioned services of password evaluation, we decided to create PCEM based on evaluating following set of criterions:

- password length;
- number of different types of characters (Latin and Cyrillic letters, numbers, special characters etc);
- absence of a specific word and/or its variations in the dictionaries and among widely used passwords (including checking the symbol replacement table, i.e. when "@" symbol will be interpreted as "a");
- in case of presence of other input fields, searching for matches of text there and password, for example comparing with individuals personal information;
- exploring time to find the password by brute force method;
- absence of repetitions or sequences of characters on the keyboard.

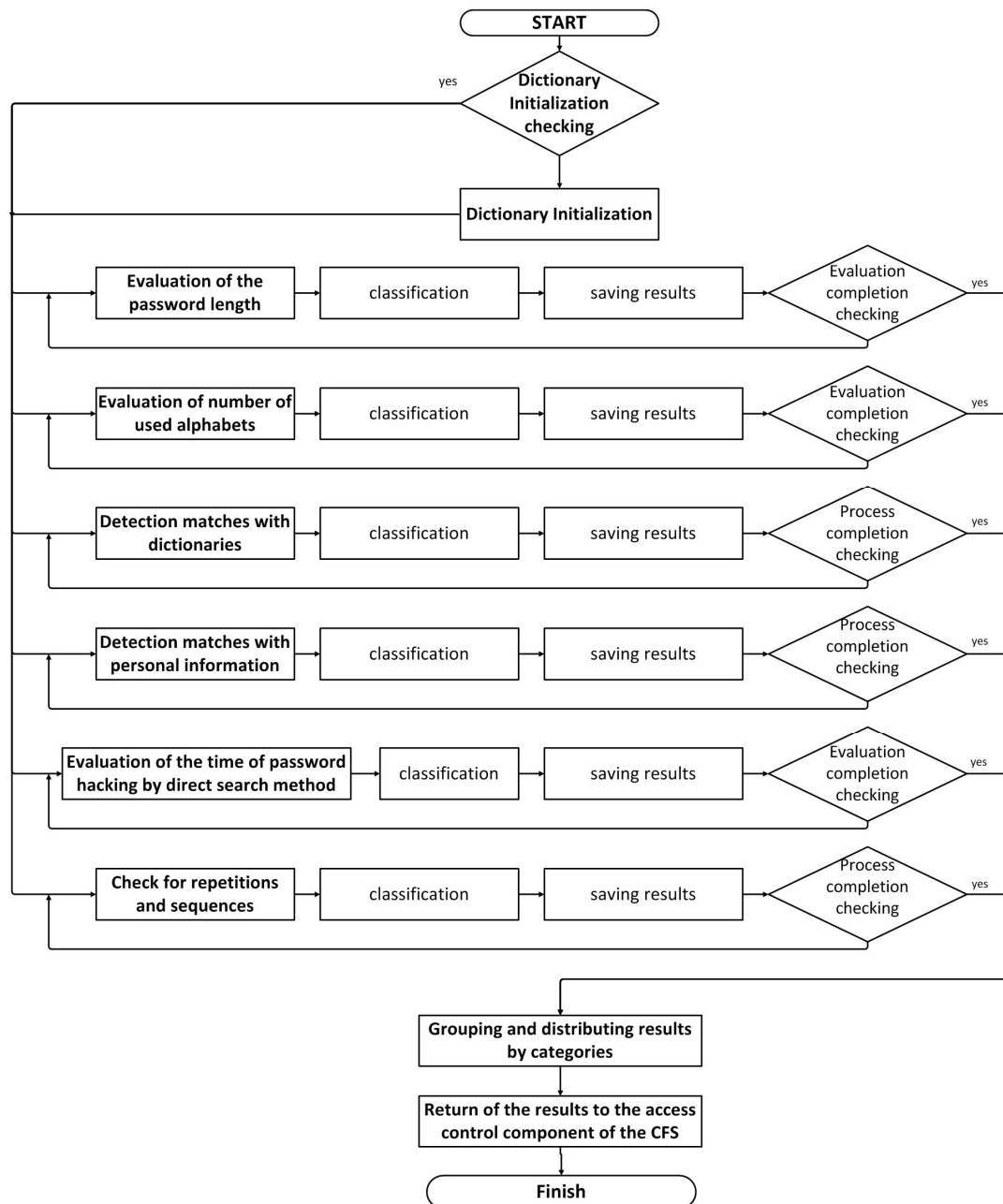


Fig.1. Block diagram of the functioning algorithm of password complexity evaluation module.

According to the given criterions PCEM will:

- evaluate password length;
- evaluate number of used alphabets;
- detect matches with dictionaries;
- detect matches with individuals personal information;
- evaluate time necessary for hacking password by the exhaustive search method;
- search for repetitions and sequences.

Thus, according to the proposed set of criterions created PCEM will sort passwords into several groups of complexity. The result of the evaluation given by PCEM will also include statistical information and will indicate number of characters, number of types of alphabets, similar word from the dictionary or other input fields if there are any, time required for password hacking by the direct search method and all replies and the sequence on the keyboard that the password contains.

Block diagram of the functioning algorithm of proposed password complexity evaluation module is presented on Fig. 1.

It is necessary to mentioned that PCEM consist of separate modules, so in case user has other criteria, they can be easily integrated to the system. Such PCEM allows you to evaluate passwords for as many features as possible. Also each developer has a possibility to set his own threshold scores according to critical parameters of CPS.

The system consists of two main blocks: the Angular2 framework test application (main CFS Access Control Component - MACC) and an independent Password Complexity Evaluation Module (PCEM), algorithm of which is proposed. Interaction process and ways of linking of MACC and PCEM is given on Fig. 2.

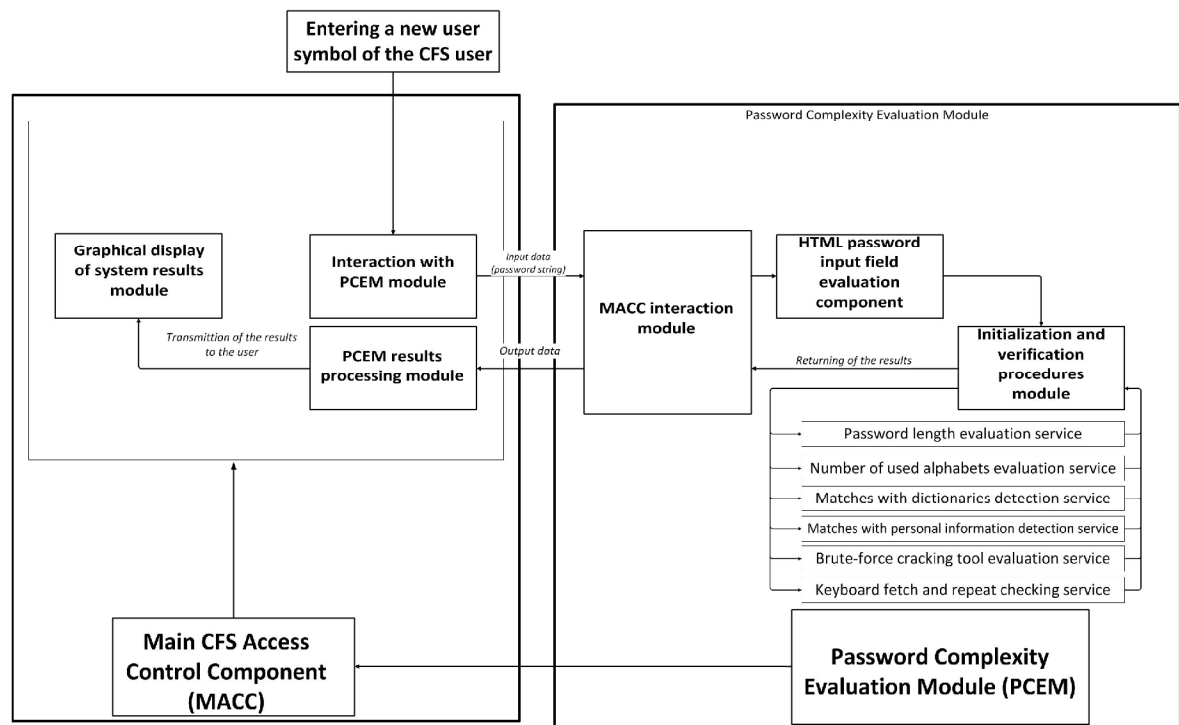


Fig.2. Structural scheme of the CFS access control component with the password complexity evaluation module.

Calling scheme procedures for the PCEM of CFS is presented on Fig. 3.

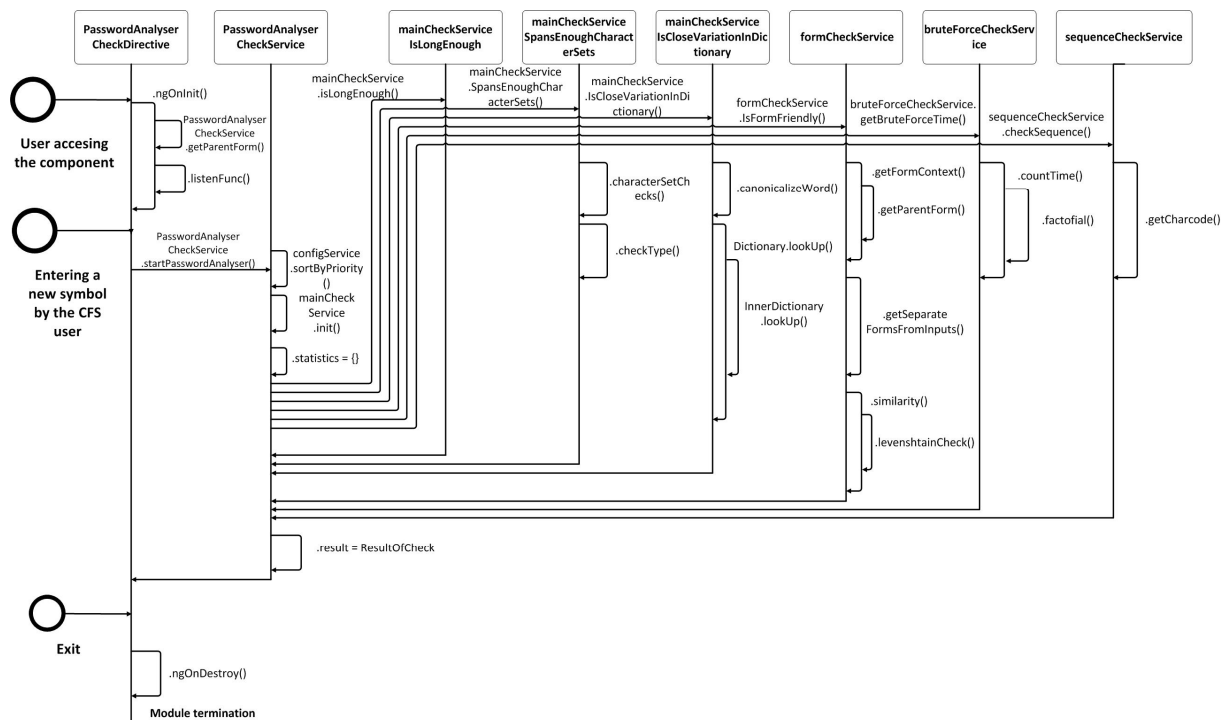


Fig.3. Calling scheme procedures of the PCEM.

As it is shown on the diagram, the system interacts with users through 3 events. Initialization takes place when the user logs in to the connection page. Not to slow down the system in the future the memory is cleared when the user leaves the PCEM. Entering each next character of the password a new password processing cycle is started. All evaluations are performed separately for each category of defined criteria.

Prototype window of the designed PCEM is presented on Fig. 4.

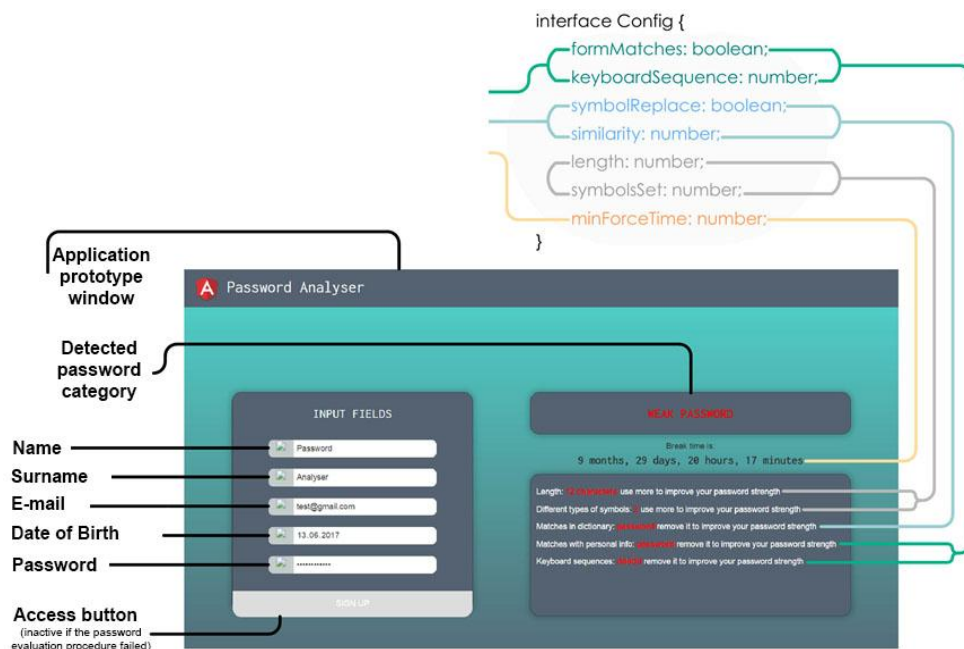


Fig.4. Prototype window of the created module.

Conclusion

Securing CPS is an important problem that is often solved by password protection. Users of CPS agree that good passwords are important, but they often choose bad passwords. Proposed in the paper PCEM software instrument helps to achieve better password complexity by evaluation of passwords using threshold scores. Those scores and evaluation criteria can be changed by user of CPS and adapted to user requirements. Such PCEM allows user to evaluate passwords for as many features as possible. Furthermore, our module can be used separately or linked with other security modules to increase CPS protection.

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Implementation of extended Galois field operational unit with help of multiprocessor computers

Andrii Kostyk¹, Valerii Hlukhov²

1. Computer Engineering Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 28a, E-mail: andy989gow@gmail.com

2. Computer Engineering Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 28a, E-mail: valeriygl@ukr.net

The features of implementation of operational units for performing operations over elements of extended binary Galois fields are considered. It is shown that implementation using a multiprocessor computers allows obtain research results in a shorter period of time and improves performance at each step of the synthesis and implementation in the Xilinx ISE Design Suite.

Keywords – binary Galois fields $GF(2^m)$, Xilinx ISE Design Suite, LUT (Lookup Table), Guild cell, performance.

Introduction

The paper discusses the features of implementation of operational units for performing operations over elements of extended binary Galois fields in modern field programmable gate arrays (FPGAs). Galois fields are used for based in elliptic curves electronic digital signatures, ensuring their reliability and protection from unauthorized persons (intruders) [1], [2]. For reliable protection of information their hardware implementation on the FPGA is increasingly used. The paper shows that implementation of operational units for operations over elements of a extended binary Galois field using a multiprocessor computers allows one to obtain the results of research much faster in comparison with a dual-processor computers.

Operations over elements of extended Galois Field

To build the multiplier for extended binary Galois field $GF(2^m)$, modified Guild cells are used ([3]). A modified Guild cell consists of an adder and a multiplier. Total number of Guild Cells in multiplier is near m^2 .

For the synthesis and implementation of a 239-bit arithmetic unit over elements of the Galois binary field $GF(2^m)$, $m = 239$, the Xilinx ISE and FPGA Spartan 6 are used. A multi-core computer is used to speed up processes such as Synthesis, Map and Place & Route. The results of synthesis and implementation are compared for 2 core mobile processor Intel Core i3-3120M and a 12 core processor Intel Xeon E5-2600 v4 (Table 1).

Table 1

Comparison of execution time of the synthesis and implementation in the Xilinx ISE Design Suite, sec

Xilinx ISE Design Suite (Stages)	Intel Core i3-3120M	Intel Xeon E5-2600 v4
Synthesize – XST– Check Syntax	57	30,2
Synthesize – XST– Generate RTL	0,6	0,4
Synthesize – XST – Generate Technology Schematic	0,4	0,4
Synthesize – XST	124,5	73,42
Implement Design – Translate	38,81	28,8
Implement Design – Map	22,89	16,22
Summary	244,2	149,44

Fig. 1 shows the workload of 12 core Intel Xeon E5-2600 v4 processor during the implementation design in this study.

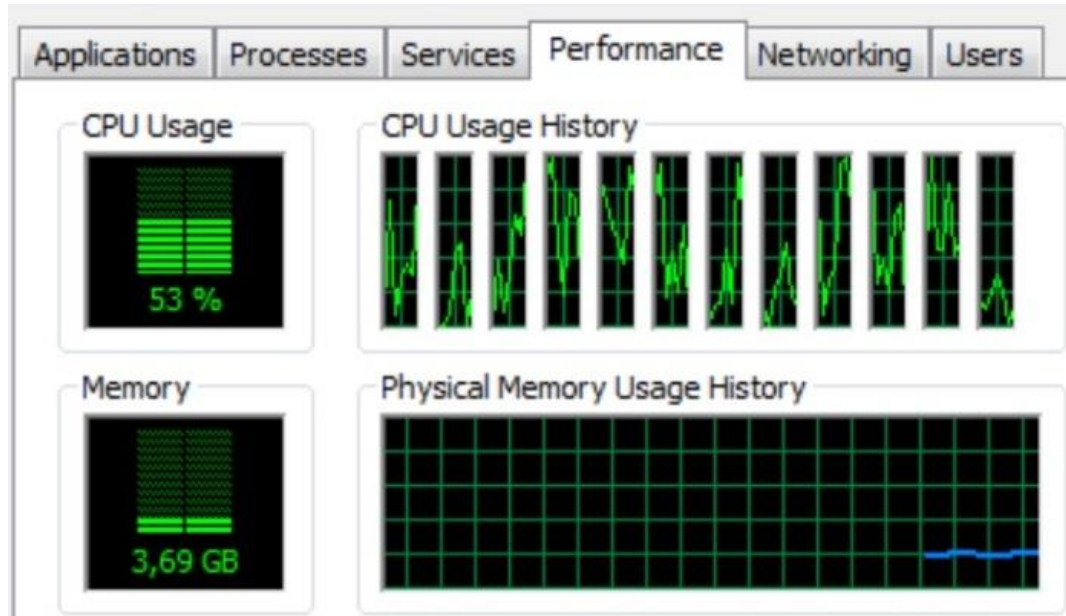


Fig. 1. Implement Design – Translate.

The results of the study show a significant improvement in performance at each step of the synthesis and implementation when multicore computer are used.

Conclusion

In this paper discusses implementation of operational units for performing operations over elements of extended binary Galois fields in modern FPGAs. Comparison of different computers execution time of synthesis and implementation in the Xilinx ISE Design Suite are performed. A significant improvement in research performance was achieved thanks to a 12 core Intel Xeon E5-2600 v4 processor compared with 2 core mobile processor Intel Core i3-3120M .

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Tools for micro-satellite video stream compressing

Khomits Valya¹, Hlukhov Valeriy².

Computers Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera street 12, E-mail: blueferrari5252@gmail.com

The features of constructing devices in modern FPGA for lossless compression of video stream by JPEG-LS method and CCSDS121.0-B-2 recommendation are considered in detail.

Keywords: lossless compression, FPGA, JPEG-LS, CCSDS121.0-B-2, software implementation, hardware implementation.

Introduction

The paper considers the features of lossless compression of video stream using CCSDS121.0-B-2 recommendation [2] and JPEG-LS method [1], as well as their implementation in the FPGA. The lossless compression method eliminates the redundancy of the data source, and after decoding it can completely restore compressed data. This method is especially useful when the integrity of the data should not be violated [5].

In the work the complexity of lossless video stream compression devices are compared.

Structure of the data compression unit according to CCSDS 121.0-B-2 recommendation

The source encoder for lossless compression consists of two distinct functional parts: a preprocessor and an adaptive entropy encoder.

The preprocessor function is a reversible operation, and, in general, the best Lossless preprocessor will produce the lowest entropy, which is a measure of the smallest average number of bits that can be used to represent each sample.

The function of an adaptive entropy encoder is to calculate uniquely encoded words of variable length that correspond to each block of data coming from the preprocessor. The entropy encoder implements several encoding options, each of them is effective for different entropy ranges of input data. The encoder chooses the encoding option that gives the highest compression ratio for each of the block of input data. Since the number of block may be small and the best compression method is used for each block, generally encoding can adapt to rapid changes in data statistics.

Fig. 1 shows the functional diagram of generally accepted adaptive entropy encoder along with a preprocessor. A unique identifier (ID) is added to the compressed data to indicate to the decoder necessary decoding method.

Realization of the CCSDS121.0-B-2 recommendation in the FPGA

The compression recommendation CCSDS121.0-B-2 is used in hardware implementations aimed at space exploration. One of the successful implementations is the core (IP Core) of the AMBA™ FPGA manufacturer[2]. Below is a structure (Fig. 2) and a description of each implementation component.

In the previous step, three basic operations are performed for each input sample according to core operation mode in the following order: formation of the feature of the extension of the previous block, formation of the predicted value of the subsequent data, and, finally, generation of filling for the last block of data flow (if necessary).

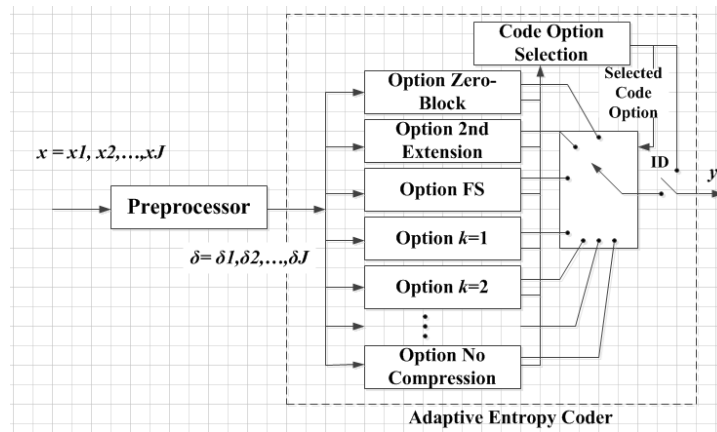


Fig.1 Adaptive entropy encoder with preprocessor according to CCSDS 121.0-B-2 recommendation

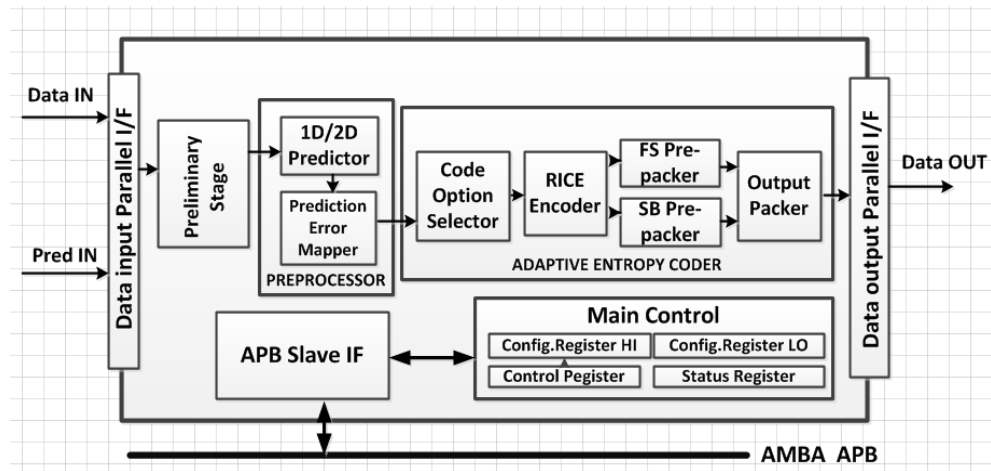


Fig.2 AMBA™ CCSDS 121.0-B-2 FPGA core structure

In the preprocessor unit there is a prediction unit that converts the value of prediction errors in non-negative integers.

Prediction Error Mapper takes the value of the prediction error and converts it in non-negative numbers suitable for Adaptive Entropy Encoder.

The adaptive entropy encoder (AEC) has the following characteristics: a) the possible size of the block of data (J) is 8, 16, 32 or 64; b) it supports the basic or limited set of code parameters; c) its sample interval (r) is from 1 to 4096. These parameters are configured by the user through the configuration register.

The coding option selection unit simultaneously calculates the effect of using each of the compression methods and chooses the method that gives the highest compression ratio among the others same data block.

The RICE Encoder unit implements the basic Rice adaptive encoding algorithm that selects the best of several code options for use in the data block J .

Pre-Packer module is used for each of the FS (Fundamental Sequence) and separated codewords data streams as a pre-formatting processing step for each block of data. This way, the FS and split-bit codewords are pre-formatted and output on a 16/32 bit bus.

The variable-length Fundamental Sequence (FS) code represents the non-negative integer m with a binary codeword of m zeros followed by a 1. Application of the FS code to a block of J samples produces a sequence of J concatenated codewords called the Fundamental Sequence. Fig.3 illustrates the FS codewords.

Preprocessed Sample Values, δ_i	FS Codeword
0	1
1	01
2	001
...	...
...	...
2^n-1	0000 ... 00001
	(2^n-1 zeros)

Fig.3 Fundamental Sequence Codewords As a Function of the Preprocessed Samples

The Output Packer receives and multiplexes already pre-generated FS codes and separated bits from FIFO at the Pre-Packer output and outputs the finished CDS (Coded Data Set) packages to the 16/32-bit bus.

JPEG-LS

JPEG-LS lossless compression method is less variable in the choice of compression parameters than the standard described above [4]. Below is the structure of the FPGA core (Fig. 4) and a description of its components.

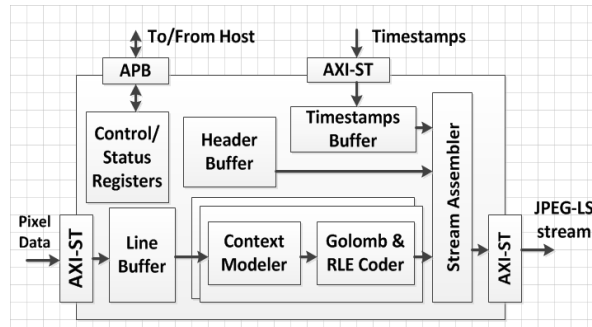


Fig.4 AMBA™ FPGA core structure

The input buffer (Line Buffer) consists of a memory module and controls memory operations of reading and writing. This component stores input sample data that are fed to the core by the interface.

The Context Modeler module performs prediction error calculations. It accesses the line buffer output and reads four contextual values needed to define the context. In addition, this module performs middle forecasting procedures, finds the edge of the image and calculates forecasting error. Finally, this module updates the context-sensitive variables with new values of the statistical parameters of the selected context.

The Golomb Coder encoding module generates a Golomb code due to a prediction error and compression parameters.

Status/controls registers contains 4 16-bit status registers, as well as registers of control. The registry file performs operations for reading the state registers and the write control operations.

The described implementation can be taken as the basis for the creation of hardware implementations of special-purpose compression.

Capabilities of Vivado package (Xilinx) for conversion JPEG-LS algorithm C-description to suitable for implementation in FPGAs VHDL-description were tested and described in [5]. Also C language structures, which can not be processed by specified means and possible circumvention of such structures were defined.

Comparison of the hardware FPGA implementation characteristics of the JPEG-LS method and the CCSDS 121.0-B-2 recommendation

The characteristics of the hardware implementation of both compression methods are not very different. The difference in speed or volume of used memory can be seen in Table 1:

Table 1

	JPEG-LS [3]	CCSDS 121.0-B-2 [6]
Type of FPGA	Kintex -7	Virtex 5
Bits per pixel (max)	16	32
LUTs	5600	5809
Msamples / sec	180	175

Further research direction

In further development of microsatellite FPGA video stream compression unit it is planned to use the obtained analysis results and the advantages of both compression methods to create a FPGA-based lossless compression implementation that best suits customer requirements.

To accomplish the task, the following steps are planned:

- Based on the example of the structure of the FPGA encoder core for compression of images, to develop own implementation for compressing the video stream from microsatellite scientific information collection system.
- Explore the characteristics of the model of the developed system.

Conclusions

In this work the methods for lossless compression CCSDS 121.0-B-2 and JPEG-LS and characteristics of their implementation in the FPGA are investigated. Also, a comparison of the characteristics of their existing hardware implementations is performed. Results of these studies are planned to use in further development of video streams lossless compression FPGA core for microsatellites scientific data collecting system.

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**9th INTERNATIONAL ACADEMIC CONFERENCE
“GEODESY, ARCHITECTURE & CONSTRUCTION 2018”
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Research of vertical dynamics of Earth's surface movements in areas of Dniester PSPP

Ihor Savchyn¹, Nazarii Danyliv², Andrii Zygar³, Andrii Romanovskyi⁴

1. Department of Higher Geodesy and Astronomy, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery Street 12, E-mail: savchyn.ih@gmail.com
2. Department of Engineer geodesy, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery Street 12, E-mail: konon.mobind@gmail.com
3. Branch "Directorate for the construction of Dniester PSP" PJSC Ukrhydroenergo, UKRAINE, Chernivtsi region, Sokyryany district, w. Vasilyevka, Central Street 71, 60232
4. Department of Photogrammetry and Geoinformatic, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery Street 12, E-mail: androm1297@gmail.com

Abstract – Processed data from the leveling network altitude Dniester PSPP for the period 1999-2018 year. The data used to determine the average speed of vertical displacement points and mapping-pattern of the average annual velocity of vertical movement points. The analysis identified three zones: a zone of subsidence, uplift and fixed area.

Keywords – geodynamics; vertical displacement; zones; leveling; Dniester PSPP

Introduction

Objects of fuel and energy, especially nuclear, hydro, and thermal power plants PSPP need constant systematic movement of the earth's surface, tectonic plates, the definition of deformation structures and process equipment, whose ultimate goal is to prevention of emergency situations and facilitate the normal operation of objects. A special place in this control is monitoring the vertical movements of land and buildings, which are mostly performed by classical methods, the most perfect of which is the geometric precision leveling. In [3] using the results of high-precision leveling (I-Grade) Network, Rivne (Ukraine) during 1984-2013 years, is set to linear trend, long period and amplitude of all items and made zoning studies. Instead, [4] Based on the results of GNSS-measuring points on the network HPP Zagorsk (Russia) during the years 2000-2011 constructed a map of velocity distribution relative vertical movement area of research. It is established that the maximum (abnormal) vertical movements occur in areas exposed to man-made influences the maximum daily pumping of large volumes of water, and the displacement of the points going forward on the closed-back path, not exceeding a few millimeters. The results of study and comparison of conventional and GNSS geodetic measurements during the years 2006-2010 Ataturk HPP (Turkey) in [5] confirmed the possibility of using them to monitor deformation of the dam and surrounding areas. The accuracy of both methods is within ± 1 cm. In [2] Dam study presented using 3D-scanning. Comparison TIN models in 2011 and 2012 on the condition that pivot points are stable. It was concluded that the values correspond to movement's dimensions and technical operation of the dam is not observed extreme values of surface strain in both dimensions. In [1] Comparative analysis pendulum, sights and GNSS data. Proved that GNSS-measurement methods are less costly and are used for accurate monitoring of the dam, although less accurate than the pendulum. A collimator data with a high degree of correlation with the movement received GNSS.

Results

Construction of the Dniester PSPP and create the upper reservoir surface area of 1.3 square kilometers and storage capacity - 11.45 km³ caused significant human impacts on the territory of

the building and surrounding area. Therefore, the qualitative prediction of spatial movements of the earth's surface in the vicinity of the Dniester PSPP need to perform analysis and interpretation vertical movements of land and buildings, which are derived from high-precision leveling. To analyze the results used precision leveling with 32 points (12 - fundamental rappers 11 - Deep brands and 9 - points GNSS network) for 1999-2018 years. During this period 46 cycles were conducted measurements, an average of 2 cycles per year with a period of six months (after 2011 enforced to 4 cycles per year). Using height determined in each cycle of measurement calculated average annual rate of vertical movement points during the study period and built a map of their distribution diagram (Figure 1).

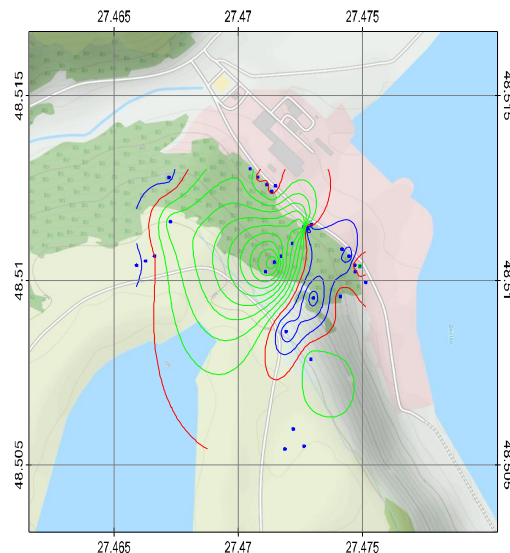


Figure 1. Map of the distribution diagram of annual average velocity of vertical movement points during the study period

Conclusion

Calculated speed vertical movements of the Dniester PSPP. The resulting value is used to build cards distribution-chart speeds average annual vertical movement point's subsidence or uplift the territory of the Dniester PSP. Analyzing the results revealed that the value of vertical movement speeds range from -0.375 mm / year (GM-2-2) to 0.858 mm / year (GM-1-7). On the basis of maps distribution-chart speeds average annual vertical movement points held zoning Dniester PSPP and identified three areas: Zone subsidence, uplift and immobile. The largest area is uplifting; it is located near the construction site, and pressure conduits.

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Low-Carbon Blended Cement with High Content of Supplementary Cementitious Materials

Hanna Ivashchyshyn¹, Tetiana Kropyvnytska², Iryna Kirakevych³

1, 2, 3. Department of Building production, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery St. 12, e-mail: aiwaszczyszyn@gmail.com

This paper considers physical and mechanical properties of low-carbon blended cements with content of supplementary Cementitious materials 50 wt. % It is shown that due to the synergistic combination of blast furnace granulated slag, zeolite and limestone compressive strength of low-carbon blended cement is obtained class 32.5 with high early strength.

Keywords – low-carbon blended cement, supplementary Cementitious materials, compressive strength.

Introduction

Climate change and global warming represent a serious problem as level of greenhouse gas emissions are still high - 32.5 Gt. CO₂ emission of the cement industry is 1,6-2.6 Gt or 5-8 % of the total amount of anthropogenic emissions worldwide [1]. It is necessary to realize by 2050 a global strategy of low-carbon development in order to prevent the temperature rise on the planet to a level significantly less than 2 °C in keeping with requirements of the Paris Agreement on the United Nations Framework Convention about Climate Change (UNFCCC) on the regulation of measures to reduce carbon dioxide emissions from 2020 [2]. Concept of sustainable development has spurred renewed interest in reducing the content of Portland cement clinker in cement binder by replacing it with supplementary Cementitious materials (SCMs), including waste industry [3, 4]. Production of blended cement according to EN 197-1 creates prospects for improving the efficiency of binder due to the possibility of reducing the content of Portland cement clinker and increasing the amount of SCMs.

Materials and methods

Ordinary Portland cement (OPC) CEM I 42,5R JSC "Ivano-Frankivsk Cement" composed of C₃S: 62.42, C₂S: 13.62, C₃A: 7.06, C₄AF: 12.32, wt %, limestone (L) with 95 wt % CaCO₃, granulated blast furnace slag (GBFS), zeolite (Z) provided from Sokyrnytsky quarry were used to develop the composition of low-carbon blended cement. The Blaine specific surface areas of OPC, GBFS, zeolite and limestone were 3400; 3680, 9940 and 10500 cm²/g.

The cements were obtained by mixing together in a laboratory ball mill. The specific surface areas of the components of the binder, as the resulting compositions of cements, were determined by Blaine. The cement mortars for determination the Strength class of cements was prepared on the basis of the investigated binder in a one part and standard sand CEN in a three parts and half part of water.

Experimental part

In order to determine the influence of the each SCMs in the composition of the cement, blended cements were prepared – containing 50 wt. % of one type of additive. For OPC i (SSA=3400 cm²/g) workability is 165 mm with W / C = 0.5. Replacement 50 wt. % OPC with GBFS is causing increase SSA and consistence respectively to 3730 cm²/g and 175 mm. Zeolite in the amount of 50 wt. % increases the SSA of the cement to 6370 cm²/g, while the workability decreases to 117 mm, while the same amount of limestone increases the dispersion to 7990 cm²/g with a decrease in the consistence of the mixture only to 160 mm. In the combination of the investigated SCMs in the corresponding quantity received a blended composition cement CEM V / A (SSA=6000 cm²/g) and its consistency by the workability is 155 mm.

OPC is characterized by water demand 31.7% and initial and final setting time respectively 235 and 340 min. Water demand of cement with content of 50 wt. % GBFS is 27.5% and the setting time are delayed for 20 min. Zeolite increases the proper water amount to 38.5% with a decrease initial and final setting time respectively to 195 and 215 min. Limestone (50 wt. %) in the composition of the binder allows to reduce the water demand of the cement paste to 26 % and the initial and final setting time to 155 min and 215 min. Blended cement ($SSA=6000 \text{ cm}^2/\text{g}$) is characterized by water demand 31%, initial and final setting time respectively 180 and 280 min.

It is shown, that the content of 50 wt. % SCMs leads to a decrease the compressive strength of cement during the all Harding period. As seen in Table 1, compressive strength of blended cement after 2, 7 and 28 days of hardening is 10,7, 19,7 and 38,0 MPa respectively. Result of research shown that blended cement has high early strength. The low-carbon blended cement complies to class CEM V/A 32.5 DSTU B EN 197-1:2015. This cement is characterized by homogeneity and a stability of the mix without sedimentation, the bleeding of composite cement paste is 15.3%. The lowering clinker factor ratio in CEM V/A 32.5 reduces the CO_2 discharge in the cement production process in 2 times/ 1 ton of cement.

Table 1

Physical and mechanical properties of cements

Main constituents, wt. %				Work-ability, mm	Compressive strength, age, MPa				SAI, %			
OPC	GBFS	Z	L		2	7	28	90	2	7	28	90
100	-	-	-	165	21,5	30,1	43,5	51,0	100,0	100,0	100,0	100,0
50	50	-	-	175	5,7	17	31,3	40,6	26,5	56,4	72,0	79,6
50	-	50	-	117	3,8	16	28,6	36,9	17,6	53,1	65,7	72,3
50	-	-	50	160	5,2	11	17,7	24,5	24,1	36,5	40,6	48,0
50	25	20	5	155	10,7	19,7	38,0	46,6	49,7	65,4	87,3	91,3

Blended cement with high content of SCMs is characterized by low energy consumption and meets the requirements of the modern building industry and the concept of sustainable development.

Conclusion

It is shown that due to the synergistic combination of blast furnace granulated slag, zeolite and limestone with increased dispersion the compressive strength of low-carbon blended cement refers to class 32.5 with high early strength. Using of blended cements with high early strength provides resource and energy saving, ecological and economic effects in construction, and also makes a significant contribution of the World strategy low-carbon development.

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Smart-monitoring system of the water supply network and the quality of transported water

Matsiyevska Oksana¹, Buhrii Mariia²

1. Department of Hydraulic and Sanitary Engineering, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: Ok_M@ukr.net

2. Department of Hydraulic and Sanitary Engineering, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: marybugrii95@gmail.com

Abstract – *The problem of water quality change in the distribution network of the centralized water supply system in the city of Lviv is considered. To prevent the deterioration of the drinking water quality the introduction of modern systems of monitoring and modeling of water quality change in the distribution network is recommended.*

Keywords – drinking water, quality, monitoring, modeling, distribution network

Introduction

The sources of water supply in Lviv are underground aquifers. Previous research has been established - the quality of water entering the distribution network of centralized water supply in Lviv, at checkpoints (at the boundary of the city) and in pumping stations, meets the requirements of drinking water.

Description of the problem

During the transport of water through the network of distribution pipelines to consumers, its quality may vary. Research of technological parameters of work of 8 plots of distribution network of water supply of the city testifies to the following [2]:

- Increasing the overall hardness and alkalinity of water is due to the mixing of water from different intakes in the distribution network.
- The increase in the value of water oxidation is due to possible emergency situations with the introduction of pollutants of organic origin into the pipeline.
- The increase in the concentration of total iron in water is due to the corrosion of districts of the distribution network, characterized by long service life (from 2 to over 50 years) and a large length (up to 10785 m).
- Reducing the content of free residual chlorine in water during its transportation to the consumer indicates its consumption for the oxidation of chemicals contained in water, as well as the destruction of pathogenic microorganisms of biofilms on the inner walls of the pipes.
- Increased values of water quality indicators (data of LCME «Lvivvodokanal») on the studied sites do not exceed the maximum permissible limits.

The results of the study of the accident rate of the Lviv city water supply network (7 plots) during 2006-2017 indicate the following:

- The total correlation of the material of pipes of the plumbing network in Lviv as of 01.11.2016 is: steel – 29,99%; cast iron – 60,62%; polyethylene – 9,39%.
- The main causes of pipe damage, causing leaks: steel: corrosion of the metal – 91,69%; cast iron: corrosion of metal – 41,05%; depressurization of tubular connections – 52,11%. During the period of observation, no leakage was observed on the investigated areas of polyethylene pipes.
- The parameter of the flow of failures of the pipelines (1/year·km) increases with a decrease

in the diameter for both steel and cast iron pipes.

- The average weighted value of the parameter of the flow of bounce steel pipes is 3 times more than for cast iron.

However, the poor condition of the water distribution network, in particular its accident rate, can provoke not only the deterioration of water quality. Large-scale leakages or accidents cause water loss, collisions of the road surface, flooding of facilities, etc. Elimination of leakage of water takes time for its inspection, repair of the water supply, restoration of the territory's improvement. In addition, there are hidden sources of water.

It is recommended to introduce modern (Smart) monitoring systems in real-time state of water supply and quality of transported water.

Smart-system for monitoring the state of the water supply network is a promising system for monitoring the hydraulic parameters of the operation of the water supply network in order to detect an accident at an early stage. Based on data on water supplied and paid by consumers, and the analysis of data on the flow and water pressure at the control points, the zones of the settlement with hidden sources are diagnosed.

With the help of noise sensors (background noise problem), the pressure or flow of water installed on the hydrants or latches on the water supply network, determine the zones of the previous localization of hidden leaks.

Finally, the sources are localized in the following ways:

- Acoustic (on the surface of the earth – fluctuations of the soil);
- Correlation (on both sides of the damaged area – fluctuations of the walls of the pipe). There are problems with plastic tubes;
- with robots (inside the pipeline) equipped with:
 - pressure sensors. There are problems associated with changing the diameter of the pipes in the areas of the network;
 - ultrasonic sensors. Advantage - on the basis of the collected data, the thickness of the pipe wall is calculated, and therefore the degree of its corrosion.

Information on the state of the water supply networks is transmitted in real time to the control service of the LCME "Lvivvodokanal" for making a decision. The development of a system for monitoring the quality of water in distribution water pipelines requires a comprehensive selection of appropriate water quality parameters and reliable sensors. The system should prevent consumers from rejecting water quality indicators from authorized values by e-mail or SMS.

Conclusion

The introduction of online monitoring will protect the drinking water supply system from accidental or deliberate pollution (eg, terrorism).

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Efficiency of the Modifiers Use for Protection of Brick Structures

Roksolana Semeniv¹, Andriy Kaminsky²

1. Department of building production, Lviv Polytechnic National University, UKRAINE, Lviv, Stepan Bandery Street 12, E-mail: semeniv.roksolana@gmail.com

2. Department of building production, Lviv Polytechnic National University, UKRAINE, Lviv, Stepan Bandery Street 12, E-mail: lemyrua@gmail.com

Abstract – *The problem of increasing the operational properties of brick for external walls is considered in the article. Bricks were modified by different types of water-repellents. The surface modification of ceramic facing brick by hydrophobic nano-liquid provides to reduction of the capillary suction of the masonry.*

Keywords – ceramic facing brick, water absorption, surface modification.

Introduction

The main factors that affect on the durability of structures and buildings are aggressive environmental factors. Most brick walls are porous and over time can be vulnerable to damp penetration [1]. Prevent damp on brick walls and masonry it is advisable to apply a brick wall coating. The brick wall coating will act as brick water proofer and help prevent water ingress which causes damp [2]. To improve the performance properties and increase the durability of the brick masonry is widely used a surface treatment method by hydrophobic substances [3]. Different classes of synthetic organic coatings have been used or tried for this purpose. These coatings are very efficient to repel water and provide a very hydrophobic surface but are expensive and require complex application conditions. The indicators of the coating destruction are their cracking, detachment, loss of mass and color. At the same time, mechanical, physic and chemical, anticorrosive properties also change, which can lead to loss of protective [4]. Recently, the potential of nanotechnology application in building is growing. Nano-liquids that reduce water absorption, permeability coefficient and increase the impermeability of structures are used to effectively protect surfaces on the nano- and micro-level [5]. In the present article we study the possible use of nano-liquid on bricks as hydrophobic barrier and water repellent coating.

Materials and methods

Ceramic facing brick ASTM C-216, Grade MW, Type FBS, Average compressive strength 16.81 MPa (EN 771-1:2003) and clinker facing brick ASTM C-216, Grade SM, Type FBX, Average compressive strength 32.3 MPa are used for investigation. Hydrophobic substances based on silicon organic compounds KO-85 (SOC), acrylic polymers (HS 1) and water-repellent of penetrating complex action with the content of nanoparticles - nano-liquids (HS 2) are used for surface modification of ceramic facing brick.

Water absorption at capillary suction is determined by water volume at atmospheric pressure at the expense of capillary or adsorption forces. The hydrophobic properties of the modified bricks were evaluated monitoring the time taken for a droplet to penetrate in the brick through the coating.

Results of investigation

Experimental studies have found that, porosity of ceramic clinker bricks is 13.6 %, water absorption – 5.2%, water absorption at capillary suction – $0.5 \text{ kg/m}^2 \cdot \text{hour}^{0.5}$. In this case, the ceramic facing brick is characterized by high porosity (21 %) and water absorption (16.5 %). The rate of water absorption at capillary suction reaches a value of $2.2 \text{ kg/m}^2 \cdot \text{hour}^{0.5}$, which is in 4.4

times more compared with clinker bricks. The studies of the efflorescence formation have established the presence of efflorescence's on the ceramic facing bricks surface after 7 days of testing.

Surface modification method by hydrophobic substances is used for the protection of structures and improvement of the operational properties of ceramic facing bricks. Surface modification of ceramic facing brick by silicon-organic compounds KO-85 decreases water absorption from 16.5 % to 13.2 %. The use of water-repellents based on acrylic polymers (HS 1) decreases porosity in 1.3 ... 1.4 times, water absorption - to 30 %, the rate of water absorption at capillary suction – in 2 times. Surface modification by a water-repellent of penetrating complex action with the content of nanoparticles (HS 2) decreases water absorption from 16.5 % to 5.1 %, the rate of water absorption at capillary suction – in 3.8 times (from 2.2 to 0.58 kg/m²·hour^{0.5}), which ensures the achievement of the clinker bricks indicator.

Surface protection by nano-liquid of hydrophobic action decreases porosity, water absorption at capillary suction, increases water resistance and efflorescence resistance of the structures. The nano-liquid is an invisible water-resistant barrier to brickwork and masonry. An application of nano-liquid slows down the spread of efflorescence's. Nano-liquid works by filling in the porous voids in the bricks or masonry at a microscopic level. It is water-vapor permeable and will not trap any retained moisture in the substrate. The coated bricks display high hydrophobicity which could, reduce water absorption in outdoor usage.

Conclusion

The masonry modification by chemical active substances provides the necessary hydrophobicity and resistance to penetration of moisture due to commutation of pores and cracks in the surface, which increases its impermeability and resistance to the effects of environmental factors. It is provided the decreasing of porosity, water absorption at capillary suction, increasing of impermeability and efflorescence resistance of structures is provided by protecting the surface of brick with hydrophobic substances and nano-liquids.

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The role of art clusters as a new form of artistic practices in urban space

Sofia Shkolyar

Architecture of buildings and structures Department, Lviv Polytechnic National University, UKRAINE, Lviv, S.
Bandery Street 12, E-mail:sofiashk2016@gmail.com

This paper analyzes the role of art clusters as a new form of artistic practices in building of public and social spaces in the city. It contains researching about how art cluster creation influences on deviant cultures formation. Here you can find new information about Ukrainian clusters, their structure and the role of their existence.

Key words: art cluster, urban space, revitalized industrial zone, cultural progress.

Introduction

The research of art penetration into new social and urban space has recently become quite important because of projects development, which are aimed at process of connections building between art, new technologies, economic for the purpose of not only art promotion development, but also to develop the city. Since the 1990s, the tendency of urban areas transformation in to specific areas for communication of representatives from various spheres of art with the involvement to the public to artistic processes began to develop in the world of art.

First of all, out lining the degree of study of the problem, we note that this topic is new and not well-studied. There were published some researches, that reveal a number of art aspects in side urban areas in our territories. Particularly important is the work of O. Chepelyk [1, 2], who investigated the mechanisms of "public order" practice, which successfully operates in the West and promotes the appearance of high-quality modern art objects in urban space. It's worth also the studies of N. Bulavin [3], N. Musienko [4] to be noted , because they give an opportunity to form a coherent picture of urban art practices in Ukraine at the present stage. In addition, it was made some important articles by V. Yeshkileva [5], which are important for the development of this topic, partly affecting some aspects of the problem.

Main

The **art cluster** is a cultural association located on the territory of their vitalized industrial zone, which includes exhibition space, theater and Movie Theater, auditoriums for seminars, foot-yards and to her similar items. Art clusters or "Lofts" are the most common forms of creative spaces organization on the territory of former factories. The idea of using such spaces was born in the forties in Manhattan (one of five city districts in New York City) because of the sharp increase of land prices in the central parts of the city. As a result, industrial buildings were moved beyond the boundaries of cities. Industrial zones eventually ceased to function, and became places, where creative professions representatives, informal organizations and deviant cultures were concentrated.

As Efimova A. notes, new "artistic complexes", which were opened and red one with unexpected perspectives of their use, can turn into democratic places where the works of art enter into communication between themselves, have a public discourse, because they may be available for review and, accordingly, perceived by numerous visitors . Unrefined interactive sites that have been explored tested and "worked out" by contemporary art are trans for mediator additional places of social and cultural exchange, involved in the universal use of classically directed art and often become the basis for the formation of new museum forms that are patronized at the state level. At the same time, the spread of art in the previously inaccessible

reality is logically inspiring the expansion of the idea of the ability to implement correction of socio-political realities, changes in consciousness and social situation with the help of artistic means. The possibilities of art as a moderator of social consciousness reused [6].

The world experience shows that the creation of art clusters can not only positively affect at the cultural and social atmosphere in the city, but also creates conditions for creative activity that promotes the development of the inner cultural potential of the city. As a result of art clusters opening, there are spaces for communication, informal "parties", creative pleinairs, and, therefore, a ground for the formation and development of new contemporary culture and art elements. Within the scope of the art cluster there is making an active interaction between representatives of the artistic circles and the general public, which thus also contributes to the creation of the cultural space of the city. Art clusters become centers of social development of the city. Such activity is not limited only to the reproduction of the known, but gives rise to a new, excellent, and relevant.

Art clusters in Ukraine arose quite recently, largely due to the process of European integration and modernization. They are located in Kyiv. At present, such clusters are well known: art plant "Platform", "Vydubychi", "Dovzhenko Center", etc. The most visited among them is the art factory "Platform" - the largest creative cluster in Ukraine, located on the Left Bank of Kyiv. The space is located on the territory of the Darnytsky Silk Factory and combines business, festivals, coworking, art, fashion and other creative industries. Since 2014, it has been visited by about two million people, and the business community brings together more than 300 different startups and innovative projects. The main goals of the cluster are the development of Ukraine and the support of talented youth. It can be said that art clusters as new forms of artistic and social practices, can integrate into the "traditional" urban space.



Fig 1. Art plant «Platform», open air space. [7]

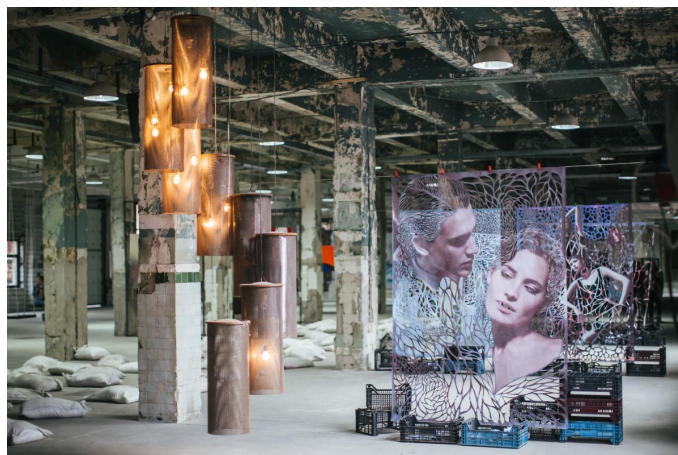


Fig 2. Art plant «Platform», exhibition hall. [8]

Conclusion

Art clusters arise as centers that unite different cultural spheres. This leads to the development of infrastructure, opportunities for the implementation of creative activity, urban spaces design, and raising the level of cultural potential in general. As known, creativity as a form of social activity, namely deviation from norms from the standpoint of the social whole, can be objectively useful, progressive and can promote the development of society. Considering the art cluster as a space for the cultural progress of the city and the national art in general, we can assert that it is the key to the successful development of the city.

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Comparative Analysis of Different Types of Dynamic Solar Tracking Systems

Maryan Luchko, Yuri Biletskyi

Electromechatronics and computerized electromechanical systems, Lviv Politechnic National University,
Ukraine, Lviv, Stryiska 75, E-mail: mm007121994@gmail.com, biletskyi.y.o@gmail.com

Abstract - *In this paper is considered the importance of solar tracking systems, the main types of their implementation are described, as well as types of drives and control algorithms. There are formed conclusions on the feasibility of using one or another system depending on the size of the SP (solar plant).*

Keywords – Solar Tracking System, dynamic tracking system, drive mechanism, control algorithm, sensing device.

Introduction

Nowadays, the problem of environmental pollution is acutely faced by all countries of the world. Along with traditional energy sources, alternative energy sources are actively developing, among which solar energy can be identified as the most environmentally friendly.

The main problem of solar energy is its unstable nature, in particular for the highest efficiency of solar panels, the sun's rays must be perpendicular to the plane of photocells. This problem can be solved by the solar tracker device, which provides the optimal angle of incidence of sunlight, falling on the surface of the panel from sunlight throughout the day [1].

1. General types of tracking systems

Solar tracking systems can be of two general types: static and dynamic. Static systems are systems in which the angle of the panels relative to the sun is fixed (like being placed on the roof) or varies with a periodicity 3-4 times during the year. Changing the angle of this type of system is done manually, by adjusting the length of one of the sides of the mechanism, on which the panels are fixed. Dynamic systems are systems where is a constant change of the angle depending on the position of the sun in the sky. Systems of this type can be unidirectional and biaxial. Unidirectional dynamic systems make it possible to change the angle in just one plane and are used mainly for watching the sun throughout the day. Two-axis dynamic systems make it possible to choose the most optimal angle in two planes. The main elements of dynamic systems are the tracking device, the microcontroller, the control algorithm and the drive mechanism. At present, a large number of studies have been conducted, in which the effectiveness of static and dynamic systems was compared. The results were virtually identical - under identical conditions, the performance of dynamic systems compared with static ones is 35-80% higher [2]. Therefore, in the future, it is reasonable to consider only dynamical systems.

2. Types of dynamic tracking systems and their engines

The function of constant correction of the angle of rotation / inclination of solar panels in dynamic systems is performed by the drive system. Depending on the design features, the region where the tracking system is installed, the number of panels that the system employs and also the cost of the project use various actuating mechanisms.

Electric drive - the most common type of drive, usually used in conjunction with a mechanical gearbox. The main advantages of this type of drive are cheapness, simplicity of construction and high reliability.

Hydraulic drive - the second most popular drive type. The advantage can be attributed to the fact that for the same size of systems for hydraulic drive can install an electric motor of less

power than for a similar system with electric drive. The disadvantages of this system are high cost, complexity of the system, constant operation of the engine in the case of non-leaky system.

Pneumatic drive - the least common type of drive. The advantages and disadvantages of this type are basically similar to the hydraulic drive, and to the disadvantages it is still worth adding the details of high accuracy in the manufacture of drive elements.

Each of these types is driven by an electric motor. For various types of drive mechanisms, electric motors of certain types are used. This is due to the peculiarities of the design and characteristics of the engines themselves. For an electric drive, DC motors, step motors, servo drives and asynchronous motors with frequency converter can be used as drive motors. In pneumatic and hydraulic drives, asynchronous motors with frequency converter, synchronous machines are used both with permanent magnets and with an electromagnetic actuator. DC motors, in these systems, have an advantage over alternating current motors, since they do not have losses on the conversion of DC into AC.

3. Management algorithms

There are two types of control algorithms - the astronomical algorithm and the real-time light intensity algorithm. Astronomical algorithm is a purely mathematical algorithm based on astronomical references. The real-time light intensity algorithm is based on light intensity indicators derived from solar intensity sensors [3]. There are many approaches to the implementation of data sensors, in particular the definition of the highest light intensity with the help of the image of the sky [4], a device that uses the direction of the shadow to determine the most illuminated area, etc.

Conclusions

Having considered the existing types of tracking systems, types of drives and management algorithms, we can form conclusions about the feasibility of using them for certain types of solar stations. In particular, for domestic sunshine (up to 35kW), it would be advisable to use a two-axis electric drive system and a control system that will operate under real-time algorithm. For medium-sized SP (up to 500 kW), it is most advisable to use single-axle trackers with a hydraulic or pneumatic drive. As with a low-power VPS, it is best to use a real-time algorithm. For SP, whose power is more than 500kW, it is not advisable to install a tracking system that will monitor the position of the sun in real time. This is due to some factors, in particular, the economic and complexity of designing such an SP. The best option is to install a single-axis system with astronomical algorithm and electric drive.

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Analysis of the feasibility of using an AC motor with new winding type for building electric vehicle

Yurii Lompart, Yurii Biletskyi

Electromechanics and computerized electromechanical systems, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: yurii.lompart.mee.2018@lpnu.ua, biletskyi.y.o@gmail.com

Abstract – Induction machines are widely used in all spheres of our life. They have different advantages and disadvantages. This paper consider one of the approaches to improve them – new type of winding Slovyanka. A comparative research of motors with different windings on electric vehicle example where conducted. Economic efficiency is shown.

Keywords – AC motor, windings, Slovyanka, electric vehicle.

Introduction

Induction machines are the keystone of world industry. AC motors are the most used motors in the all of industries, in varied aggregates and machines, even electric vehicle. Squirrel-cage induction motors (SCIMs) are probably the most frequently used compared to other AC motors. Such widespread use of this type of motors is due to their high reliability, cheapness, easy use and manufacturing. In spite of all advantages of AC motors there are also disadvantages: significant consumption of magnetization current, large starting currents (5-7 of nominal), small values of starting and minimum moments.

For quite a long time of its existence, asynchronous motors improved their characteristics (by improving insulating materials and steel grades, reducing the air gap between stator and rotor, even appeared AC motors with a copper rotor), but did not undergo any significant changes. The only part of the induction motor, which has not changed is three-phase stator winding, although it has steel losses and losses due to the current of magnetization, which strongly influence the efficiency. In AC motors, two types of three-phase winding are used: star and delta connection. Star - reduces starting currents, but the power is lost, the delta - allows you to get full power, but has high starting currents. Often, a combined star-delta motors is used, which makes it possible to avoid high starting currents, however, the starting torque is reduced twice.

The new technology of three-phase stator winding

There is a new technology of three-phase stator winding, which combines the benefits of both compounds and eliminates their shortcomings [1]. It is called «Slovyanka». Such connection involves the use of two sets of windings, star and delta, connected in parallel. According to [2], this method of winding allows to obtain a number of significant advantages, such as:

- 1) reduction of starting currents down to 2-3 nominal values;
- 2) increase of starting and minimum moments by 30-40%;
- 3) reduced magnetization current, due to reduction of losses in steel in 2,7-3,0 times;
- 4) the efficiency is close to the nominal in the range from 0,3 to 1,4 of the nominal loads;
- 5) reduction of the level of electromagnetic noise and vibration;
- 6) reduction of start-up switching equipment and absence of the additional power supply cable for starting the "star-delta";
- 7) savings of electric energy by 15-40%.

Techno-economic comparison of the AC motor with regular winding and winding «Slovyanka»

In order to analyze the feasibility of using a motor with new winding, it was conducted a research on such intensively developed recently mechanism as electric vehicle.

Electric vehicles are becoming more and more popular. Electro mobiles, such as Tesla, use AC motors instead of brushless direct current motors (BLDC). These AC motors are specialized for using in electric vehicles – they are made from electrotechnical steel for input voltage frequency of 200-300 Hz. Although they are cheaper than BLDC, but still expensive. The new technology, Slovyanka, enables to use industrial motors with regular electro-technical steel in electric cars.

Comparative studies between windings were made under normal environmental conditions for the same vehicle which was driven according to Japanese “10-15 driving mode” (Fig. 1) [3]. This standard “10-15 driving mode” was commonly used for fuel economy testing. As a vehicle it was selected car “Slavuta”, with weight 850 kg and frontal area is 2.002 square meters.

Main force balance question for electric cars looks the following:

$$F_{tp} = F_{frw} + F_{lr} + F_{ar} + F_i, \quad (1)$$

where F_{tp} – traction power; F_{frw} – strength of rolling resistance of wheels; F_{lr} – strength of lifting resistance; F_{ar} – strength of air resistance; F_i – strength of inertia.

Based on Eq.(1) the torque to provide “10-15 driving mode” (Fig. 1) can be calculated:

$$M = \frac{(F_{frw} + F_{lr} + F_{ar} + F_i) \cdot r}{\eta_{tr} \cdot k_{tr}}, \quad (2)$$

where r – wheel radius; η_{tr} – transmission efficiency; k_{tr} – transmission number of the transmission.

Fig. 1 shows velocity according to the «10-15 driving mode» and torque, which required for driving vehicle. Multiplying speed by the torque, we can receive power P (Fig. 2). As follows, performed calculations showed, that to provide “10-15 driving mode” “Slavuta” requires a motor with nominal power of 26.4 kW and 49 kW maximum power. According to this requirement the following motors were selected for comparison: specialized motor for electric cars AC-15 (price is 1393\$ [4]) and AYR100S8 with winding «Slovyanka» (final price is 465 \$ [5]). In order to study efficiency of two motors with different windings a comparative graph of efficiency as function of mechanical power for two motors (regular and winding «Slovyanka») [2] was used. This graph was interpolated to more powerful motor, assuming that proportion of difference would be the same. This way a graph of efficiency change during «10-15 driving mode» for vehicle with motors with different windings where obtained - Fig. 2.

Fig.2 shows power, which is needed for vehicle moving and efficiency of AC-15 (η_1) and AYR100S8 with winding «Slovyanka» (η_2). The analysis of this graph shows that the integral value of the efficiency of the motor AYR100S8 with winding «Slovyanka» is 0.86% higher than of the AC-15.

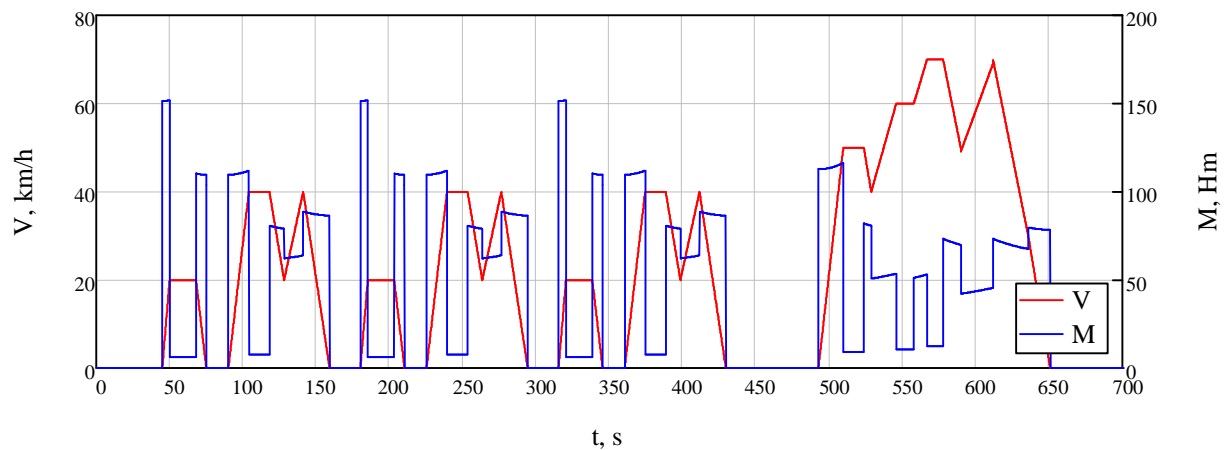


Fig.1. Velocity and torque of “Slavuta” for «10-15 driving mode».

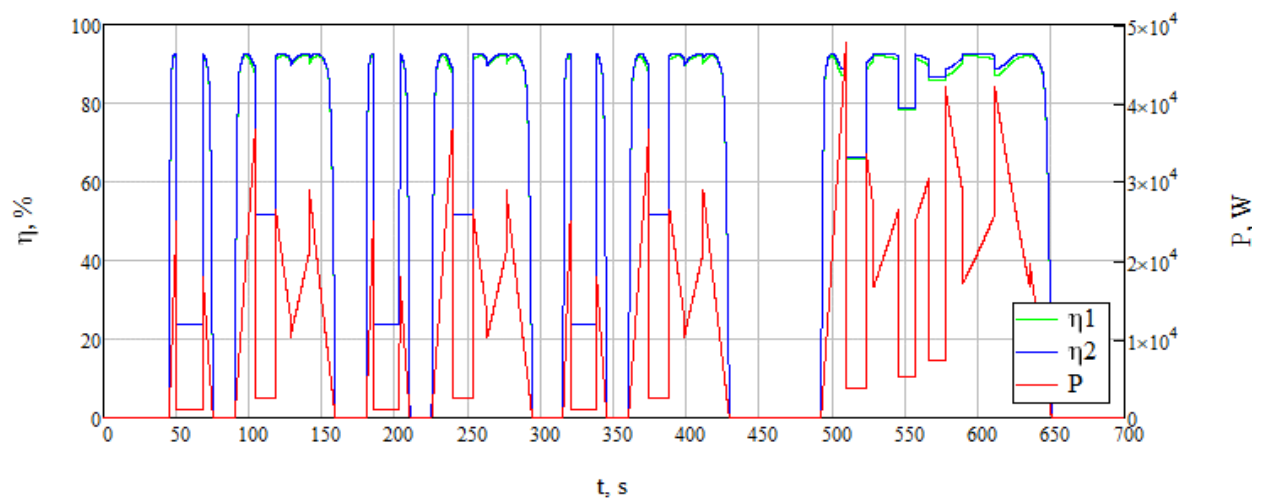


Fig.2. Power and efficiency graph: η_1 – AC-15 motor, η_2 - AYR100S8 with winding «Slovyanka».

Conclusion

There is new type of winding for AC motors that combines star and delta - «Slovyanka». Performed researches showed, that being 3 times cheaper it provides 0.86 % higher efficiency on electrical vehicle. This enables to produce more effective and cheaper electric vehicles.

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Increasing the bandwidth of networks by moving to a higher voltage class

Mariana Dobriianska

Department of Electric Power Engineering and Control Systems, Lviv Polytechnic National University,
UKRAINE, Lviv, 12 Bandera street, E-mail: marianadobr@gmail.com

Abstract – *The feature of domestic distribution electrical networks is the physical deterioration of fixed assets. At the same time, electricity consumption is increasing every year. This creates the need to upgrade the power grids and increase their bandwidth. It is proposed to carry out the modernization of the networks with the simultaneous transition to the higher voltage class of 20 kV.*

Keywords – bandwidth, physical deterioration, modernization, voltage class, transformer.

Introduction

The peculiarity of distribution electric networks, like most rural electric networks of Ukraine, is their considerable length due to the relatively small power that they transmit. Typical power supply voltage is 10 kV, and operating mode – with isolated neutral.

The using of obsolete equipment complicates the operation and repair of network equipment, as spare parts for such equipment are no longer produced. Therefore, domestic networks often require radical upgrades.

Main Material

The analyzed electrical network (Fig. 1) has been in operation since 1970. Fixed assets are physically worn out. Percentage of transformer substations (TS) in need of overhaul – 27%, the rest of TS need to be reconstructed. At the same time, electricity consumption is increasing every year [1].

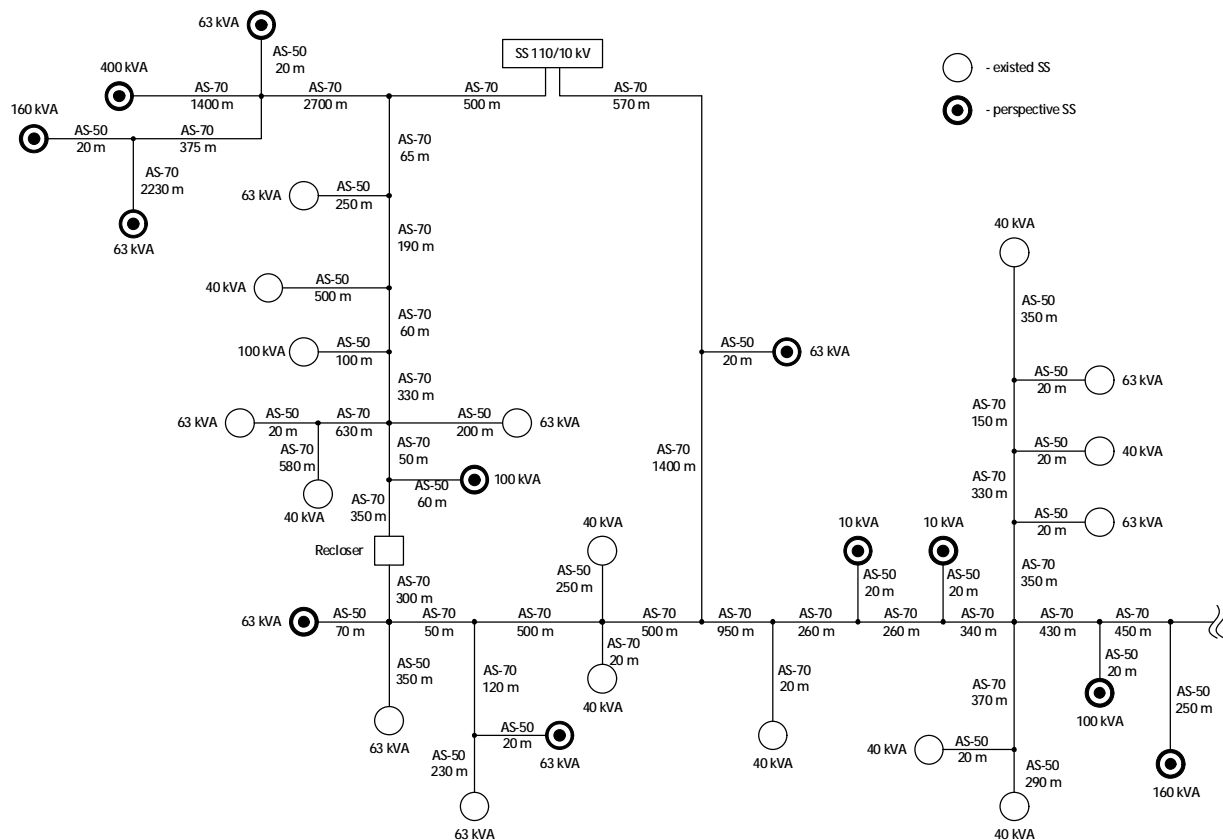


Fig.1. The scheme of the electrical network part for the 110/10 kV substation

At first, it is necessary to estimate the growth of electricity consumption of consumers that are connected to the network in accordance with the current normative documents.

The prognosis of the level of loading is carried out in accordance with the methodology given in the GID 34.20.178: 2005 [2] and based on current electricity consumption data, broken down by customer groups. As of 2017, the share of industry was 8%, agricultural consumers – 1.9%, electric transport – 0.7%, construction sector – 0.4%, communal households – 18.1%, population – 52%, other consumers – 2.6%. Losses in networks make up 16.3%. Total actual power of consumers - 2880 kVA.

According to calculations, the volume of electricity consumption in the next 10 years will increase by almost 40% and will reach almost 4,000 kVA.

Since fixed assets are in need of reconstruction, in order to increase the throughput of networks, it is proposed to switch to a higher voltage of 20 kV. This will require the modernization of all 10/0.4 kV transformer substations, as well as the 110/10 kV district substation. It will also require a partial change in the configuration of electrical networks and the installation of additional transformer substations (see Fig. 1).

The results of calculation of the perspective maximum mode of 20 kV shows that at all substations the required supply voltage is provided.

In order to ensure the gradual replacement of the 10 kV power grid by a 20 kV power supply, a new transformer TMN-6300/110-U1 110/20 kV is proposed at the district substation in addition to the existing transformer 110/10 kV with the retrofitting of the 110 kV voltage transmission line and the equipment of the RU-20 kV for new transformer. After complete transfer of the 10 kV power grid to the electricity supply system of 20 kV, the equipment of the existing circuit with TM 110/10 kV must be dismantled.

Note also that the proposed solution requires an additional definition of the conformity of existing elements of distribution electrical networks to the requirements of reliability and quality of electricity supply to consumers. Such technical justification should be performed in compliance with the JMA - H MPE 40.E20.576: 2005 [3] and SOBU MEVE EE 40.1-00100227-01: 2016 [4].

Conclusion

Domestic energy networks require radical modernization. Therefore, the approach proposed in the article of increasing their bandwidth through the transition to a higher voltage class is appropriate.

Acknowledgments

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Virtual source of reactive power in electricity supply systems of household consumers

Mykhailo Korchak¹, Yevhen Fediv², Olha Sivakova³

1. Department of Electric Power Engineering and Control Systems, Lviv Polytechnic National University, UKRAINE, Lviv, 28-A Bandera street, E-mail: misha.korkirov@gmail.com
2. Department of Electric Power Engineering and Control Systems, Lviv Polytechnic National University, UKRAINE, Lviv, 28-A Bandera street, E-mail: yevhen.i.fediv@lpnu.ua
3. Department of Electric Power Engineering and Control Systems, Lviv Polytechnic National University, UKRAINE, Lviv, 28-A Bandera street, E-mail: olha.m.sivakova@lpnu.ua

Abstract - The principle of distributed generation of reactive power is proposed in the structure of the basic principles of constructing smart grids for civilian objects. For its implementation at points of final distribution of electricity networks of buildings and structures should provide for the installation of individual reactive power compensation devices.

Keywords – electricity supply systems, reactive power, virtual power plant, virtual reactive power plant, reactive power compensation.

Introduction

Virtual Power Plant (VPP) is an efficient resource at the disposal of the smart grid operator to solve the problem of balancing active power. VPPs are formed on the basis of the following resources: a) Distributed (decentralized) sources of electricity, mainly, renewable sources of consumers; b) distributed resources for the accumulation of electricity (electric power storage); c) controlled electric receivers.

An important task of the operator of a smart grid (microgrid) is to provide a balance of reactive power and appropriate levels of voltage in the grid that meet the requirements of quality, cost effectiveness and reliability of electricity supply. In the event of a deficit of reactive power in the power grid, regimes with reduced voltage level come in, which reduces the stability of the work of electric motors of technological installations of consumers and worsens the quality of electric energy. In addition, the flow of reactive component currents leads to additional energy losses in the elements of distribution networks.

The principle of creating virtual power plant.

As a reactive power resource, it is expedient, by analogy with VPP, to create virtual reactive power sources (VRPP) that will accumulate the power of distributed reactive power compensation. The sources of reactive power in the final distribution networks (fig. 1) are usually based on the principle of individual compensation and are regulated according to the load schedule of the given node, that is, on the consumer's demand. To improve the economic performance of power supply systems in such networks, discretely regulated static capacitor's batteries or reactive power generation by synchronous motors of process plants are installed. To obtain an additional reactive power resource by the operator of the distribution network (DSO), it is possible, by analogy with VPP, to attract a distributed compensation resource at the DSO at the voltage 0,4 kV, which can be described as a virtual source of reactive power.

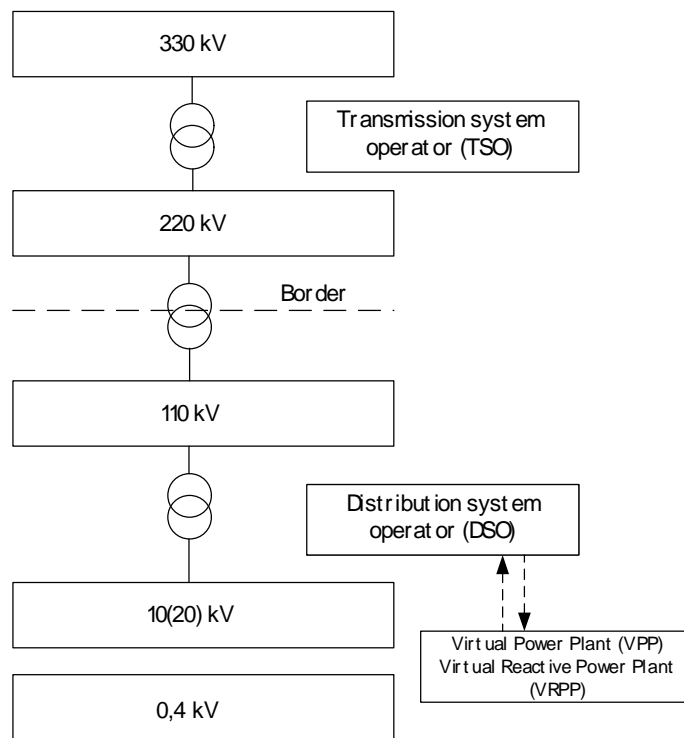


Fig.1 Network operators in Different Voltage Levels in Ukraine

Creating VRPP based on the resources of non-residential consumers is not fundamentally problematic, since the principle of distributed compensation of reactive power is widely used in non-residential power supply systems. For objects of consumers with a permitted power of 16 kW or more, if the volume of reactive energy of generation or consumption during the accounting period is 1000 kVA · h or more, a charge for the flow of reactive electricity in accordance with the "Methods for calculating the charge for the flow of reactive electricity", approved by the order of the Ministry of Energy and Coal Industry of Ukraine, 06.02.2018, No. 87 [1]. The consumer is encouraged to install PFM devices with automatic regulation and means of accounting for consumed and generated reactive electricity. The creation of VRPP for such facilities means the provision to the distribution network operator of the customer's devices to solve the problem of reactive power balancing.

The problem of compensation of reactive power in the distribution grids of civilian objects

At the moment, existing regulatory framework does not oblige and does not stimulate household consumers to install reactive power compensation devices. According to [3], the domestic consumer of electrical energy □ is a natural person who uses electrical energy to provide his or her own household needs that does not include professional and commercial activities, based on an electricity supply contract with an electricity supplier. In accounting systems for the consumption of energy in the electricity grids of such consumers, there is still no account of reactive energy, mainly due to the small volumes of distributed consumption compared to industrial objects, the occasional nature of electricity consumption by a significant number of single-phase electric receivers, a relatively small unit capacity of consumers who pay for electricity, the complexity of the phase control of reactive power compensation devices, that is, due to technical and economic inexpediency.

Recently, a number of publications appeared in which justified the expediency of compensation of reactive power in the distribution grids of civilian objects, and in the residential sector in particular. This is due to the increase in the density of communal loads, the increase in

the electrical load of civilian objects, the increase in the consumption of reactive electricity by dwellings of increased comfort, etc. But the main argument in favor of the use of individual SMP in the domestic sphere is the opportunities that arise as a result of the construction of power supply systems as active (intelligent) distributive networks (microgrid). Such systems are built. In such systems, install intelligent meters and means of regulating electricity consumption.

As an illustration, we present the results, performed according to the current method of State Building Codes [2], calculations of the level of reactive power consumption of typical buildings of modern civilian development. Three types of apartment houses: a) 9-storey 6-section residential house with gas stoves for 210 apartments (1st type housing in terms of household appliances and I-level electrification according to the estimated specific load in accordance with [2]); b) 16-storey two-section house with electric stoves and 2 elevators per section (2nd kind, III level of electrification) for 126 apartments; c) 24 storey two-section high-rise residential house with electric stoves and 2 elevators per section (2nd and 4th level electrification) for 112 apartments and a shopping center with a total area of 10,000 m².

For residential buildings, the calculated active load:

$$P_p = p_{spec} \times N_{app} + 0,9 \times K_d \times n_{el} \times p_{el} \quad (1)$$

where p_{spec} - specific calculated electrical load; N_{app} - the number of apartments; p_{el} - Installed power of the electric motor of the elevator; n_{el} - number of elevators; K_d - coefficient of demand for lift load.

2. For the office center:

$$P_p = M \times p \quad (2)$$

where M - total area of premises; p - specific power of electrical equipment for 1m².

Taking into account these expressions the value of the total load capacity is calculated, respectively, for a 9-storey 6-section residential building with gas stoves for 210 apartments; A 16-storey two-section residential building with electric stoves (with 2 elevators per section) for 126 apartments; 24-storeyed two-section residential dwelling house of high comfort with electric stoves (with 2 elevators per section) for 112 apartments (Eq.1), as well as a large office center with a total area of 10, 000 m² (Eq.2):

$$P_{max1} = 210 \times 0,86 + 0,9 \times 0,65 \times 6 \times 7 = 205,2 \text{ kW},$$

$$P_{max2} = 126 \times 1,96 + 0,9 \times 0,65 \times 2 \times (7+9) = 267,2 \text{ kW},$$

$$P_{max3} = 112 \times 2,48 + 0,9 \times 0,7 \times 2 \times (7+9) = 298 \text{ kW},$$

$$P_{max4} = 10000 \times 0,2 = 2000 \text{ kW}.$$

Estimated reactive load:

$$Q_p = P_p \times \text{tg } \varphi_{norm} \quad (3)$$

Where $\text{tg } \varphi_{norm}$ - the normative factor of reactive power.

$$Q_{max1} = 180,6 \times 0,43 + 28,14 \times 1,17 = 110,6 \text{ kVar},$$

$$Q_{max2} = 247 \times 0,4 + 18,7 \times 1,17 = 120,7 \text{ kVar},$$

$$Q_{max3} = 277,8 \times 0,4 + 20,2 \times 1,17 = 137,6 \text{ kVar},$$

$$Q_{max4} = 2000 \times 0,62 = 1240 \text{ kVar}.$$

The average reactive power factor for a typical block with these typical buildings is: 0,58.

Consumption of such volume of reactive power leads to additional losses in the low voltage distribution network, which is an incentive for the application of compensation.

This is especially relevant for power supply built on intellectual principles, with the installation of smart meters with their capabilities to monitor consumption, quality of energy, and consumption management.

Our proposals for Micro Grid for household objects:

1. At the regulatory level, provide for distributed compensation of reactive power for each consumer by installing condenser batteries for compensation of reactive power, which will be managed by an information structure based on an intelligent counter.
2. To provide for the standard setting of condenser batteries in each surface switchboard for compensation of reactive power, which will be controlled by an information structure based on an intelligent counter.
3. The received resource of sources of the distributed generation of reactive power to transfer to the disposal of the distribution network operator for its use as a virtual source of reactive power.
4. In the era of the introduction of intelligent power supply, characterized by distributed generation, distributed accumulation and control of the work of electrical equipment, compensation of reactive power should be mainly based on the principle of distributed generation. Our proposals for Micro Grid for civilian objects:

Conclusion

In this paper the problems of consumption of reactive power by domestic consumers are considered. The calculation of reactive power consumption by typical buildings in the new residential quarter is calculated, and ways of solving the problem of unbalance of reactive power in distribution networks of domestic consumers are proposed, by installing condenser batteries and combining them into virtual reactive power plants.

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Modernization of water supply system of steam generator PGV-1000

Oleh Skvarok, Marta Kuznetsova

Department of Heat Engineering and Thermal and Nuclear Power Plants, Lviv Polytechnic National University,
Ukraine, Lviv, 12 Bandera str., E-mail: skvarok969@ukr.net

Abstract – There are presented the constructive decisions of steam generator PVG-1000 modernization. It is shown that the modernization of the water-supply system of the steam generator allows to significantly increase the reliability of the heating surfaces, reduce the concentration of corrosion-active substances due to the organization of step-by-step evaporation.

Keywords – steam generator, NPP, modernization, reliability, salt content.

Introduction

Today, 15 nuclear power units with WWER (13 – WWER-1000 and 2 – WWER-440 [1]) reactors are operated at four nuclear power plants in Ukraine. The priority task at the NPP is to ensure the safety of the existing power unit, with the fact that most of the blocks have worked out their resource, therefore the question of finding methods to improve the work of the station is an urgent task. One of the ways to improve the safety and efficiency of existing units is to modernize and upgrade their operating equipment.

Steam generators, together with nuclear reactors and steam turbines, belong to the main equipment of multi-contouring steam turbine NPPs. In them production of steam is carried out at the expense of heat, which is withdrawn from the core of the reactors by a cooling medium - a coolant. Reactors and steam generators of the NPP work under difficult conditions of radiation exposure to them, great thermal loads, high velocities and pressure of heat coolants and working substances, as well as other factors caused by the course of neutron, thermal, hydraulic, corrosive, erosion and other processes. For this reason, steam generators belong to the most vulnerable nuclear facilities. Therefore, provision of reliability and increase of work resources of steam generators is one of the most urgent tasks of increase of economy, reliability and safety of exploitation of NPP power units.

One of the main practical issues is the exploitation of steam generators in the conditions of deterioration of the water supply system of the steam generator. Such deterioration affects the formation of corrosive active impurities, which provokes the process of failure of the heat exchangers of the steam generator, there is accumulation of a large amount of sludge (Fig. 1). These phenomena significantly reduce the work resource of the equipment. Therefore, one of the main ways of modernizing the steam generator is to improve the water supply system, which will ensure reliable work of the steam generator and its main constructions.

Main part

On the basis of the existing experience of exploitation of PVG-1000 steam generators that are operated with WWER-1000 reactor, it has been discovered, that the time of work of the steam generators before the damage detection is from 10 to 60 thousand hours and is caused by the emergence with a gradual growth and merging of a set of corrosion-mechanical cracks, which leads to the formation of cross-cutting cracks and loss of strength of welds in the place of welding of heat-exchange tubes to anticorrosive surfacing. This phenomenon is the result of slowed-down deformation-corrosion cracking at low speed of deformation, which leads to the fact that the metal of the perforated zone noticeably loses its plastic properties and becomes prone to aging. The main contribution to the occurrence of damage to collectors has a violation or poor quality of the water-chemical mode of steam generator. For example, at a lowering pH of

purging water at block number 2 of the South-Ukrainian NPP, the failure of collectors took place in a very short time - within five years.

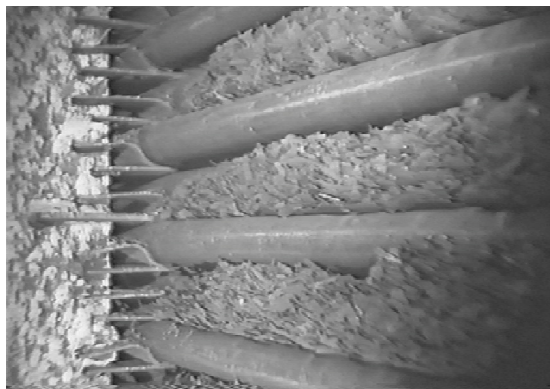


Fig.1. Local zone of accumulation of sludge in volume of steam generators

In order to increase the reliability of work of the steam generators on existing NPPs, it is proposed to introduce certain constructive solutions that permit the reconstruction of the distribution system of feed water to move the zone of maximum salt content to the "cold" side of the steam generator, where the thermal load of the heating surface is approximately two times less than about input coolant collector. To do this, six cockpit cranes (Fig. 2) were installed on six distribution water supply collectors in the "cold" end during the upgrade, and in the "hot" end over the embedded hollow sheet four collectors distributed (with openings facing down the dipped hollow sheet).

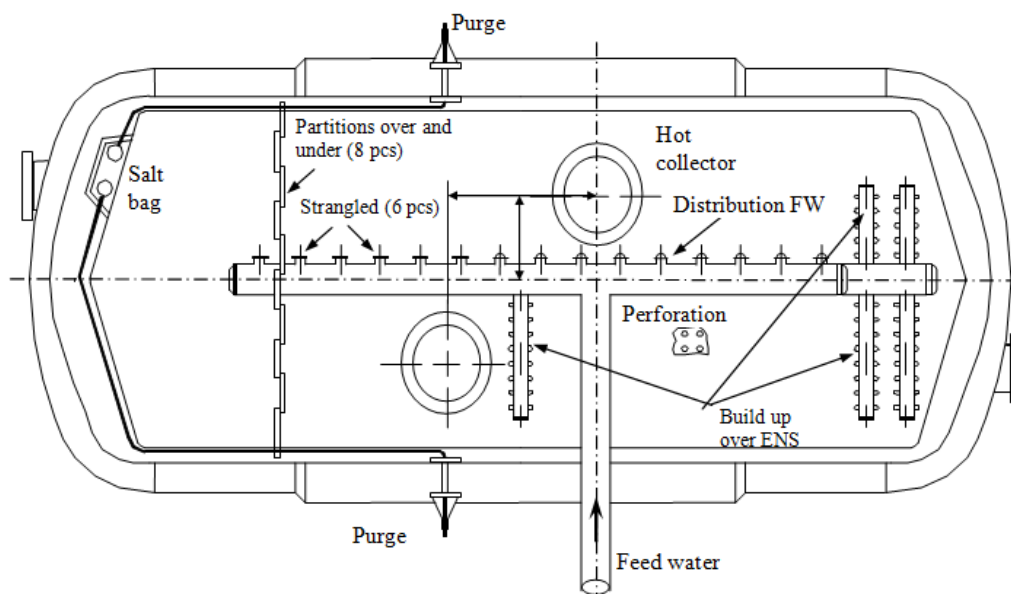


Fig.2. Scheme of modernized steam generator

To reduce the discharge of water from the immersed hole sheet in the "cold" end was installed a special partition. Uninterrupted purging is carried out from a salt bag located in the "cold" end on the edge of the immersed hole sheet. All spray nozzles on the GHG unit are combined with one line of periodic purge. Also, modernization involves the installation of steam isolators and conductometric sensors for salt meal.

The results of operation of the modernized steam generator are shown in Fig. 3 in the form of graphs of changing the quantity of the reduced salt content along the length of the steam generator (the given salt content corresponds to the salt content of the feeding water $2 \mu\text{g} / \text{kg}$ and the purge consumption of $10 \text{ t} / \text{h}$). On the hot part of the steam generator, the salt content

has decreased by more than 40 times compared to the regular version of the distribution system for feed water and purge. In the zone of the collector coolant, the average salt content decreased by 2.0 ... 2.5 times. The higher value of the reduced salt content on the "hot" side ($200 \mu\text{g} / \text{kg}$) compared with the average calculated salt content of purge water at a nominal load ($148 \mu\text{g} / \text{kg}$) is related to the selection of purge water on the "cold" and "hot" sides. When selecting it only on the "hot" side, the salt content in water volume should decrease by about 30%. It is noted quite different salt content on the sides of the input and output collector on the "cold" half of the steam generator in about 1,5 times. At the "hot" half of the steam generator, the concentration of sodium in water volume under normal purging was low. Its value ($1.5 \dots 2.5 \mu\text{g} / \text{kg}$ at sodium concentration in feed water, about $0.8 \mu\text{g} / \text{kg}$) was evaluated according to the results of tests with completely closed steam purifier, in which the maximum salt content was about $900 \mu\text{g} / \text{kg}$, and the minimum exceeded the sensitivity limit of the measurement method and reached a value of $5 \dots 12 \mu\text{g} / \text{kg}$.

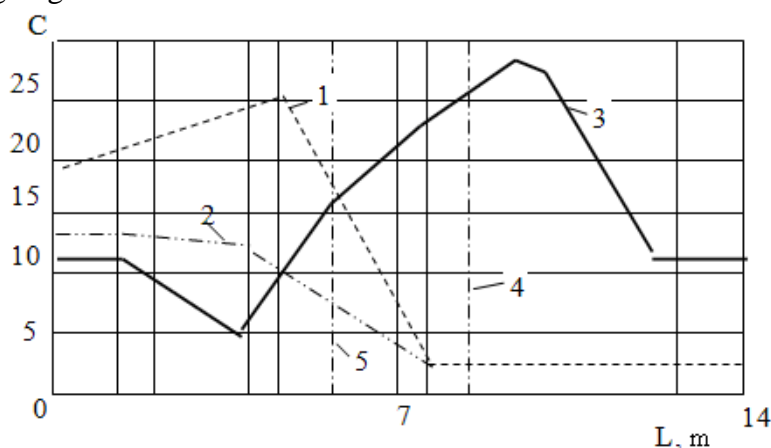


Fig.3. Charts of change of the given salt content along the length of the steam generator (six collectors on the "cold" side are disconnected)

1 - on the "hot" side; 2 - on the "cold" side; 3 - standard version; 4 - the axis of the input collector; 5 - the axis of the output collector

Conclusion

So, the proposed version of the modernization of the distribution system of feed water and purge system should contribute to increasing the reliability of the work of the pipe surface heating in the area of high thermal loads in the input coolant collector, as it allows significantly reduce the concentration of corrosive active substances, as well as reduce their concentration and output collector zone. The given constructive decisions allow to realize in a steam generator the principle of step evaporation which, is used in thermal power engineering. This principle allows to maintain the concentration of impurities in the steam generator (especially in its critical areas) is much lower than in purge water. At the same time, in the "cold" end, in which the salt compartment is organized and continuous blowing, the concentration of impurities remains balanced, that is, approximately the same, which was in this area before reconstruction.

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Optimization of Analog Signal Filtration Process

Sviatoslav Klos¹, Oleh Svyryd², Roman Fedoryshyn²

1. Department of Electromechatronics and Computerized Electromechanical Systems, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery Street 12, E-mail: slavikklos@gmail.com

2. Department of Automation and Computer-Integrated Technologies, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery Street 12, E-mail: romanfedoryshyn@yahoo.com

Abstract – The technique for designing the optimal value of the filter time constant for analog signal is presented. This technique is based on the objective function which takes into account the quality index of the filtration process and the dynamic error of the filtered signal.

Keywords – filter, time constant, optimization, analog signal, dynamic error, objective function.

Introduction

Analog signal filtration is often used in the up-to-date automated measurement and control systems. The main purpose of the filtration process is to eliminate the disturbances (noise) and to allow the useful signal to pass [1]. Setting a too small value of the filter time constant will lead to a low quality of filtration process because not all the disturbances (noises) will be filtered (removed). Setting a too big value of the filter time constant will provide a good quality of filtration, however it will lead to a significant delay of the filtered signal which, in turn, will lead to a big value of the dynamic error in the filtered signal. That is why there is a problem of defining such value of the filter time constant at which a good quality of the filtration process and a small dynamic error would be provided. To solve this problem the technique for designing the optimal value of the filter time constant was developed. This technique is based on the objective function which takes into account the quality index of the filtration process and the dynamic error of the filtered signal.

Design of optimal filter

It is proposed to design the optimal value of the time constant for the exponential filter in the following way:

1. Computation of the average analog signal by means of the non-causal moving average filter.
2. Computation of the mean square of the experimental samples deviation from the smoothed experimental points according to the formula

$$D = \frac{1}{N-4} \sum_{i=3}^{N-2} (y_i^e - y_{i-2}^a)^2, \quad (1)$$

where N is the number of registered experimental samples of the analog signal; y^e are experimental samples; y^a are smoothed experimental points obtained in clause 1.

3. Filtration of the experimental analog signal by means of the exponential filter with the time constant $T_f=1s$. The signal y^{f1} will be obtained as a result.

4. Computation of the average filtered signal by means of the non-causal moving average filter like it was made for the experimental signal in clause 1. The signal y^{a1} will be obtained as a result.

5. Computation of the mean square of the filtered points (y^{f1}) deviation from the smoothed filtered points (y^{a1}) according to the formula

$$D = \frac{1}{N-4} \sum_{i=3}^{N-2} (y_i^{f1} - y_{i-2}^{a1})^2. \quad (2)$$

6. Computation of maximum dynamic error of the smoothed filtered points with respect to the smoothed experimental points according to the formula

$$d_{\max} = \max(|y^{a1} - y^a| \times 100). \quad (3)$$

7. Accomplish clauses 3-6 for the exponential filter time constant $T_f = 2, 3, 4, \dots n$ s. The computation should be done until the maximum dynamic error does not exceed 10 %. The dependences of the mean square of deviation D and the maximum dynamic error δ_{\max} on the filter time constant T_f will be obtained as a result of the computation.

8. Computation of the objective function for the obtained arrays of the mean square of deviation D and the maximum dynamic error δ_{\max} according to the formula

$$I = D' + d'_{\max}, \quad (4)$$

where D' is the reduced mean square of deviation; δ'_{\max} is the reduced maximum dynamic error.

Based on the calculated values of the objective function the optimal time constant of the exponential filter shall be defined as follows

$$T_f = T_f^{opt} \Big|_{I=\min(I)}. \quad (5)$$

The optimal time constant of the exponential filter is the time constant value at which the objective function reaches its minimum.

The value of the mean square of deviation D represents the scattering of the filtered points around the smoothed filtered points. This value is taken as a quality index of the filtration process.

The example of the optimal filter design for the experimental transient processes presented in [2] is shown in Fig.1.

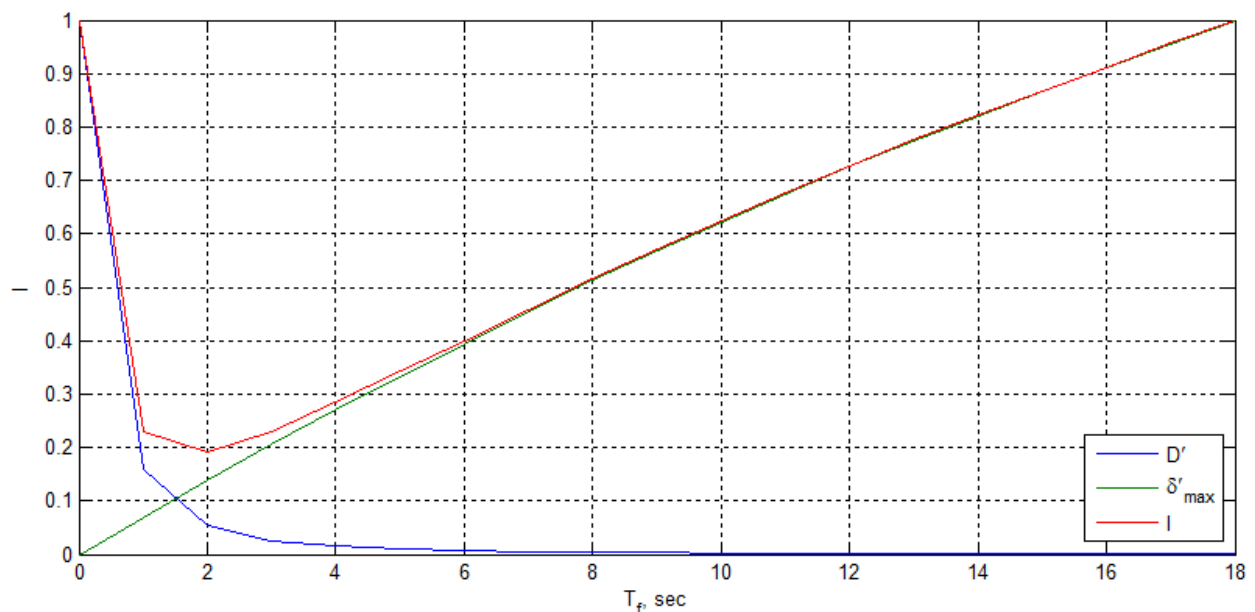


Fig.1. Curve of objective function versus filter time constant.

Conclusion

Application of the developed technique for designing the optimal time constant of the exponential filter in the automated measurement and control systems will provide high quality of the filtration process and small dynamic error of the filtered signal.

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Research of the coefficient of hydraulic resistance of padding with triangular channels of the package of cold and hot layer of RAH

Tetiana Rymar, Taras Kravets, Oleksii Smirnov, Volodymyr Kleman

Department of Thermal Power Engineering, Thermal and Nuclear Power Plants, Lviv Polytechnic National University, UKRAINE, Lviv, Bandery street, 12, E-mail: v.kleman1996@gmail.com

Abstract – *Research of the coefficient of hydraulic resistance of padding with triangular channels of the package of cold and hot layer of RAH is described in article. The graphic dependence of the change in the coefficient of hydraulic resistance of the padding with triangular channels from the Reynolds number for different values of the length of the replaced areas was constructed.*

Keywords – boiler installation, regenerative rotary air heater (RAH), cold layer padding, hot layer padding, hydraulic resistance.

Introduction

Increasing the efficiency of the convective heating surfaces of the thermal power plant, taking into account the features of their layout and construction, the uneven distribution of thermal and hydraulic parameters, is an actual and important scientific and applied task. Research of hydrodynamic processes in existing structures of convective regenerative rotary air heaters (RAH) is necessary for the improvement of these structures, in particular, for comparison with the energy characteristics of new upgraded structures of RAH.

Presenting main material

Hot and cold layer packages with intensified padding of high thermal efficiency are heat exchange surface of the RAH of various modifications and are destined for the transfer of heat from exhaust gases to the air, that enter in a burning room of steam boiler for combustion of fuel. From the point of view of compactness, the paddings with triangular channels are promising [1]. These surfaces, in optimum performance, are also characterized by the maximum thermal perception of the appositional resistances.

The paddings with triangular channels are represented on fig. 1. Intensification of heat exchange in this case is achieved due to the displacement of the wavy surface of one wall and the displacements of two smooth walls alternating. The above result causes to effect of updating the boundary layer and its turbulence.

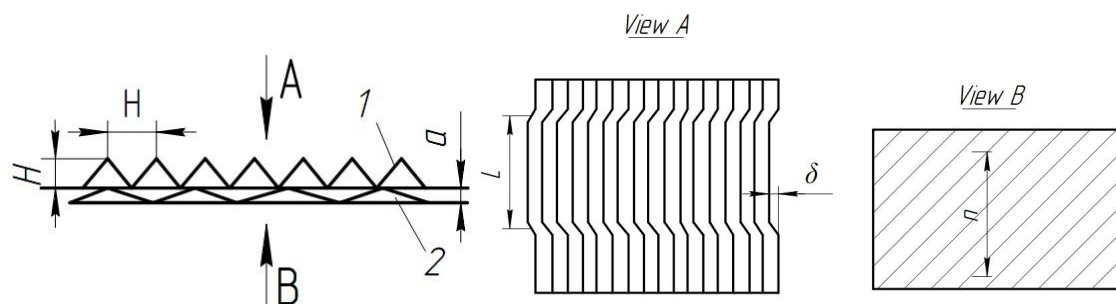


Fig. 1. Padding with triangular channels: 1 - a sheet with triangular corrugation; 2 - sheet with wavy corrugation; a - the size in the lumen, without taking into account the thickness of the sheet

Hydraulic resistance for padding, represented on fig. 1, is calculated by the formula [1]:

$$\frac{l}{l_0} = 4,47 \cdot \left(\frac{L}{d_e} \right)^{-0,248}, \quad (1)$$

$$I_0 = \frac{0,303}{(\lg Re - 0,9)^2} - \text{coefficient of resistance of the smooth channel.}$$

Formula (1) is valid for values: $\delta = 2 \text{ mm}$, $3,5 \leq L/d_e \leq 40$; $1,6 \cdot 10^3 \leq Re \leq 10^4$. In the given range of values of the Reynolds number for values $d_e = 6,7 \text{ mm}$ and $\delta = 2 \text{ mm}$ for different values of the length of replaced sections L graphic dependences (fig. 2) are constructed by the formula (1).

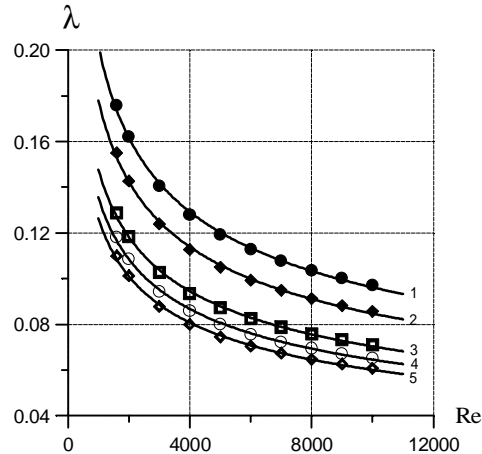


Fig. 2. Dependence of the coefficient of resistance of the padding with triangular channels from the Reynolds number for different values of the length of the replaced sections L :

1 – 30 mm, 2 – 50 mm; 3 – 100 mm; 4 – 150 mm; 5 – 200 mm

As we see on fig. 2, in the area close to the turbulent regime ($Re \approx 10^4$), an increase in the length L of 6,67 times leads to a decrease in the coefficient of resistance by 1,6 times. Dependence of change of resistance coefficient of the investigated padding in an area close to the laminar regime ($Re \approx 2000$), from the length L has a similar character, however, the value of the resistance coefficient λ is 1,7 times more compared to the exploitation of this padding layer in the turbulent motion of the heat carrier ($Re \approx 10000$) in all researched range of variation of the length of replaced areas L . The energy comparison of the padding with triangular channels, which differ in the lengths of the displaced sections $L = 100 \text{ mm}$, $L = 50 \text{ mm}$, $L = 30 \text{ mm}$, shows that at the same power required to overcome the resistance, for the case $L = 30 \div 50 \text{ mm}$, the thermal perception at 8 – 10 % higher [2], than for case $L = 100 \text{ mm}$. Given the fact that for large values of the length of the replaced area the danger of contamination decreases, it is necessary to recommend for practical use the value $L = 50 \div 70 \text{ mm}$, $L / d_e = 7,5 \div 10$.

Conclusion

The most promising intensified packing with triangular channels of the hot and cold layer of the RAH were used for research the hydraulic resistance coefficient, because it is characterized by the maximum thermal perception of the appositional resistances. For a area close to the turbulent regime, an increase in the length of the replaced sections L in 6,67 times leads to a decrease in the resistance coefficient by 1,6 times. However, taking into account the danger of surface contamination, it is necessary to recommend for practical use the value $L = 50 \div 70 \text{ mm}$, $L / d_e = 7,5 \div 10$.

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Smart technologies for common building equipment of dwelling buildings

Oleh Balitskyi¹, Mykola Dnistrian², Vasyl Sviastyn³

1. Department of Electric Power Engineering and Control Systems, L'viv Polytechnic National University, UKRAINE, L'viv, 12 Bandera Street, E-mail: banckijj@gmail.com

2. Department of Electric Power Engineering and Control Systems, L'viv Polytechnic National University, UKRAINE, L'viv, 12 Bandera Street, E-mail: mykolareka@gmail.com

3. Department of Electric Power Engineering and Control Systems, L'viv Polytechnic National University, UKRAINE, L'viv, 12 Bandera Street, E-mail: sviastynvasul@gmail.com

Abstract – One of the main goals of the law «On Energy Efficiency of Buildings» is decreasing of energy consumption in dwelling sphere. Electricity consumption does not have the biggest part of it nonetheless it is significant. The article proposes the solution that can help to decrease electricity consumption by common building equipment.

Keywords – energy efficiency, smart technologies, electricity consumption, elevators, microcontrollers.

Introduction

On July 23, 2017, the Law of Ukraine «On Energy Efficiency of Buildings» came into force [1]. This law, in particular, provides for mandatory certification of energy efficiency of state-owned buildings. The main goal of it is decreasing energy consumption in the dwelling sphere.

According to the [2] energy consumption in dwelling sphere consists of electricity (10%), natural gas (56,5%), heat energy (33,4%) and different fuels (0,1%). Electricity consumption does not have the biggest part nonetheless it is significant.

Electricity consumption of typical dwelling building consists of four parts: flats, offices, hall lightening and common building consumers. Annual electricity consumption of dwelling house according to the [3] is given in Table. 1.

Table 1

Annual electricity consumption of dwelling house by consumers

Electricity consumers	Electricity consumption	
	kWh	%
Flats	248013	76,6
Commercial offices	50476	15,6
Hall lightening	6734	2,1
Common building consumers	18600	5,7
Total	323823	

Table 1 shows us that common building equipment gets 5,7% of the whole building electricity consumption. On the one hand, it is not as significant as the flats electricity consumption whose part is 76,6% or offices' whose part is 15,6%. On another hand, dwelling building consists of 162 dwelling flats and 13 commercial offices. Thus, electricity consumption of common building electricity consumption is near twelve times higher than electricity consumption of average flat or near five times higher than electricity consumption of average commercial office.

It shows us that the problem of decreasing common dwelling house is an important problem in dwelling sphere.

Main Material

The significant common electricity consumers of dwelling buildings are electrical equipment for elevators, ventilation, pumping and fire pumping units etc. Systems of air pumping, fire pumping or fire water supply and pumping, as a rule, are installed only in high-rise dwelling buildings (more than 9 floors). Thus, the most significant consumer is elevators.

With the purpose to decrease energy consumption by elevators it is proposed to complement its control system by system of personalization accounting for electricity consumption based on smart technology like Arduino or Raspberry Pi. The system demands to change all elevators buttons by special RFID-readers so every user has to have a special RFID label that identifies his number of flat. Every RFID-reader is connected with microcontroller like Arduino (Fig. 1).

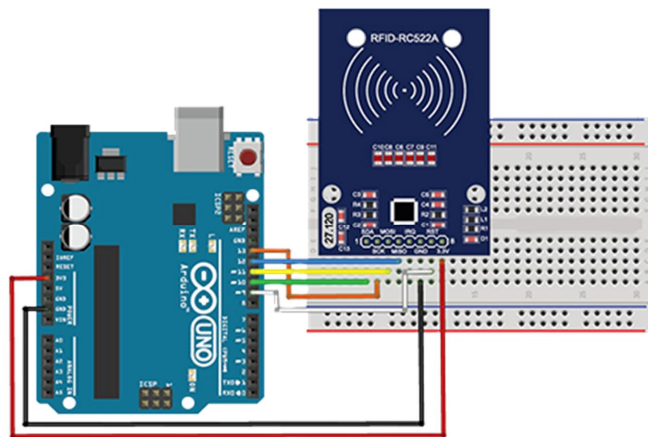


Fig.1. Connection scheme of a RFID-reader and microcontroller Arduino.

All microcontrollers Arduino are connected with minicomputer like Raspberry Pi that account energy consumption by every flat and saves it in database. At the end of a month it will be know how much electricity was consumed by every flat.

Additional benefit is that identified system protects elevators from using them amusingly.

Conclusion

Proposed system of personalization accounting for electricity consumption based on smart technologies is not expensive and can help to decrease electricity consumption by common building equipment.

Acknowledgments

Authors express sincere gratitude to the scientific supervisor Andrii Muzychak, docent of the Department of Electric Power Engineering and Control Systems.

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Computer-Aided Design of Gas Flow Temperature Measurement Errors

Petro Dychuk¹, Roman Fedoryshyn²

Department of Automation and Computer-Integrated Technologies, Lviv Polytechnic National University,
UKRAINE, Lviv, S. Bandery Street 12, E-mail: petro@dychuk.com (1), romanfedoryshyn@yahoo.com (2)

Abstract – *The system for computer-aided calculation of additional systematic errors of natural gas temperature measurement is developed. Calculation is made for the data on real working conditions of the gas metering unit. The following errors are calculated by the system: error caused by heat exchange between the thermometer case and the pipe wall, error caused by heat exchange between the pipe wall and the ambient air, error caused by temperature decrease as the gas is throttled through the pressure differential device.*

Keywords – gas, errors, computer-aided design, measurement of gas temperature, temperature transducers.

Introduction

Economical consumption of natural gas is possible only in the condition of its metering. This requires accurate metering of natural gas at all stages of its transportation and delivery to consumers. The accuracy of such a metering is defined by technical base, normative and metrological base [1, 2].

A negative factor affecting the accuracy of measuring the flow and volume of natural gas is the presence of heat exchange processes in the metering system, which may lead to the occurrence of additional systematic errors in measuring the gas temperature and, accordingly, the errors in measuring the flow and volume of gas [3].

Errors of flow temperature measurement

Error of flow temperature measurement consists of the following components:

- the error caused by heat exchange between the thermometer case and the pipe wall (ΔT_T);
- the error caused by heat exchange between the pipe wall and the ambient air (ΔT_x);
- the error caused by temperature decrease as the gas is throttled through the pressure differential device (ΔT_{thr});
- the error caused by temperature decrease as the gas pressure is reduced at the gas pressure regulator (ΔT_{red});
- the error caused by temperature signal lag at cyclic variations of the flow temperature (ΔT_{lag}).

The combined additional error of flow temperature measurement can be calculated as:

$$\Delta T = \Delta T_T + \Delta T_x + \Delta T_{thr} + \Delta T_{red} + \Delta T_{lag}. \quad (1)$$

Calculation of these errors is a complicated process since there is a need to accomplish computation of the gas properties (density, viscosity, isentropic exponent etc.) as well as the heat exchange processes in the pipe. In order to calculate the gas flow temperature measurement errors, various methods can be used: calculation by means of a calculator (simple but time consuming and not efficient), application of MS Excel (more efficient than the calculator but there is no possibility to accomplish a cycle computation with the exit by a condition “while”), Matlab (efficient but requires special skills from the user). To simplify the process of calculating the errors a special CAD system was developed.

The developed CAD system provides calculation of ΔT_T , ΔT_x , ΔT_{thr} errors.

Computer-aided design of gas flow temperature measurement errors

The system is built using the following technologies:

- HTML (HyperText Markup Language). This is the standard markup language for creating web pages and web applications;
- CSS (Cascading Style Sheets). This is a style sheet language used for describing the presentation of a document written in a markup language like HTML;
- JS (JavaScript). This is a language which is also characterized as dynamic, weakly typed, prototype-based and multi-paradigm;
- PHP (Hypertext Preprocessor). This is a server-side scripting language designed for Web development.

To perform the calculation of errors, the following data should be entered by the user:

- General data of the metering system;
- Properties of gas;
- Parameters and characteristics of the gas flow;
- Parameters and characteristics of the pipeline;
- Parameters and characteristics of the temperature measuring transducer;
- Parameters and characteristics of the ambient air;
- Parameters and characteristics of the thermal isolation of the pipeline.

The navigation menu of the CAD software consists of the following items (see Fig.1):

File (Файл) - allows the user to create a new calculation, open or save a file with input data that has been entered by the user;

Edit (Правка) - allows to return from the calculation results page to the data input page;

Calculation (Розрахунок) - performs the calculation and displays a table with a short list of the calculation results;

Параметри і характеристики потоку газу		
Абсолютний тиск газу в зимових умовах	0.3	МПа
Абсолютний тиск газу в літніх умовах	0.29	МПа
Температура газу в зимових умовах	-8	°C
Температура газу в літніх умовах	25	°C
Витрата газу в зимових умовах	938.17	м ³ /год
Витрата газу в літніх умовах	304.84	м ³ /год
Втрата тиску газу в зимових умовах	15.231	кПа
Втрата тиску газу в літніх умовах	4.4796	кПа

Fig.1. Navigation menu.

Protocol (Протокол) - on the basis of calculation results, creates a protocol and displays it to the user in PDF format;

Help (Допомога) - allows the user to view information about the program and about the errors of gas flow temperature measurement.

After entering all the input data the *Calculation* button should be pressed. The system will execute the calculations and return a short list of the calculation results together with the curves of the flow temperature measurement error versus the distance from the primary device (see Fig.2).

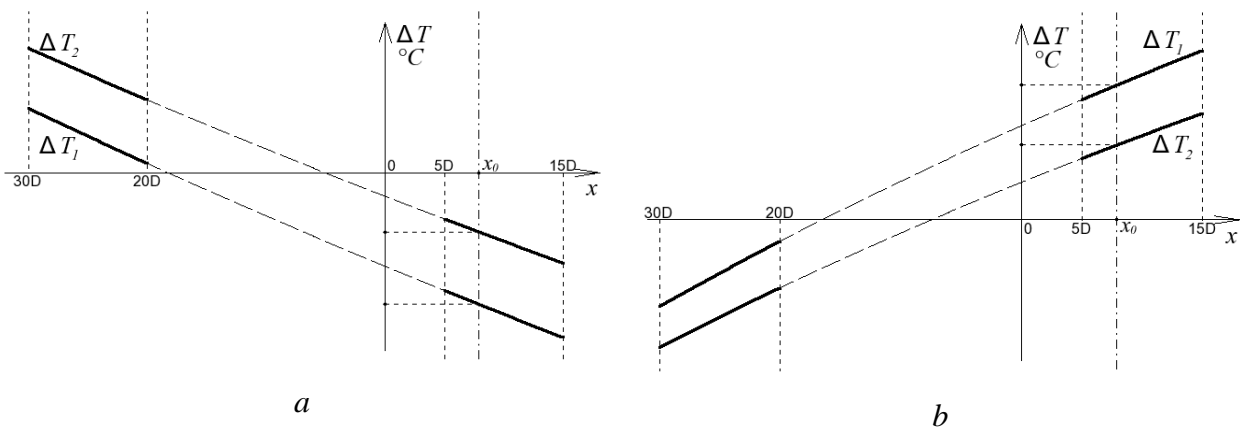


Fig.2. Curves of flow temperature measurement error ($\Delta T_T + \Delta T_x$) versus the distance from the primary device (*a* – winter conditions; *b* – summer conditions).

The short list of the calculation results includes the velocity of the gas flow, the heat flux from the gas to the ambient air, the temperature of the pipe internal surface, the temperature of the pipe external surface and other. The CAD system returns the recommendation on whether there is a need to install the heat insulation for the flow meter or not.

Conclusion

The article presents the system of computer-aided calculation of additional systematic errors of natural gas flow temperature measurement on the basis of initial data on the real operating conditions of the gas metering unit. The system interface is currently developed in Ukrainian, and its translation into English is planned for the future.

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Prospects of the Ukraine's energy sector development with renewable energy sources

Yurii Fedak

1. Department of Power Engineering and Control Systems, National University "Lviv Polytechnic", UKRAINE, Lviv, Stepan Bandera street, 12, E-mail: y.fedak@gaz.net.ua

Abstract - Renewable energy sources have a great potential for development, because they do not require the cost of fuel and do not harm the environment. In Ukraine, there is one of the highest green tariffs for the renewable energy in Europe, it allows us to build industrial solar and wind power plants.

Keywords – Renewable energy, alternative sources, prospects, solar power plants, solar energy.

Introduction

Alternative energy sources relate to electricity generating installations using renewable energy sources (RES), such as solar energy, are the most powerful source of energy on Earth.

In the last decade, a number of countries have widely implemented energy facilities that use renewable energy sources [1-2].

The main factors contributing to the use of RES:

- the exhaustion of organic (natural gas, oil, coal) and nuclear fuel stocks and the constant rising of their price;
- the reduction of harmful and greenhouse gas emissions into the environment and reduction of the influence on the global climate of the Earth;
- the continuous improvement of power generation technologies with the using of RES, reducing the cost of electricity, making it competitive compared to traditional energy sources;
- the increasing the reliability of electricity supply to consumers in the area of construction of new sources, reducing the technological costs of electricity for transmission in electricity networks;
- new jobs and additional revenues to the budgets of different levels;
- a number of factors of state incentives in the use of RES, which makes investment projects attractive to investors.

Main Material

Energy facilities with the use of renewable energy increase solar power plants the energy independence of the state.

The main document defining the RES development in Ukraine is the National Renewable Energy Action Plan for the period up to 2030. According to the Plan, the power of wind farms and solar plants should be at 2000 MW in each direction.

The technically achievable potential for each renewable energy source in Ukraine (according to the data of the Institute of Renewable Energy of the National Academy of Sciences of Ukraine) is given in Table 1.

At the beginning of 2018 the power of wind power stations was 1200 MW (without the AR of Crimea), and solar power stations - 760 MW (without the AR of Crimea), and their part in electricity production was 2.5%.

An analysis of the work of solar power plants in Ukraine shows a rather high level of insolation, practically throughout the whole territory of Ukraine.

The number of hours of use of the rated power of solar power plants varies from 960 to 1300 hours per year. So, it is possible to build industrial solar power stations of various capacities. The average payback period for the construction of solar power plants is 6-7 years.

Table 1 - Renewable Energy Potential in Ukraine

Areas of development of renewable energy sources	Annual technically achievable energy potential		Annual volumes of replacement of natural gas
	<i>billion kWh</i>	<i>million tons of fuel</i>	<i>billion m³</i>
Wind power	41,7	21,0	18,26
Solar power	28,8	6,0	5,22
Geothermal energy	105,1	12,0	10,43
Hydropower	27,7	10,0	8,70
Bioenergy	162,8	20,0	17,4
Energy of the environment	154,7	18,0	15,65
Total	520,8	87,0	75,66

The construction of the solar power plants requires significant land plots, an average of 2.0 hectare per 1 MW of power solar power plants with a plain terrain. Taking into account the value of constantly growing land, for the construction of solar power plants it is expedient to use land unsuitable for agricultural production, first of all land dumps of industrial enterprisolar power plants.

There is a problem of precisely predicting the load of the solar power plants and ensuring the claimed load by the solar power plant.

Solar power plants are among the most important objects for Ukrainian energy, which are attractive for investment in construction.

The solar power plants include:

- Fields of solar modules from poly-, mono-crystalline elements, unit capacity of the module from 270 W to 340 W.

Solar modules are fixed on metal structures made of galvanized steel.

The electricity generated by the solar modules is converted from the direct current into an alternating current of 0.4 kV or 0.8 kV by the inverters. An alternating current of 0.8 kV is transmitted to a power transformer of appropriate power. The power transformer is connected by a cable or air line to the substation of the UES of Ukraine.

Conclusion

Ukraine is one of the fastest growing enterprises in renewable energy sources and has an extraordinary potential for research, as it is possible to attract a large number of specialists and attract private investors. However, the green tariff is decreasing from year to year so it is necessary to use this opportunity to get the most out of the results.

Acknowledgments

Authors express sincere gratitude to the scientific supervisor Myroslav Sabat, docent of the Department of Electric Power Engineering and Control Systems.

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**8th INTERNATIONAL ACADEMIC CONFERENCE
“HUMANITIES AND SOCIAL SCIENCES 2018”
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The Effectiveness of Cooperative Learning in Teaching English as a Foreign Language (TEFL)

Oleksandra Monastyrna

Department of Applied Linguistics and Methods of Teaching Foreign Languages, Alfred Nobel University,
UKRAINE, Dnipro, Naberezhna Sichelavska street 18, E-mail: monastyrnaya@gmail.com

Abstract – The article aims to investigate the effectiveness of implementation of cooperative learning approach in EFL classes and describes the use of cooperative learning techniques to enhance learning experience of students, their motivation and confidence in mastering the foreign language.

Keywords – cooperative learning, group work, learning process, interaction between students, EFL

I. Introduction

There is a strong research evidence in favor of effectiveness of cooperative learning as a teaching strategy in raising educational standards. It is proved to produce positive outcomes in the learning process for every student. Hence its' implementation in EFL classroom can significantly accelerate students' progress in mastering a foreign language, and moreover, it contributes to students' personal characteristics and their motivation.

II. A Comparison of Traditional and Cooperative learning approaches

Cooperative learning has become a common practice in EFL classes in Western countries. However, in Ukrainian educational practice traditional learning methods are more frequently used.

One of the main issues of traditional teaching approaches is that they are aimed at the teacher-to-student knowledge and skills transfer. In the process of acquiring knowledge a student is mostly viewed as a passive agent or «consumer of information», whose role in the learning process is not to produce knowledge, but «consume» it.

Traditional education is mostly based on rote learning, memorization and acquiring objective knowledge. Such an approach to educational process neglects the importance of understanding facts, analyzing and development of students' critical thinking.

Traditional teaching-based EFL classes tend to limit student's participation in learning activities. Such classes are rather teacher-centered than student-centered. Full attention, in most cases, is focused on teacher, students solve the vast majority of in-classroom assignments on their own, collaboration and group work is discouraged. Implementation of these traditional teaching approaches into educational process cannot produce positive outcomes of foreign language learning since such isolated teacher-centered learning environments, in which students are discouraged from direct interaction with one another, are not productive.

During traditional teacher-centered classes students are mainly focused on the development of two or three language skills: reading, writing (that are paramount), and listening. However, listening is still not widely used in Ukrainian educational practice. But the main issue of traditional learning-based EFL classes is lack of speaking practice. Students are discouraged from direct interaction with each other, all the educational activities are aimed at development of writing, reading, and translation competence of the student. In the process of learning they may broaden their vocabulary (passive) and practice grammar material but, at the same time, students face a lack of communicative competence when it comes to speaking. Students find themselves

unable to use the acquired knowledge during communication. They face difficulty in expressing their thoughts, in "feeling" the language, since learners are used to writing their thoughts down and translating them from their native language into the foreign language. Therefore, the language progress might not happen in classes based on development of writing and reading skills as long as speaking competence is neglected. Language is a system, lexical, phonological and grammatical, that lies at the base of speaking. Consequently, its acquisition requires constant communication and interaction between individuals.

Thus, there is an increasing need for the development, and, subsequently, for implementation of effective language teaching strategies and techniques in educational process in order to improve the current situation with foreign language teaching in Ukraine.

III. Implementation of Cooperative learning strategy in EFL classes

Cooperative learning strategy can be a very effective instrument for achieving a number of learning outcomes including increase of student's motivation towards English language learning and improvement of their interest in learning activities. The approach is based on the idea that knowledge is socially produced by groups of people and that learning is a natural social act, in the process of which participants speak to each other, that is, learning takes place in the process of communication [1].

People exchange their ideas, feelings, experiences, processing this information into knowledge, and coming to an understanding of what is acceptable and meaningful for other members of the community.

Therefore, cooperative learning can be characterized as a learning process in which students acquire necessary knowledge and skills in the course of active interaction with each other.

Implementation of cooperative learning in EFL class helps to solve the following methodological tasks:

Increasing the effectiveness of learning process. Students learn much better if they are able to communicate and interact with other members of the group;

Increasing speaking and writing proficiency. Students' ability to write competently and logically depends on the ability to communicate with other students.

Unlike the individual approach to the learning process, cooperative learning enables students to achieve separate learning goals working together cooperatively. Every student achieves his/her own educational goals only if the other members of the group achieve their goals. They work together in small groups to ensure that each member of the group has the opportunity to take an active part in the solution of the task.

During the cooperative learning-based classes the impact of the teacher on the educational process is reduced. Teachers are no longer the "sage on the stage" but the "guide on the side". This means that the teacher takes on the role of a facilitator (not the center of the classroom like in the traditional learning-based classes), who guides students towards best achieving educational objectives.

The teacher divides the class into small groups and gives each group an assignment. Students work on it until all the members of the group have completed the task. Such teamwork creates the necessary condition for striving for mutually beneficial cooperation, so that every student benefits from the success of the others.

Working in a small groups or in pairs, students actively cooperate with one another and that helps them not only to practice and improve their communication skills but during such an interaction they have a mutual impact on each other's knowledge and skills by learning from each other.

During cooperative learning-based classes students interact "face-to-face" with their classmates contributing to each other's' learning experience, providing help, sharing ideas, encouraging to study. They explain material to one another, discuss it, teaching each other what they know.

In the course of cooperative learning-based classes students are encouraged to not only use regular course books but other sources of information such as the Internet, social networks, magazines, etc. that contribute to the development of students' cognitive activity, information culture, research and analysis skills, and, most importantly, to strengthening language skills.

IV. Use of Cooperative learning in development of student's speaking skills

Implementation of cooperative learning in EFL classes can be very beneficial for the development of student's speaking competence. During cooperative learning-based classes students are motivated to work together in order to find the solution for given tasks, which encourages them to discuss and share their opinions on the issue with other members. Such an interaction positively affects on student's confidence and willingness to speak in the foreign language with their peers.

A significant contribution to the student's speaking skills development can be achieved through various techniques such as:

Role play is used to create specific situation in which students have an opportunity to take on different roles while solving the given task. It is an effective technique that contributes to the development of student's speaking skills providing them with opportunity for spontaneous communication.

Discussion enables development of student's speech fluency as well as their motivation and interest in the learning process through conversation, sharing their opinions and experience on given issue. Discussion can be applied through various activities such as comparison of two connected pictures that provide a visual hint for questions needed to be discussed.

Work shop allows students to prepare an academic activity on given (chosen) topic and present it during regular classes. In the course of workshop all students are actively involved in the learning process and discussion.

Brainstorming activities are aimed to encourage students to find a creative solution to the complex issue through the group discussion.

Peer teaching or learning through teaching creates appropriate conditions for student's active cooperation with one another and that helps them not only to practice and improve their communication skills but also during such an interaction students have a mutual impact on each other's' knowledge and skills by learning from each other. In short, the technique occurs when one student (the tutor) teaches another (the tutee) under the guidance of the teacher and at the same time both tutor and tutee benefit from it.

V. Advantages of Cooperative learning

First of all, cooperative learning helps students to be directly involved in the learning process. During regular classes students can be distracted from the task or stop listening to the lecturer; however, during cooperative learning-based classes a student (within a group or pair) is

faced with the task and has to cope with it. Therefore, students listen to their classmates much more attentively, taking an active part in discussions and solution of the task and understanding their responsibility for it.

Another strong point in favor of the cooperative learning strategy is that, since students spend more time with each other than with the teacher, they are aware of personal characteristics (strengths and weakness, positive and negative sides, temper, attitude, etc.) of their classmates. It helps them to find an effective individual approach to one another much easier in their academic activities while the teacher, mostly, does not possess sufficient information.

With proper application cooperative learning has a number of benefits for all students:

Students' social competence, motivation, confidence, and self-esteem are developed;

Provides students with an effective and supportive atmosphere that helps to reduce their anxiety in speaking the foreign language;

Promotes student's greater productivity and higher achievements;

This technique encourages the development of students' communication skills. Greater understanding is fostered in the process of discussion between students. Finally, active learning is promoted in the process of students' interaction.

The approach also provides students with the ability to acquire a number of team building skills such as:

Communication;

Establishment of trust between students;

Problem solving;

Teamwork;

Leadership.

Conclusion

The cooperative learning has proven to be a very effective approach in mastering a foreign language, especially in developing student's oral proficiency in English. It promotes friendly and supportive atmosphere that contributes to the reduction of student's anxiety and low self confidence, as well as to development of their social skills and motivation towards English learning.

Thus, systematic students' cooperative work allows to significantly improve communication skills, develop social skills, leadership qualities, strengthen the relationship between students, and increase their motivation.

The prospects for further research lie in developing practical ways of implementing cooperative learning in the language study process at higher schools.

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Ukrainian national movement in Galicia through the prism of Ivan Franko's historical and cultural heritage

Nadiia Baranovska¹, Danylo Hordon²

1. Department of History of Ukraine and Ethnic Communication, Lviv Polytechnic National University, Ukraine, Lviv, 3 Mytropolyt Andrei str., Building 4, Room 202, E-mail: Nadija7777@i.ua
2. Institute of Jurisprudence and Psychology, Speciality: "Psychology", Lviv Polytechnic National University, Ukraine, Lviv, 1/3 Knyaz Roman str., Building 19, Room 304, E-mail: blablabla1715@gmail.com

The article examines an evolution of Ivan Franko's views, as a leader and participant of the national movement in Galicia at the end of the nineteenth and early twentieth centuries, on the idea of a nation and a state, a path from a socialist with an autonomous inclination towards national-democratic, expressed in its historical and cultural heritage.

Key words: Ivan Franko, Ukrainian national movement, Galicia, a national idea, heritage.

I. Introduction.

Ivan Franko (1856-1916) was one of the leaders and a direct participant of the national movement, so all his creativity was drawn primarily to the problems of Ukrainian nation. We can divide Franko's opinions about the idea of a nation into 3 periods: socialist-autonomous (1877-1883), socialist (1883-1896) and national-democratic (since 1896).

II. Ukrainian national movement in Galicia through the prism of Ivan Franko's historical and cultural heritage

After "Spring of Nations" (1848-49) in Galicia two currents of the national movement were distinguished: Moscovophiles and Ukrainophiles. In the time when Ivan Franko began to take an active part in public life (1877), the Moscovophiles were losing their positions, and Ukrainophilism was spread only to a narrow circle of intellectuals.

After Franko arrived in Lviv in 1875, for some time he was a member of the editorial board of the Moscow-Philippe magazine "Friend", in which he published his works. Under the influence of M. Dragomanov, who in 1877 wrote 3 letters to the editorial "Friend," Franko moves on to socialist positions, taking over his autonomous views. Analyzing the letter of I. Franko to Olga Roshkevich from September 20, 1878 and the brochure "Catechism of Economic Socialism", one can conclude that I. Franko considered the solution of socio-economic problems to be a priority task, after which a national question should be solved, in Franko's opinion, the best option is an autonomous status within the federation of states. So, he wrote in the letter to Olga Roshkevich from September 20, 1878 about an eternal federation and an autonomous community as an integral part of a federation in which, in solving all economic and social problems, individual nations could be better developed and so national development does not contradict the socialist [1]. This idea of an autonomous community is represented in his story "Zakhar Berkut".

In the article "Formal and Realistic Nationalism" (1889) Franko concludes that development of a nation is impossible without cultural and socio-economic development, and therefore, the development of a nation without these factors is "an pipe dream" [2]. Ivan Franko's socialist position was manifested also with the adoption of a program of the first Ukrainian political party RUP (1890), in which he refused to write in the maximum part of the program the requirements for the restoration of the Ukrainian state, and in the minimal - division of Galicia into the East and West.

Gradually, Ivan Franko changed his views and renounces socialist views. Franko believed a national idea is a number one priority and criticized M. Dragomanov's autonomous concept. However, in a review of Y. Bachynskyi's work "Ukraine Irredenta" (1896) I. Franko still

observes the old autonomist views, but, he is already sympathetic to the idea of independence of the Ukrainian nation. In the second half of the 1890's, his attitude is changing in the direction of national-democratic views. In the article "With the end of the year" I. Franko appeals to the intelligentsia to create a radical national-political movement that would manifest itself in "radical agitation" of proscribed political literature among the workers and the peasantry. I. Franko still does not raise the question about complete independence of Ukraine, assuming that history will show it [3].

The events that inspired Ivan Franko to revise his previous positions were student veches (1897-1900), on which students demanded the independence of Ukraine. Already in the article "Beyond the Possible" (1900), Franko clearly expresses his views about the priority of the national idea. However, becoming a nationalist Franko did not adhere to the position of etatism [4].

In 1899 Ivan Franko left URP and became a member of UNDP. The final goal of UNDP program was gaining of independence of Ukrainian nation. In the articles "From the last decades of the nineteenth century" (1901) and "To the history of the socialist movement" (1904) [5]. Ivan Franko proved the harmfulness of socialism for Ukrainian nation and predict the totalitarian nature of future communist country, which changed an exploitation a human by a human to an exploitation of a human by the government.

Ivan Franko left UNDP because of health problems in 1900. As a member of the Shevchenko Scientific Society, he is actively involved in scientific activities. In socio-political journalism of the 1900's Franko spoke quite rarely and cautiously about the state's independence of Ukraine as a national ideal, but not because of political wariness, but more because of deep discretion, realizing that the future would open up different chances for the Ukrainian nation. Franko's views on the contradictory path to independence were represented in his ingenious poem "Moses".

III. Conclusion

Therefore, contradictory evolution of Ivan Franko's views as a direct participant and one of the leaders of the national movement in Galicia, which we say in his historical and cultural heritage, symbolizes the contradictory of Ukrainian national movement itself. Despite all the contradictions Franko's the first priority was well-being of his own nation. Even if he wasn't a radical independist, it was only because he understood which opportunities are possible to bring to life. Being national idea's guide, Ivan Franko directly influenced it, choosing the direction of historical development for millions of Ukrainians. That is why a lot of his ideas and views are still an actual.

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The process of dispossession of the kulaks as a personal tragedy Podolsk family

Nadiia Baranovska¹, Olha Herasimchuk²

1. Department of History of Ukraine and Ethnic Communication, Lviv Polytechnic National University, Ukraine, Lviv, 3 Mytropolyt Andrei str., Building 4, Room 202, E-mail: Nadija7777@i.ua
2. Institute of Computer Science and Information Technologies, Speciality: "Philology", Lviv Polytechnic National University, Ukraine, Lviv, 28a Bandera str., Building 5, Room 513, E-mail: herasimchuk2001@gmail.com

The article analyses the process of dekulakization, on the example of one Podillia's family, as one of the ways of building a Soviet totalitarian state and the removal of conscious Ukrainian peasantry, capable to resist the Soviet system.

Key words: collectivization, dekulakization, Podillia, peasantry, tragedy.

I. Introduction.

One of the most unexpected problems for the population of the 20th century was a sudden start of building the new country and new processes that had been put in order. The main one was the process of collectivization which later led to the development of the main problem of people - Dekulakization. Dekulakization was inevitable, not only for wealthy individuals, but also for the entire peasantry. It contributed to the depletion of Ukrainian villages and the destruction of families.

II. The process of dispossession of the kulaks as a personal tragedy Podolsk family

The creation of the Soviet Union provided some strategic measures that were needed to provide a new ideology. However, a wide historical experience showed that the establishment of a chosen fret could be stopped by numbers of conscious Ukrainians, who were ready to fight for their future. This layer of the most rebellious population in this period were wealthy peasants. The protests were caused by a number of factors, including the beginning of collectivization in 1928.

As a consequence, the Soviet authorities decided to eliminate the richest layer of the Ukrainian population, which was considered to be a source of capitalism in the countryside. Vivid testimony may the resolution of the Orgburo measures for the elimination of kulak households in districts of continuous collectivization, which was released in January 1930. Earlier, in 1929, Stalin began to use the word "kulaks". Subsequently, the term was spread to all the peasantry.

Especially intensively the process of dispossession of the kulaks in the first half of 1930 is observed. It was the beginning of the expansion of the list of people, which was called as «kulak», because the class started to include farmers who had not agreed to go into collective farms. Later they invented a separate term which was named as "Pidkurkulniki".

Although the Sovnarkom of the Ukrainian SSR adopted a resolution "About signs of kulak farms, that are subject to the rules of the Labor Code of the UKRAINIAN SSR", but, in practice, they didn't use the provisions of this regulation.

The kulaks were conditionally divided into 3 categories:

- active enemies of the Soviet power (they had a 10-year prison or were shot);
- passive enemies of Soviet power (their property was confiscated and the hosts had to be sent to the northern and eastern areas of the Soviet Union);

- loyal to the policies of the Communist Party (such peasants were sent from the territory of collectivization, and were given the worst land).

The process of dispossession of the kulaks was fairly widespread, in practice, it could be understood from the speech of the Secretary General of the USSR (b) u.

Postashev said in 1934 that during the years of collectivization about 200 thousand farms were destroyed. But, in fact, this figure is only a repetition of that one mentioned by the statistical bodies in 1927, when they talked about the number of kulak households in Ukraine. In addition, for about one million Ukrainians were deported to northern areas, where they had incredibly difficult conditions for life. Also, a big number of peasants just left the place of their residence and all property just because of the threat to be replaced.

From the above it follows that the process of dispossession of the kulaks was an important stage in the formation of the Soviet political system, and not always the process was legal and justified by existing laws. Dekulakization was conducted throughout the territory of Ukraine. However, the greatest repression occurred in such areas as Volhynia, Podolia, in areas where the level of Ukrainian consciousness was higher.

That is why I want to illuminate the history of dispossession of the kulaks on the example of my relatives- family Kostukiv - the inhabitants of the village Plischtschyn, which is located in Podolia.

Gregory himself was a native settlement of village Radisivka, however, he subsequently settled to the village Plischtschyn, where he created his family. Initially, the man had no property, and actually built his life on a new site from scratch, made a living by building houses in the village. At that time the profession of Builder was quite lucrative, thanks to which, he gradually made some fortune. He had 2 oxen, 2 horses and a cow, and also his own apiaries, which produced honey. Kostyuk was respected in the village, and it was caused not only by his generosity, but also by the fact that he had not hired servants, served his land himself, along with the family.

However, the reason the cannibalization wasn't the property status of a peasant. All of the events occurred in May 1932. Then, there were wires in the village, which, according to the old tradition, virtually all the inhabitants of the village went to the cemetery to the athlete of their ancestors. Komsomolzi that passed the cemetery unashamedly singed loudly and plagued throughout the procession. The oldest son of Kostyuk was one of those activists. That is why Gregory Filippovich went to youth and expressed his dissatisfaction with the actions of his son. However, at first glance, insignificant words were not unnoticed, because the event was attended by a representative of the District Government.

A few days later Gregory Pilipovich was visited by some people who came from the district. Besides the fact that he was sent abroad, all the property was removed and his wife remained with the children with absolutely no-conditions for survival. Kostyuk was sent to Samara, where he remained until the beginning of World War II.

As soon as he saw the possibility of coming back home, he made it. However, the lack of property on which he'd been working all his life, ruined house, problems with health, led to Mr. Gregory's rapid death.

III. Conclusion.

So, on an example of this routine Podolsk family, we can see how the desire of the Soviet Government to build a totalitarian state led to unlawful depletion, and persecution of our fellow citizens, and to changing social situation in the country. In fact, the process of dispossession of

the kulaks affected not only farmers who were directed, but also the whole family. In fact, after the lose of their breadwinner, and after removing all the property, the family were fated to the survival in harsh conditions.

The process of dispossession of the kulaks is, actually, a way to eliminate the conscious layer of the Ukrainian nation, which was ready for the resistance to the Soviet Government. So, it succumbed not only rich people, but all those who showed even the slightest resistance to the actions of the government.

Cannibalization became not only the way of Soviet system to establish its authority on the territory of Ukraine, but also a real national tragedy, the deployment of which destroyed the fate of many Ukrainian families.

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The Impact of Depreciation Policy on Investment

Anna Blahii¹, Iryna Kondrat²

1. Institute of Economic and Management, Lviv Polytechnic National University, UKRAINE, Lviv, Mytropolita Andreja street 5, E-mail: anyablahiy@gmail.com

2. Institute of Economic and Management, Lviv Polytechnic National University, UKRAINE, Lviv, Mytropolita Andreja street 5, E-mail: iryna.y.kondrat@lpnu.ua

Abstract – The purpose of this article is to characterize the significance and place of depreciation policy as an effective management tool on investment decisions. In addition, comparison of depreciation policy in Ukraine to the US and West European countries is mentioned. The relationship of the depreciation policy of the investment policy is presented.

Keywords: depreciation policy, depreciation resources, fixed assets, financing investments, investment resources, investment policy.

Introduction

Fixed assets of an enterprise is one of the defining factors of its success. Their initial progressivity and the degree of physical and mental deterioration largely determine the competition ability of any enterprise.

Leading economists: V. V. Aleksandrov, A. V. Cherep, T.M. Starytsky, O. M. Zborovska, M. S. Gerasimchuk, I. I. Lukinov have actively explored the problem of depreciation policy, its role in the management of the enterprise and use as a means of activization of investment processes.

Review of depreciation policy in Ukraine

For a long time in our country depreciation policy was viewed as an integral part of scientific and technical policy of the State, when the depreciation was withdrawn to a centralized fund to finance socio-economic projects, which are established by the State.

Analysis of foreign experience showed that Ukrainian depreciation system is significantly different from the depreciation systems of developed countries in which scientist quite often to stimulate implementation of the newest tools, technologies equate fixed assets (equipment) to working capital, and the cost of their purchase equate to production costs for one year. The generalized result of the ineffectiveness of depreciation policy is the low percentage of depreciation in the structure of GDP.

In connection with the transformation on the essence of depreciation, adding it investment focus arises the need to consider depreciation policy in relationship with investment policy, which includes the functions of mobilization, redistribution and the effective use of financial resources, the determination of the structure and sources of funding.

Characteristics of fixed asset depreciation

As for the depreciation of fixed assets, as part of the formation of the financial resources of the enterprise it can be characterized as below:

- 1) depreciation of fixed assets is quite a long process of transferring part of the cost of fixed assets on production costs;
- 2) depreciation is often one of the largest spending in the budget.
- 3) the amount of depreciation reduces the tax liability of business entities;
- 4) investment nature of depreciation-as a result of the fact that depreciation is not a cash expenditures and the funds do not go beyond the enterprise, the entity is able to use these funds, [2].

The relationship of depreciation policy and investment

Depreciation deductions in the world is recognized as the main source of financing industrial investments and are 60-70% of investments in fixed capital. In the West European and American companies depreciation deductions represent 40% of the total amount of current and capital expenditure.

The funds received from depreciation deductions should be directed at the renewal of fixed assets that have been eliminated due to deterioration of technical condition and moral aging. It is the depreciation deduction that forms the basis of the formation of own sources of investment for enterprises, because unlike the profit, they are not subject to sharp fluctuations under the influence of market factors, [1].

The legality of considering depreciation as an investment source of an enterprise is also grounded in the fact that the total depreciation charges for the entire life of long-term assets do not always equal their original value.

The relationship between depreciation policy and investment policy should consist of choosing sources financing investments. The main problem, which is facing potential investors, is the choice of the optimal sources of financing for realization of investment activity. The most common source is their own money (depreciation deductions and net income that remains at the disposal of the enterprise), but quite often the choice is made in favour of the debt (loans to banks and credit institutions, leasing) to ensure the investment process, without sufficient study of the effectiveness of their use, [3].

The level of the availability of depreciation deductions for investment activity can be characterized as high, since depreciation deductions are always available to enterprises or organizations, even if their activities are not profitable or unprofitable.

Conclusion

The study of the theory and practice of forming depreciation policy by enterprises showed that it needs to be improved in order to solve the problem of investing in technical development of enterprises at the expense of its own sources of financing and the creation of depreciation funds. Additional concomitant expenses do not accompany use of depreciation resources, for their use there is no need to pay. Thus, depreciation is the most appropriate source of financing investments, which corresponds to the economic nature of property embodied in the capital category. When investing at the expense of external sources, funds will be required in the amount that exceeds this value on the value of appraisal of the investor's economic interest. The only drawback of using depreciation deductions is their limited volume.

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Development of Innovation and Investment Activity in Agriculture of Ukraine

Yurii Dziurakh

Administrative and Financial Management Department, Lviv Polytechnic National University, UKRAINE, Lviv,
S. Bandery street 12, E-mail: yriu.dziurakh@ukr.net

Abstract – Consideration is given to increasing efficiency and stimulating investment activity in the field of agricultural production. Innovative processes require assistance in the form of financial and credit support, targeted government preferences, as well as the creation of specialized infrastructure

Key words – innovation processes, agriculture, development, stimulation.

Introduction

In a market economy, most agricultural enterprises require investments in order to upgrade their fixed assets and expand their volumes, introduce innovative technologies, purchase new varieties of plants and animal breeds, as well as other capital-intensive innovation and investment projects. Therefore, the question arises about the search for new forms and methods of activating the organizational and economic mechanism for the innovation and investment activities development.

Presenting main material

Agricultural production today has an extensive character and this state of development is caused by a number of factors and, above all, the apathy of the state to the agriculture development state. As a result one can notice the shortage of financial and logistical resources in agricultural enterprises, the outdated labor force of fixed assets. Thus there is the need to increase the cost for their repair.

In modern conditions the activation of investment activity is decisive due to the global food crisis that has led to a sharp rise in the prices for foodstuffs. It has led to the need for domestic and foreign investment attraction.

Thus, investment is the most important part of the extended reproduction financing that can provide economic growth in the long run. It determines the pace of agricultural production development. Investment application can cause structural changes, technological re-equipment and modernization, the introduction of modern high-performance and resource-saving technologies, the market power and priority of the industry.

Investment resources, in actual volumes, do not provide extended reproduction, and most of domestic enterprises has their own funds as their main source of investment. All these facts have caused the situation when most agricultural enterprises are unprofitable. They use the outdated equipment and most of the working capital is used not for upgrading of the equipment, but for the current and major repairs.

The main formation and development features of the innovation process in the agriculture are the following:

- 1) significant differences in the regions of the country in terms of natural and climate conditions and production specialization;
- 2) variety of agricultural products, processing products, the significant difference in the process technology, keeping and feeding animals;
- 3) a large difference in the periods of production of certain types of agricultural products and products of its processing;
- 4) the presence of a large variety of production types under different organizational and legal forms and forms of ownership, size, specialization, subordination, cooperation, etc.;

5) the high dependence of agricultural production technologies on natural and climatic conditions, road and transport networks, distance from supply centers and product markets and other factors;

6) isolation of agricultural producers, their remoteness from information and consulting services and organizations that produce scientific and technical products;

7) different social and educational levels of agricultural employees;

8) the absence of a clear and scientifically determined organizational and economic mechanism for transferring the science achievements to agricultural commodity producers and, consequently, the condition of a significant lagging behind the development of innovations in production [1].

Ukraine, which has the best natural and favorable climatic conditions in the world for agricultural production, but due to technological backwardness and irrational organization of production today can not provide its population with high-quality and affordable food products.

On the domestic market, domestic products are being driven out by imports due to its higher quality and higher competitiveness, achieved through the use of more advanced technologies than in Ukraine. The development of innovation in agriculture in Ukraine is an important direction in increasing the competitive advantages, as the agricultural sector of economically developed countries gradually transforms into a science-intensive industry.

The main directions of development of innovation and investment activities in the agricultural sector are:

- improvement of the mechanism of management of innovative activity in the agricultural sector;
- intensification of innovative activity in the agricultural sector by providing various benefits, grants, using foreign experience;
- technical and technological reequipment in agricultural enterprises.

Conclusion

The financing of innovation programs in the field of agriculture should include: studying the feasibility of an innovation program (at cost and planned profit taking into account possible risks); development plan implementation; organization of financing, including: evaluation of possible forms of financing and selection of the one that meets the requirements of the innovator; identification of the investor organizations and the structure of the sources of funding; control over the implementation of the plan and terms of financing [2].

Innovative activities in the field of agriculture should be aimed at creating and attracting from the external environment such innovations that would promote competitiveness, strengthen market positions, and provide a development perspective.

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Current state and prospects of development of cryptocurrency in Ukraine

Karpiv Olesia¹, Pozniakova Olena²

1. Department of finance, Lviv Polytechnic National University, UKRAINE, Lviv, Bandera 12 str., E.-mail: olesia.karpiv.fk.2015@lpnu.ua

2. Department of finance, Lviv Polytechnic National University, UKRAINE, Lviv, Bandera 12 str., E.-mail: pozniakovalv@gmail.com

Abstract – *This report describes how cybercriminals behave in the market. The advantages and disadvantages of cryptography are described. In accordance with the current legislation, cryptocurrency as a mutual settlement can not be used, respectively, bitcoins as a means of payment - can not.*

Keywords – Cryptocurrency, Bitcoin, Advantages, disadvantages, investment.

I. Introduction

Bitcoin, or Bitkoin – an electronic currency, the concept of which was announced in 2008 by Satoshi Nakamoto, and presented by him in 2009, is based on the self-published document of Satoshi Nakamoto.

Today, financial systems of individual countries, as well as other sides of the economy, are being improved and progressing in the context of the development of globalization, the spread of IT technologies and general computerization. It promotes the emergence of new financial institutions, tools and forms of interaction between people. So, there was an analogue of traditional currencies - crypto currency and its most common currency bitcoin. The existence of the need for constant monitoring of the movement of these monetary units reveals the current trends of monetary and foreign exchange systems on the world market.

II. Results

Cryptocurrency is digital counterfeit-proof coins that can be stored in electronic wallets and transact between wallets.

In the modern world, the most famous type of cryptocurrency is Bitcoin. Its main advantage is that Bitcoin is anonymous. However, any state wants access (for example, by court order) to personal data to counteract crime [3].

Bitcoin is developing fast enough today. Investment in bitcoin remains a very serious alternative to investment in altcoins. Many experienced investors say that even in case of the most successful altcoins today, the rate growth in the next year, at least, will slow down, and in the worst case, even stagnation and a few times fall are possible [4].

Such jumps occurred repeatedly in the history of bitcoins and more than once even in 2017, so analysts believe that after recession the rise will begin again. Skeptics still believe that the cryptocurrency rate is practically not supported by anything, as opposed to the exchange rate or the gold rate.

The features of the cryptocurrency system functioning have practically the same impact on both ordinary users and business representatives. Accordingly, the pros and cons will also be the same for all.

It is necessary to specify the advantages and disadvantages of cryptocurrency.

The situation with regard to cryptocurrency in Ukraine is unclear. Although cryptocurrency has no legal status, it still is in a high demand, it does not discourage compatriots from using it. As it has been mentioned before, there is no law or subordinate normative legal act on the

cryptocurrency that regulates operations with its application. However, cryptocurrencies have been in operation for about ten years (including in Ukraine), without any controlling authority or central bank, which allows any transactions to be carried out completely anonymously, without any user identification.

Table 1.

Advantages and disadvantages of cryptocurrency in Ukraine [4]

Advantages	Disadvantages
<ul style="list-style-type: none"> • Open source of algorithm allows you to extract it to anyone who wishes; • Anonymity of transactions - information about the owner of a crypto wallet is missing (there is only a wallet number); • Decentralized nature, lack of a single digital bank, lack of control over transactions and payments; • Not prone to inflation (limited amount of coins is emitted); • Security: it can not be copied. 	<ul style="list-style-type: none"> • Due to the lack of regulatory mechanisms there are no guarantees of preservation of electronic crypto wallets; • High volatility due to specific use • National regulators may have negative effects on it (such as the prohibition by the Central Bank on bitcoin transactions); • Loss of the password to the electronic crypto wallet or its disability leads to the irreversible loss of all crypto coins contained in it; • With increasing complexity level, crypto coins mining on the equipment of individual users becomes unprofitable.

In addition, it should be noted that while financial regulators can not determine the status of cryptocurrencies in Ukraine, two draft laws on this issue are under consideration in the Verkhovna Rada of Ukraine:

– Draft Law No. 7183 dated October 6, 2017 "On the Circulation of Cryptocurrency in Ukraine";

– Draft Law No. 7183-1 dated October 10, 2017 "On Stimulation of the Cryptocurrency Market and Their Derivatives in Ukraine".

Both bills stipulate the need for public administration in the field of cryptocurrency circulation, the authority of the regulator to determine the procedure for the creation and operation of cryptocurrency exchanges, monitor the cryptocurrency transactions, identify the subjects of cryptocurrency transactions, etc. [2].

It is quite important that on August 31, within the framework of the Financial Stability Council of the NBU, the Ministry of Finance, the National Commission for Securities and Financial Markets (NCSFM) and other regulators agreed to work out a common position on the legal status of Bitcoin in Ukraine within 3 weeks.

On September 28, the Verkhovna Rada's Committee on Financial Policy and Banking began dealing with preparation of the law "On the Circulation of Cryptocurrency in Ukraine" [1].

Finally, it is worth saying that, in accordance with the current legislation, cryptocurrency can not be used as mutual settlements, therefore, bitcoins as a means of payment – are incapable. Thus, natural persons or legal entities using bitcoin currency carry out operations and conduct business at their own risk and without any guarantees on behalf of the state. The NBU warns against operations with cryptocurrency, including in bitcoins, until a system of rules is created that will be able to prevent abuse.

Conclusion

Therefore, it is worth saying that nobody knows how to regulate the circulation of cryptocurrency and who can do it. Even the relative stability of the rate may not be enough to convince large investors to invest in digital assets. Without the confidence and regulatory solutions, bitcoin will not be able to break into the category of key payment instruments for trading.

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Factors of Success of Brewing Enterprises (By the Example of "Mykulynetskyi Brovar" LLC)

Tetiana Kulinich¹, Natalia Herelius²

1. Management of Organisations Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: tetiana.v.kulinich@lpnu.ua

2. Management of Organisations Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: herelius@ukr.net

Abstract – The authors reveal the results of their research on the existence or creation of certain working conditions, which positively distinguish the brewing enterprise from its competitors. Also, the paper analyzes specific features of such enterprise that allows it to be more successful. The main subject of the research is “Mykulynetskyi Brovar” LLC, for which the key success factors are highlighted.

Keywords – factors of success, competitiveness, competitive advantages, enterprise, technology, production, brewing.

Introduction

Beer industry occupies a significant place in the whole processing industry of Ukraine. It is profitable not only for investors and direct producers, but also for the state. The latter is that breweries are large taxpayers, and given the specifics of the product and local taxes, the product is quite cost-effective and popular, so investing in its production involves quite profitable financial prospects. That is why studying the factors that affect the success of enterprises is relevant today.

Presenting main material

For a long time, production of beer in Ukraine was a family tradition. It was prepared for holidays and home entertainment. From the XV century beer stores started to appear in cities [1]. Most domestic brewers were hereditary masters, they learned their craft from their ancestors and passed it on from generation to generation. During the First World War, the authorities banned the production of beer. Breweries closed and some were even destroyed. Until 1920, only 83 out of 218 original breweries remained. Beer production began to be restored only in 1922 due to the allowance of distribution to the public. At that time, most of the beer factories concentrated on the territory of Lviv and Ternopil regions, although they produced less beer than two breweries in Kyiv.

From 1991 to 2008 beer production began to grow. In those days the industry was considered progressive and promising. The brewing industry was not considered isolated, as it was closely linked with other branches of the national economy: agriculture (growing of hops, barley), chemical and glass industries (glass and PET bottles). As a result, the beer industry helped to develop related industries, thus creating new jobs that improved the economy as a whole. Over time, enterprises became increasingly isolated, built their own factories for the production of malt, glass containers and recycling PET bottles [2].

Unlike large breweries, small and medium-sized breweries tend to be more likely to suffer from a number of significant problems that complicate their development. In particular, seasonal changes are the most common obstacles, as beer production is mostly in demand in the summer. The situation is also complicated by the low purchasing power of the population (besides, beer is not a product of prime necessity). Production is very dependent on the availability of its ingredients. After all, in Ukraine, every year, hops and brewer's barley are grown less and less.

All of this occurs during unstable socio-economic policies and other external factors [3-5]. Under such conditions, most small and medium-sized enterprises either cease to produce beer, or are bought out by larger more profitable breweries.

Nevertheless, there are a number of factors that allow small and medium-sized breweries not only to stay on regional beer markets, but also to capture new market segments. Among such enterprises, which successfully operate and dynamically develop in the field of brewing, is "Mykulynetskyi Brovar" LLC [6].

"Mykulynetskyi Brovar" has a number of competitive advantages:

- real live non-pasteurized beer from Ukraine;
- traditional brewing technologies - the production cycle is about 60 days;
- original recipes and rich taste;
- availability of honey beer (no analogues in Ukraine);
- availability of low-fermentation wheat beer;
- option of a gift variant of the package;
- The brewery is the only one in Ukraine, which for high quality products according to European standards, that has been awarded the diploma and certificate of the European Business Assembly of Oxford (England 2006).

According to the research, maintaining a high quality standard is one of the key factors in the success of brewing enterprises [2, 5]. This is achieved by making beer according to the original recipes from natural high-quality, environmentally friendly raw materials and special technologies that combine the advanced achievements of science and the traditions of old brewers.

The technology of the Mykulynetskyi brewery focuses on the fact that none of its beer varieties contain preservatives, but only valuable vitamins, minerals and other nutrients for health. For each type of beer, the brewery's specialists develop the technological conditions that correspond to the technological instructions and recipes in compliance with sanitary norms and rules approved in accordance with the established procedure. "Mykulynetskyi Brovar" LLC uses raw materials authorized by the Ministry of Health of Ukraine to make beer and their filtering materials are fully compliant with the state standards of Ukraine.

While most breweries are using foreign malt and hops, "Mykulynetskyi Brovar" LLC has its own malt which provides the company with its own raw materials. It positively affects the quality of beer produced and provides superiority over competitors.

In order to ensure that their products maintain fresh, large producers use pasteurization, which requires the use of various preservatives that harm human health. The main competitive advantage of Mykulyntsi beer is that it is not pasteurized (live). This is an important method for the success of this enterprise in the regional market, since consumers of Mykulyntsi beer are attracted to the fact that non-pasteurized beer is better for you (they have toning properties). This is because with moderate consumption it quenches thirst, stimulates metabolism in the human body, increases immune protection and the nervous tension is removed.

In addition, only "Mykulynetskyi Brovar" LLC produces untreated, non-pasteurized beer. It is sold on the ground through its own sales network.

Such competitive advantages have made it possible for "Mykulynetskyi Brovar" LLC to succeed on the national market. The basic principle of this enterprise is no impurities, flavors or preservatives. The technologies of this brewery consist of individual, unique types of hops and barley for each variety of its products. It also uses local, naturally filtered water to give the beer a particularly mild and delicate taste.

In recent years, in Mykulyntsi, a state-of-the-art, specialized, wheat beer facility has been built. New high-yielding lines for the production of barley beer have been put into operation. The quality control of all beer products is carried out in accordance with ISO standards. Natural, environmentally friendly and local raw materials are used during the production of their beer. Also, they import high-quality ingredients. Due to their wide variety of beverages, they are able to succeed in the competitive Ukrainian market.

The company focuses a lot on their marketing tactics. After visiting a brewery in Europe, the leadership was interested in the idea of reviving ancient traditions of beer bottling in special bottles with folding cork, which are delivered from Germany. The very design of the bottle allows the unfiltered beer to be poured in its natural state. The content of yeast present in beer prolongs the process of fermentation, giving it an unusual taste - soft and full. Three new varieties of beer were developed by the technologists: “Vyshcha proba”, “Elitne” and “Ternove pole”. Thanks to the efforts of the employees, these elite beers have received great appraisals from beer brewers and real connoisseurs of high quality produce.

The enterprise has a wide network of dealers, which are distributed throughout Ukraine. Dealers have appropriate discounts depending on their volume of sales. Accordingly, there are three categories of prices for each of them. Each month, an implementation plan is developed which specifies how much the dealer has to sell the producer's products for during this period. So, with constant implementation of the plan, achieving a certain amount of sales means that dealers get discounts on goods, which usually stimulates them to lower their prices.

Implementation of its products through the multichannel marketing system provides an opportunity to cover different markets more thoroughly. The company sells a few products through branded bars and restaurants, some through a network of dealers who work with retailers in a large part of Ukraine and some through the wholesale bases at the manufacturer.

When forming distribution channels, the company tries to avoid a large number of wholesale intermediaries, which is why they use zero, one-level (mainly in the Ternopil region), two-level (on the rest of Ukraine) channels of intermediaries.

There are four branded bars in the Ternopil region, located in Ternopil, Gusyatin, Mykulyntsi, Terebovlya. Also, sales of products are carried out through their own wholesale bases. There are four such bases in the region, namely: in Ternopil, Borshchiv, Berezhany, Shumsk, and one in Ivano-Frankivsk. Ternopil base is the largest producer of products. On the rest of the territory, sales are made through a network of dealers. In general, Ternopil region consumes 67% of products.

The enterprise constantly monitors the status of distribution channels. It has information on the number of levels of channels and the specific composition of its participants. This information allows us to estimate the speed, time, traffic efficiency and integrity of goods when delivered from the manufacturer to the end consumer. This is done all through the marketing service, which implements the full range of sales management functions of the enterprise.

The plant's products are unique, not pasteurized beer. That is why the demand for this beer is very large and continues to grow. Demand is high even during the period of economic crisis and therefore the cost of advertising is relatively low. The development of new types of labels, brochures and posters is focused on the quality of the product. There is little advertisement on local radio stations and television.

Advertising support for those who sell beer, namely dealers, plays a very important role in selling beer on the market. Shelf bows, glasses, stands under the glasses, equipment for cooling and bottling beer, refrigerated show-windows – all this is advertising in the trade.

The Company is constantly allowing tours of their facilities so that the consumer can see for themselves how the beer is made and that it is truly a natural, not pasteurized product, made using modern equipment. After this, beer tastings are conducted, consumers get acquainted with beer varieties and the workers of "Mykulynetskyi Brovar" LLC speak about the properties of their beer.

Conclusion

Therefore, key success factors define areas where the company needs to achieve better efficiency, and needed skills and resources. The analysis of the success factors of the enterprise is analysis of the internal environment which allows us to identify the internal features of the company.

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Preparation of Ideas for a Social Project: Methods and Practice of Process Management

Tetiana Kulinich¹, Olha Perminova²

1. Management of Organisations Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: tetiana.v.kulinich@lpnu.ua

2. Management of Organisations Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: perminovaolha@gmail.com

Abstract – *This article studies the various ways of observation and analyzing during the process of creating social action projects for youth. It contains different methods and practical approaches to creating productive and effective ideas for the social projects. The key problems of some unsuccessful social action projects are identified and opened in this work.*

Keywords – social projects, process management, effective idea, selection criteria, brainstorm.

Introduction

Nowadays many companies (corporations) are charity involved, but really most of them are just investing part of their income on social action projects that can help them to recommend themselves to make society trust their goods or services. From the side of social action projects' ideas creators it's important to invent well-themed projects, in order to be suitable for the needs of company.

Moreover, most of the social action projects are not popular at the beginning and need to be developed in response to needs of community to become interesting for participation. As every project starts with an idea, it's better to analyze and to optimize the management of brainstorm process with a task of choose of such successful project which will be needed for citizens and will touch their personal needs.

All of the above emphasizes the importance of a thoughtful organization of process of developing ideas for social design using modern methods for training of responsible managers and participants in such projects.

Main part of research

Analyzing the main difference in social action project with other activities, we can make a definition, that social action projects are carried out by individuals or groups of people working together for the good of others and not for profit. The objective of the project is to bring about social change that will benefit an individual, communities or society [1-3]. Here comes the first mistake of the most managers that could not correctly differentiate and define the meaning and the main idea of this social action project.

If manager understands in a right way this goal of social projects, then the next stage is creating an idea with a method of brainstorm. During this stage there are two ways for a project manager: to create an idea by himself and then to create a team with like-minded people or to brainstorm with already united team [2, 4]. In a clue of our observation, the most productive ideas were made in already grouped team of the people that manager trust the most. Otherwise, there are still some remarkable social projects that were originally made by one project manager.

During observation of the key stages of successful project creating, the most common problem was also detected. On the stage of choosing the right idea this idea should be suitable for the way of thinking of the project managers, otherwise that will be quiet a deceleration, which brakes of creating a successful social action project. It happens because of the

unawareness of managers how to organize the brainstorming process and to make ideas work as a successful social action project.

While the brainstorm, manager can guide his group for not only generating new ideas, but also to improve them due to the needs of society. Before brainstorm most of leaders don't take into account the importance of organizing and controlling of ideas producing process. If manager wants to have a remarkable result, it's needed to provide rules to prevent debates and aggressive mood inside of a team [4, 5]. It could be finger rules, to prevent arguing, or individual meeting with each participant from the team.

As to the other stage, it goes when the team or project manager by himself need to choose one idea that would be successful by the early prediction due to answering on next questions that are called "criteria of the successful ideas" [4]:

1. Whom this project can interest? (Age, sex, sphere of interests)
2. Why do people should be involved into this project?
3. Which global issues does it affects?
4. Which personal issues does it affects?
5. What is it purpose?
6. How relevant is this project (from 1-5: 1 – not relevant at all, 5 – should be implemented as soon as possible)?
7. How difficult it will be to implement this project?

During our research, it was noticed that this questions help not only to see the success of the idea that was chosen but it also how is it possible to make it in that right moment.

Conclusion

The success of the ideas of a social action projects depends on the skills that manager has and how he can use his power of influencing on another people to achieve the common goals. As a matter of fact, the social action project area is more or less competitive for most of project managers if they don't have constant financial support. Due to our research, social projects should help people to understand worldwide problems by accepting them personally, and as a result it should become the main goal of every social project manager – to make people understand global problems and to push them to act for making a better life for themselves. This may help with area-orientation of social projects and understanding the stages of idea-creating process, which, inevitably, will guide their projects to good competitive position in the project management sphere.

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Theoretical Approach to the Banking Crisis Management Model

Irina Lashchyk¹, Lidiya Bondarenko²

1. Department of Finance, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera street 12,
E-mail: lashchykxxx@ukr.net

2. Department of Finance, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera street 12,
E-mail: bondarenko.lida.p@gmail.com

One of the main problem in the field of crisis management, which has developed to date, is the lack of a unified approach of scientists to its essence, functions and tasks. As a result this problem raises disagreements in the authors' approaches to the crisis management process, number of its stages and the sequence of their implementation. First of all, it concerns the sphere of banking services. Consequently, the aim is to clarify the essence of the "crisis management" concept, as well as to build a model for its implementation, adapted to the Ukrainian banks activities.

Key words – crisis, crisis management, essence, model.

I. Introduction

In recent years not only in Ukraine, but also in many European countries, crisis phenomena have been increasingly observed, especially in the banking sector. Most often such crisis phenomena have negative consequences and reflected not only on the efficiency of the bank itself, but also cause massive population insolvency and economic imbalance of the country as a whole. Since crisis phenomena are mostly local in nature, so at first they arise at the level of the separate functioning of the banking institution. So here the crisis management should act in order to prevent crisis further development. This confirm us in a need to study problems of development and improvement of banking crisis management in Ukraine.

II. The main research matherial

The problem of the banking crisis management is not the first year in the center of scientific research of domestic and foreign scholars. Analyzing scholars work we can see two main approaches to its interpretation for today. Representatives of the first approach argue that the banking crisis management is a combination of tools and methods that should take effect only in the case of the bank crisis and aim to prevent start of a bankruptcy case and bank liquidation.

According to the second approach representatives, the banking crisis management is a set of preventive measures that must be implemented before the crisis in order to avoid it, maintaining the financial stability of the bank, stability and competitive positions in the market.

In our view, banking crisis management is an integral part of the overall management system, which should be carried out continuously, and the nature of the measures has to be determined by the type, depth and severity of the crisis.

To sum up, we recommend that the banking crisis management model should include sixteen successive interconnected steps, which have to take into account the features and conditions of Ukrainian banks activities (fig 1).

Conclusion

In conclusion, banking crisis management list of stages is not exhaustive, as it can change depending on the specific conditions of the bank activities, its type and the current situation. However, adherence to our proposed list and the sequence of the crisis management stages will make this process uninterrupted and, consequently, more effective.

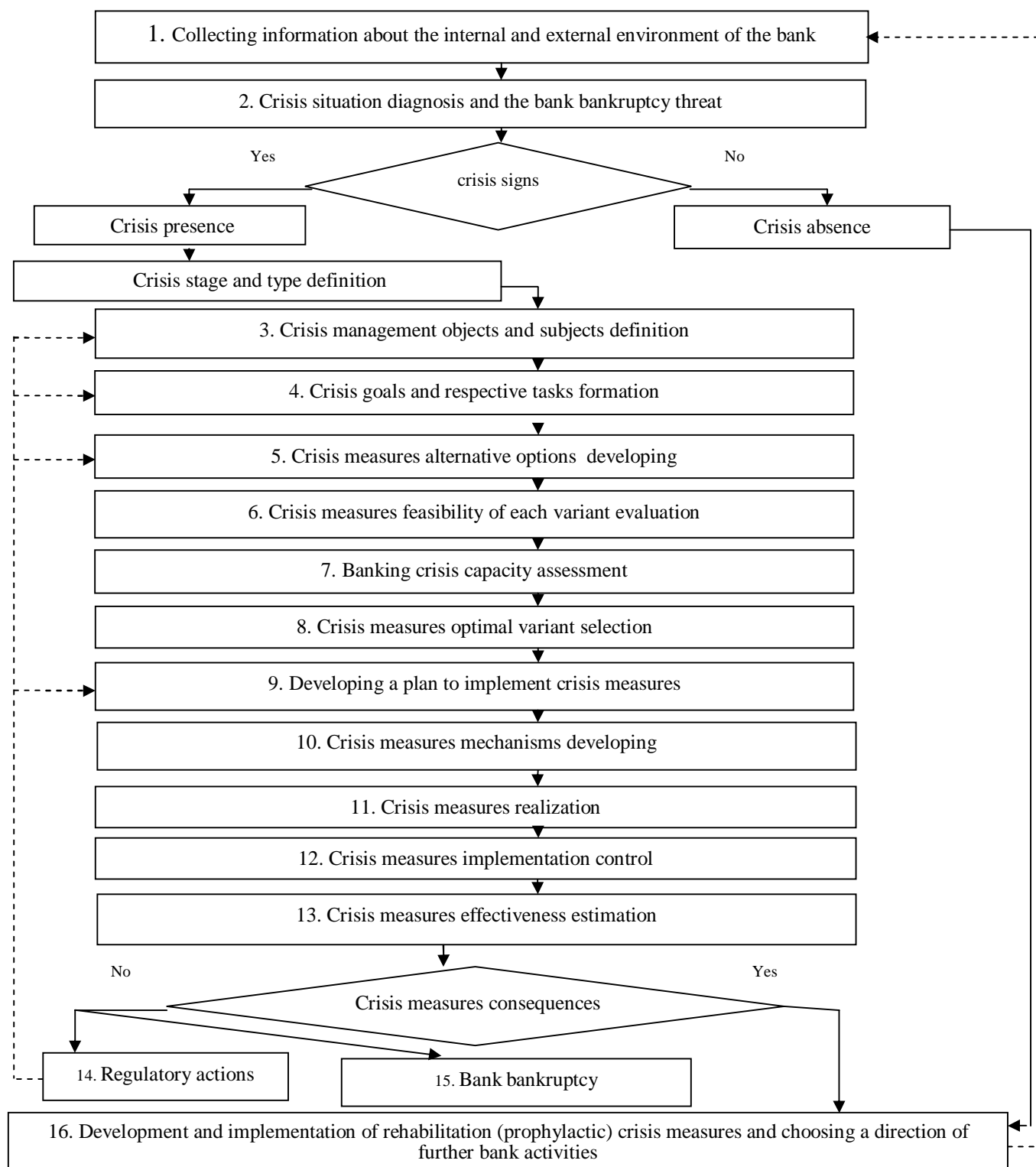


Fig. 1 - Graphic interpretation of the banking crisis management model

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Foreign Customs Experience as a Basis for Reforming Ukrainian Customs System in Terms of European Integration¹

Olha Melnyk¹, Marta Adamiv², Andrii Todoshchuk³

1. Foreign Economic and Customs Activity Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: olia_melnyk@ukr.net

2. Foreign Economic and Customs Activity Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: marta_adamiv@i.ua

3. Foreign Economic and Customs Activity Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: a.todoshchuk@gmail.com

Abstract – The article analyzes the foreign customs experience in the context of the organizational construction of customs authorities and key trends of development of national customs systems. On the basis of received results the key problems of Ukrainian customs system have been identified.

Keywords – customs, customs system, customs authorities, customs experience, European integration.

Introduction

In the conditions of strengthening the role of globalization and integration processes in the global space and thus transforming state borders into conditional boundaries, deepening of international economic cooperation and intensification of foreign economic activity, and at the same time the growth of external threats and dangers of military-political character, increasing the level of smuggling and fraud, customs authorities play an important role in the system of public authorities of any country. Realizing such tendencies, many developed European countries have managed to build highly progressive national customs systems. In developed European countries, the customs is one of the key authorities aimed at protecting the state and its citizens from prohibited dangerous and poor-quality goods, raising the level of national security (including economic security), and the intensification of legal international trade. Unfortunately, today we are compelled to state the fact that the national customs system is in the stage of stagnation. This situation is caused by a number of internal and external problems, both objective and subjective, which must be adequately resolved in order to preserve the territorial integrity of the state, ensure an adequate level of national security, protect society and, at the same time, provide the harmonious Ukraine's accession to the European Union.

Main part of research

According to the World Customs Organization (WCO) research [1], there are no generally accepted terminologies and definitions regarding customs organizations. Customs organizations differ in different countries in many details, and have been often modified reflecting changes in their priorities. Thus, the WCO identified five categories, considering the relationship between customs and tax administrations [1]: Customs Department; Revenue Department; Revenue Authority; Customs Agency; and Border Agency.

According to the last WCO research [2], in 2017-2018, the prevailing share (36.8%) of customs administrations in the world were organized in the form of departments of ministries; 31.9% - as customs organizations; 29.7% - tax authorities; and only 1.6% - border protection services. As we can see, the dominant tendency towards the organization of the work of customs

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authorities is the functioning of customs authorities as separate independent bodies that are concentrated on customs functions (68.7%).

In the conditions of unification of customs and taxation spheres into a single authority, Ukrainian customs system gradually declined, there was a leveling of the customs component and the priority of the fiscal function; most of the customs decisions were taken on the principles of "political convenience", which led to the suspension of the development of state customs. Thus, the key problem is the absence of a separate authority that would be positioned as an independent body exclusively for the customs profile and ensured an efficient, coordinated, and goal-oriented management of the national customs activity at different levels. It is about a lack of a qualitative organizational structure of customs authorities that reflects clear vertical and horizontal links, determines optimal functional load and clear responsibility at different levels. Today, we can talk about the decentralization of customs management and the lack of an institutional level of management in the customs sphere, which prevents making the effective, targeted decisions on customs-specific functions related to the promotion of legitimate international trade and protection of the state and its citizens. Another major problem is the hypertrophied fiscal function of the customs, which is not essential for any customs administration in Europe. Although, in fact, it is a derivative of other customs functions - protection of the domestic market, the application of legislation regulating foreign economic operations, the organization of the safe movement of goods.

Conclusion

On the basis of the study of foreign customs experience, it is possible to distinguish key modern trends in the customs sphere:

- contributing to the activation of international trade, especially in the territory of the European Union by simplifying customs procedures, reducing the time that business entities spend for customs formalities, absolute automation of customs procedures;
- expanding the role of customs authorities at the border in the context of strengthening national security, protection of society from dangerous and harmful goods, improve the security of the international supply chain;
- increasing the complexity and volume of functional loading of the customs authorities in the conditions of globalization and integration processes, as well as under the influence of external threats and hazards;
- shift of accents in the work of customs authorities to ensure compliance with European and international customs standards and rules;
- strengthening the interaction of customs authorities with other national and international authorities in the context of improving the efficiency of customs systems, etc.

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Anticrisis Management Goals

Tetiana Patsai¹, Iryna Kondrat²

1. Institute of Economic and Management, Lviv Polytechnic National University, UKRAINE, Lviv,
Mytropolyta Andreja street 5, E-mail: tpacaj2301@gmail.com

2. Institute of Economic and Management, Lviv Polytechnic National University, UKRAINE, Lviv,
Mytropolyta Andreja street 5, E-mail: iryna.y.kondrat@lpnu.ua

Abstract – The article explores anticrisis management as a way of overcoming the company's crisis during unstable economic conditions. The essence of "anticrisis management" has been defined along with the main anticrisis management goals. Also the necessity of its implementation into company has been proven.

Keywords – anticrisis management, crisis, loss-making enterprises, anti-crisis management goals, bankruptcy.

Introduction

The emergence of crisis situations is characteristic of all stages of the enterprise life cycle. Therefore, in the conditions of the Ukrainian economy transformation, the process of developing and using effective methods and forms of crisis management of the enterprise is relevant.

The financial condition of most Ukrainian enterprises in modern economic conditions

The financial position of most Ukrainian enterprises in modern economic conditions is diagnosed as a crisis.

The actual results of most domestic enterprises, with the exception of small and budgetary institutions, are far from desirable, as shown by the dynamics of the share of loss-making enterprises in Ukraine.

Table 1

Financial results of large and medium-sized enterprises during 2014 -18 years [1]

Year	Financial result (balance)	Profitable enterprises		Loss-making enterprises	
		In % of the total number of enterprises	Financial result	In % of the total number of enterprises	Financial result
2014	-523587,0	66,3	334517,3	33,7	858104,3
2015	-340126,6	73,7	475321,2	26,3	815447,8
2016	-22201,5	73,4	523759,4	26,6	545960,9
2017	287848,5	72,8	673891,1	27,2	386042,6
1/2018 - 6/2018	189780,8	71,7	289737,0	28,3	99956,2

The main causes of the enterprise's insolvency can be defined as the following: an unstable socio-political situation; the development of inflationary processes (the inflation index in Ukraine in 2015 was the largest and amounted to 143.3%, while in 2014 – 124.9%, and in 2016-2017 – 112.4% and 113.7% respectively) [1]; a significant increase in the gas and gasoline price, which provoked an increase in the production cost; the instability of the financial and currency markets; significant depreciation of the national currency; unprofessional management.

The essence of anticrisis management

In accordance with the above, the problem of the anticrisis management essence, as well as the development and implementation of its effective mechanism can be considered as an actual one. In modern conditions there are quite different approaches to the definition of the anticrisis management enterprise essence. By analyzing the existing approaches described in the writings of domestic and foreign scientists, it can be concluded that the overwhelming majority of author's views agree that anticrisis management is a function of management that ensures that crisis situations are avoided, reducing or eliminating the consequences of the financial crisis in an enterprise, ensuring an adequate level of solvency .

The main anticrisis management goals

The main aim of anticrisis management is the rapid financial solvency renovation and restoration of sufficient financial stability of the company in order to prevent its bankruptcy. Taking into account this goal, the company develops a special anticrisis management policy at the threat of bankruptcy, which includes:

- constant monitoring of the enterprise financial condition;
- determining the scale of the enterprise's crisis situation;
- identification of the main factors that determined the crisis situation of the enterprise;
- the formation of goals and the choice of the main mechanisms for managing the financial capital of an enterprise in the event of a threat of bankruptcy, taking into account the scale of the crisis situation and the forecast of the development of the main factors determining the threat of bankruptcy;
- introduction of internal mechanisms of enterprise financial stabilization and control over the timeliness and effectiveness of the implemented measures;
- financial support of liquidation procedures in the event of enterprise bankruptcy.

Conclusion

Consequently, anticrisis management should be carried out on a permanent basis for the effective operation of the enterprise. The practice of conducting anticrisis management at the level of domestic enterprises is not perfect, but its implementation is a prerequisite for the development of business entities. Therefore, the development and implementation of an effective anticrisis management mechanism will enable enterprises to respond flexibly to changes, to interfere actively with the course of production processes, and help to reduce the impact of financial risks. All this will provide the opportunity to create an effective management system with competent executives and high level specialists, which will ensure a continuous and systematic process of enterprise development.

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The Impact of FinTech on the Development of Traditional Banking

Nazar Strypa¹, Iryna Kondrat²

1. Institute of Economic and Management, Lviv Polytechnic National University, UKRAINE, Lviv,
Mytropolyta Andreja street 5, E-mail: strypanazar096@gmail.com

2. Institute of Economic and Management, Lviv Polytechnic National University, UKRAINE, Lviv,
Mytropolyta Andreja street 5, E-mail: iryna.y.kondrat@lpnu.ua

Abstract – The article explores the essence of financial technologies and their role in the development of the financial sector. The FinTech classification and the analysis of FinTech-services is presented. The advantages and disadvantages of using FinTech in comparison with traditional banking services are analyzed. New strategic priorities of banking institutions based on financial technologies are proposed.

Keywords – financial technologies, FinTech, innovations, bank, traditional banking.

Introduction

The sector of financial (in particular, banking) services today is under the significant influence of the "digital revolution", which is associated with the development of so-called financial technologies. Most experts believe that those financial technologies that have recently emerged in banking create an atmosphere of uncertainty in financial markets, as they are already beginning to change the paradigm of traditional intermediary services, making them unnecessary. Therefore, the research of the latest financial technologies, as well as the opportunities and threats they create for classical banking, is becoming extremely urgent.

The essence of FinTech

Within the limits of our research it is necessary first of all to define the terminological content of the concept of "financial technologies". According to domestic and foreign scholars, Financial Technologies, or FinTech – is an industry of companies that combine banking expertise with modern management practices to improve the efficiency of financial systems and thus compete with traditional financial institutions represented by banks and intermediaries in the financial services market [1, p.52].

An analysis of the historical and technological evolution of the FinTech concept has been made, which makes it possible to state that it has unfolded in three stages [5, p.264]

- The first stage (FinTech 1.0) lasted from the laying of a trans-Atlantic telegraph cable to the development of the global telex network; it covered long-term interactions between technology and finance (lasted until 1987).
- The second stage, FinTech 2.0, includes the global financial pre-crisis period, due to the digitization of traditional financial services, from the first ATM to Internet banking (continued during 1987-2008).
- The third stage (FinTech 3.0) began after 2008, when the post-crisis regulation and balance problems of financial institutions pushed for the emergence of numerous start-ups that offered effective solutions beyond the limits of traditional concept.

Advantages of FinTech

In the FinTech 3.0 era companies provide services that are directly related to traditional banking services. The range of services provided by FinTech companies is given in Table 1.

As we see, the range of services offered by FinTech companies is quite wide and is not limited only to intermediary or credit and deposit services. In addition, FinTech companies have some other advantages over banks due to [2, p.797]:

- minimal dependence on regulators and the lack of need for strict territorial affiliation; to open FinTech business you do not need to buy a server and build a large infrastructure of offices;
- the convenience of using Internet-based services for clients that can not be provided by traditional financial consultants who work under the usual "9 to 6" schedule;
- loyal requirements for the entry of new participants who were not previously members of the banking system and do not have a bank account (38% of them live in only three Asian countries, such as India, Indonesia and China).
-

Table 1

Areas of activity of modern FinTech companies and the range of offered services

Activity direction	Types of services
Credit, deposit and capital increase services	Kraudfounding, P2P lending (without financial institutions), neobank (online bank), alternative credit scoring, investment platforms, on-line betting
Payment, clearing and settlement services	Mobile purses, digital platforms of currency exchange, wholesale trade in foreign currency, B2B-finance, cryptocurrency
Asset management services	Social trade, robots-counselors, e-commerce, mobile and desktop software for personal finance management, auto insurance with the use of telematics, RegTech, InsureTech
Services to support the market	Ecosystem (infrastructure, open source, APIs), Big Data analysis, blockchain, cloud programming, IoT, Artificial intelligence

Source: formed by the author using [2, p.795-796] and [4, p.102]

The impact on the economy

Due to the wide range of services and the above-mentioned advantages, the so-called "FinTech revolution" over time can destroy about half of the banking institutions in the world. According to PwC, more than 77% of respondents believe that technology development will change the requirements to banks by 2021, and by 2025-2030 the world will exist completely without banks in the traditional sense. And according to estimates of the largest American Citibank, the further growth of FinTech-startups will lead to the fact that by the year 2025, 30% of banking employees (1.7 million) of the world banking system will lose their jobs [3]. This confirms their potentially large impact on the functioning of the financial system, which requires a more detailed analysis of the impact of FinTech-innovations on the economy. Such an analysis is given in Table 2.

Along with the advantages, FinTech-innovations can potentially lead to a negative systemic impact on the financial system and the provision of critical financial services. Among the risks of too wide use of FinTech services, one can distinguish: liquidity risk (due to lack of secured loans), cyber risk of hacking, legal / regulatory risk, risk of excess volatility, risk of re-lending to the economy, systemic risk, and others.

FinTech in Ukraine

As for the Ukrainian FinTech market, it is, in general, at an early stage of development: focused only on digital payments. Therefore, it does not face any of these risks today. Its main investors are banks that are currently not inclined to increase the cost of improving their technology.

Table 2

Influence of FinTech-innovations on the macro level

Potential benefits	Specific impact on the economy
Decentralization and diversification	<ol style="list-style-type: none"> 1. Big data analysis and automation of loans reduces barriers to entry the market. 2. Robo-consulting introduces new players to the asset management sector.
Efficiency	<ol style="list-style-type: none"> 1. Robo-consulting can improve the business model of existing financial institutions. 2. Machine learning and artificial intelligence can help to improve decision-making processes. 3. Using credit scoring algorithms allows platforms to work at relatively low cost. 4. FinTech lending can reduce the cost of finding a customer.
Transparency	<ol style="list-style-type: none"> 1. Reducing the asymmetry of information on the financial services market. 2. Credit FinTech and Crowdfunding can combine households and businesses.
Access to financial services and convenience	<ol style="list-style-type: none"> 1. Neobank allows consumers to quickly and efficiently receive credit services and make purchases. 2. Digital identity and TDR-based applications can support improved quality and availability of financial services.

Source: formed by the author using [4, p.103] and [5, p.265]

Banks traditionally dictate the rules and force the consumer to follow them, while the new FinTech companies have the readiness and ability to recognize the needs of consumers of financial services and try to meet them. In order to survive, traditional financial institutions, in our opinion, will need to constantly digitize their own services, widely use mobile applications, as well as cloud technologies. In essence, the natural step in this situation is the interaction with FinTech to form a competitive advantage in quality of the offered services and a spectrum of services. According to G.M. Pochenchuk, traditional banks should be fully united with FinTech-companies, having created a qualitatively new financial ecosystem [1, p.54]

Conclusion

Financial technologies today form a new branch of the economy, combining the banking experience with modern management methods. The development of the FinTech market took place gradually and has now become impressive. This was largely due to the wide range of innovative services offered by FinTech companies, while banking institutions remain relatively conservative. This, in turn, can have a significant impact on the economy: diversification of the financial services market will take place, its efficiency and transparency will improve, and traditional banks will eventually cease to exist. Therefore, banks are invited to widely apply new

financial technologies and, possibly, even to combine with certain FinTech companies, so as not to lose their positions in the market.

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Implementing Digital Tax Administration in Ukraine

Nataliya Synyutka¹, Oksana Kurylo², Lidiya Bondarenko³

1. Finance Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: synutka@gmail.com

2. Finance Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: synutka@gmail.com

3. Finance Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: bondarenko@gmail.com

Abstract – The article analyzes global experience and trends of digital tax procedures. Digitalization creates an innovative and progressive design of fiscal space around the world, enhances the administrative efficiency of public services. The first digital steps in taxation of Ukraine are determined.

Keywords – taxation, digital technologies, revenue authorities, fiscal policy, electronic taxpayer office, electronic administration of VAT.

I. Introduction

Fiscal policy has a significant impact on the whole world. The digital revolution holds vast potential to improve fiscal policy. Governments and revenue authorities now have access to better data. Digital technologies can also provide tax compliance, reduce tax collection costs, and increase administrative efficiency of public services. Realizing such tendencies, many countries are already finding that it costs less to collect taxes, administer social programs, and manage public finances. Fiscal space changes promptly in the direction of transparency and simplification. This has opened new policy options, including a more innovative and progressive design of tax compliance and revenue authorities for Ukraine too.

II. Main part of research

Computerization and digitalization – the use of computers to perform human tasks—has become as familiar and routine in revenue authorities as anywhere else. Digitalization has also increased the possibilities for data collection and storage. In 2000 only 25 percent of data were stored digitally; by 2007 this metric had risen to 94 percent [1]. Through digitalization, governments and tax offices can potentially conduct current fiscal policy more effectively.

Tax authorities are gaining access to the huge amount of information from the private sector (for example, data on bank transactions) through the digital systems, standardized reporting formats, and electronic interfaces. Systems for sharing information have also improved. New norms in global tax transparency have led to the development of a global reporting standard on automatic exchange of information on the financial records of nonresidents with the tax authorities in their country of residence.

Governments and revenue authorities collect more timely information. Electronic filing of tax returns has reduced the cost of compliance for taxpayers and of administration for the government. Many countries began experimenting with electronic filing of tax returns. In the United Kingdom, HM Revenue and Customs' connect computer draws on information from a wide range of sources to create a profile of each taxpayer's total income. Such analytical capability could even be used to assess the behavioral impact of new tax and spending policies.

Digital systems present new roles for consumers and third parties in facilitating enhanced compliance. Estonia, for instance, uses the platform technology to connect Uber drivers directly with the tax office, adding income from rides directly to their tax return [1]. Offering a role for consumers as auditors, Brazil using a special digital payments system, which designed to

encourage better enforcement of the VAT at the final consumer stage by providing monthly lottery prizes to consumers who ask for receipts [1].

Implementing digital tax administration in Ukraine, a process that has only just begun. The most important digital project in domestic taxation is Electronic taxpayer office (ETO), which was started in February of 2014 [2]. It offers such instruments for taxpayers as online submission of tax returns, tax payment service, collection information about taxpayers, automatic tax calculation, interaction between tax authorities and taxpayer. The benefits of this service are that it operates round the clock and free of charge with using of personal computers, smart devices, and electronic digital signature. Online submission of returns is gradually becoming the norm for Ukrainian taxpayers.

Ukrainian cities of the TOP-10 consumers of the Electronic taxpayer office are Kharkiv, Dnipro, Lviv, Odesa, Kyiv, Poltava, Vinnytsia, Mikolayiv, Cherkasy. In general, the geography of users covers more than 70 countries and includes the United States, Italy and Germany.

With data being collected in more standardized formats, increased processing capabilities have allowed tax authorities to assess taxpayer risks by analyzing large data sets and by combining different sources of data (for example, firm-level input and output data for VAT purposes). Massive cross-checking of value-added tax (VAT) invoices (to verify that sellers have been charged the tax for which they seek a credit) was presumed to be technically impossible. Now Ukraine is showing that it can be done. The System of electronic administration of value-added tax provides for the automatic registration of taxpayers, tax invoices, cargo customs invoices and automatic calculation of VAT amounts.

Digitalization may provide the revenue authorities with more information on total individual consumption expenditures, for example, due to greater use of digital payment methods. Indeed, in the future all consumption transactions may eventually become electronic and cash may be abolished. It could essentially expand a tax base. For this purposes the State Fiscal Service of Ukraine started up new electronic service E-Receipt in 2017. The SFS has seen the rollout of online cash registers that record information on each transaction, which is then transferred daily to a server where tax authorities can access and analyze it.

Conclusion

Digitalizing government payments and tax procedures is not a simple task for fiscal bodies worldwide. Digitalization is concerned with the challenges, but also the opportunities. It can create new kind of risks. Digitalization of products and services shortens distance between tax authorities and taxpayers in a fiscal space.

Electronic taxpayer office, E-Receipt, electronic administration of VAT are only the first digital steps in taxation of Ukraine. Purchasing and implementing new payment systems is a significant undertaking in cost and time. For expanding the tax base and growing paid taxes, revenue authorities should gather and analyze information about transactions suspected of involving money laundering, cash consumer transactions.

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The Management of the Potential of the Economic System

Iryna Yaremko¹, Veronika Karkovska²,

1. Administrative and Financial Management Department, Lviv Polytechnic National University, UKRAINE, Lviv,
S. Bandery street 12, E-mail: yaremko.i@i.ua

2. Administrative and Financial Management Department, Lviv Polytechnic National University, UKRAINE, Lviv,
S. Bandery street 12, E-mail: Veronika.Y.Karkovska@lpnu.ua

Abstract – The study is contextually related to the economic growth and competitiveness of economic systems. The dependence of the productive force of aggregate potential on the conditions of the external (global, national) socio-economic environment is revealed. The emphasis is on the need for more valid factors and the role of social environment influence on the potential of a separate economic system, which is disclosed as a complex economic phenomenon and is illustrated by examples of potential losses by individual countries, known corporations.

Keywords – economic system, potential, management, global socio-economic, financial potential.

Introduction

In the current global socio-economic environment, future (expected) productively-technological, financial and economic opportunities (potential) are the determining category, which is associated with the investment attractiveness and competitiveness of any national economy, the basic possibilities for the effective functioning of this economy in a socially – production systems of different levels. Scientists generally agree that “the economic potential of the country is obviously the most important indicator of the direct development of the country and the standard of living” [1, p.46], and, at the same time, is identified with the notions of “competitiveness of the country, national economy”. It gives reasons for “the process of reproduction of innovation and investment potential is a complex and important determinant of economic development” [2, p. 12].

Analytical reviews of the state of national economies in different countries, the practice of international transnational companies, domestic economic subjects, primarily public companies, confirm the importance of creating long-term (potential) competitive advantages: “Institutionalization is the only precondition for the transformation of economic resources into capital. Insufficiently institutionalized economy is characterized by a low level of mobility of resources, which makes it impossible to integrate them in the form of social capital” [3, p. 100]. The importance or even the determination of the potential, its objective structuring and effective (rational) implementation to ensure the declared socio-economic development of Ukraine and the innovative type of development of the national economy are expressed in the writings of leading Ukrainian scientists.

Page Setup

In today's economy, the criterion of the efficiency of the economic system is not only its profitability, but a number of other indicators (market value of equity, capitalization of assets, etc.). Such a change in morality in recent studies is considered the basis of potentiality and is carried out through potentiation or making it possible. The concept of “modality” is used when considering the potential of economic systems – the effect of the modal cycle of the economic system. Universalization and alternatives set two main axes of the functioning of the economic system: the state of objects (potential components) and the relation of subjects (Fig.1.).

The management mechanism of the potential economic system should be considered as an

integrated system of methods, tools and information and analytical tools that help to optimize the structural elements of the potential and aim at maximizing the efficiency of its implementation. Successful functioning and development of the modern economic system is determined by the effectiveness of the interaction of all elements of its potential. From that point of view it is believed that the methodological basis for the study of modern economic formations is a systematic approach.

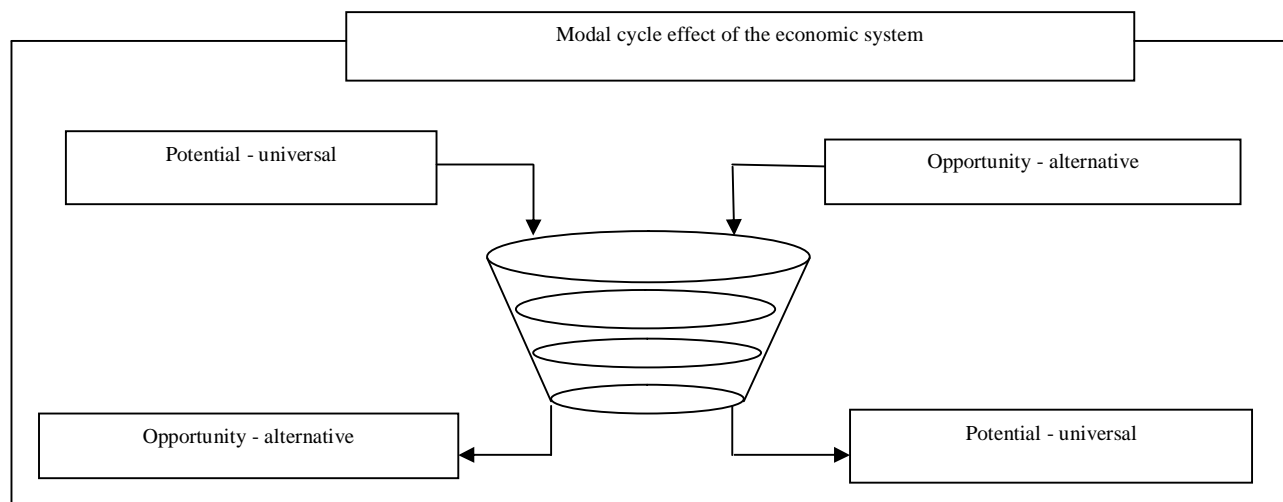


Fig.1. The modal cycle effect of the economic system

General, adaptive to the conditions of the domestic economy scheme of the mechanism for managing the potential of socio-economic systems is the following.

On the basis of the systematic approach, the conceptual foundations for the construction of the organizational and economic mechanism for managing the potential of socio-economic systems are formulated, which suggest that such a tool acts as a self-regulating system of elements and components of potential as management objects. Within this mechanism there is a purposeful transformation of the elements of the potential in order to achieve maximization of its productive energy; the initial response of the mechanism's efficiency is estimated by the results of the functioning of the controlled system. The study revealed that the fundamental principles of the organizational and economic mechanism for managing the potential of economic systems, borrowed from developed economies, do not sufficiently take into account features or inadequate domestic transformational economies.

The study revealed that the fundamental principles of the organizational and economic mechanism for managing the potential of economic systems, borrowed from developed economies, do not sufficiently take into account features or inadequate domestic transformational economies. The complex analysis of world economic practice of realization of the potential, system of methods, means and informational-analytical tools is carried out with the help of which structural elements of the potential are optimized and directed to maximize the efficiency of its implementation. The comparative analysis of the possibilities of their direct application in the national practice is given, certain aspects of their ineffectiveness and ways of implementation in the management of the potential of the social and production systems of the national economy are disclosed.

The predominance of situational fundamentals in the implementation of managerial approaches in managing the potential of domestic social and production systems against the background of financial and investment expansion of foreign capital, the pressure of global

economic actors and emerging market institutions has been noted.

The supplements to the existing conceptual bases of potential management are proposed and the general structural and logical scheme of the adaptive mechanism of management of the potential of domestic social and production systems is formulated.

The proposed format of the management model embodies a set of organizational and economic fundamentals of reproduction of the potential socio-economic systems. At the same time, the organizational component ensures the efficiency of the economy based on the disclosure of functions related to the process of increasing its productive energy provided by the financial potential.

Conclusion

The generalization of the conceptual foundations of the theory of potential allows us to formulate a modern definition of the potential, which, taking into account the results of recent domestic and foreign developments in the subject field, will form an in-depth conceptual-categorical apparatus of the potential of modern economic systems.

The study of world experience in evaluating and managing potential and the possibilities of its implementation to the peculiarities of the national economy will determine the main directions of its adaptation, in particular, by expanding the tools of management of the intangible component of the potential of competitive advantages, increasing the importance of the integral indicator of natural potential, indexes of social significance of the use of potential by economic entities.

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Public-Private Partnership Projects Implementation

Iryna Yaskova¹, Iryna Kondrat²

1. Institute of Economic and Management, Lviv Polytechnic National University, UKRAINE, Lviv, Mytropolyta Andreja street 5, E-mail: ira.jaskova96@gmail.com

2. Institute of Economic and Management, Lviv Polytechnic National University, UKRAINE, Lviv, Mytropolyta Andreja street 5, E-mail: iryna.y.kondrat@lpnu.ua

Abstract – The world experience in implementing projects on the basis of public-private partnership has been analyzed and its benefits and advantages have been identified. The forms and spheres of the implemented projects in Ukraine are determined. A comparative evaluation of one of the projects on attracting a private partner and without its involvement in the mechanism of public-private partnership was conducted and the effectiveness of establishing partnerships was proved.

Key words – public-private partnership, public sector, private sector (business), public sector, concession, joint activities.

Introduction

In today's conditions, for a successful socio-economic development of regions and the state as a whole, the economy needs co-ordinated cooperation in various spheres between the public and private sectors.

Mechanism for development and attraction of funds of public-private partnership

The partnership between the state and business has become widespread in Canada, the USA, Mexico, Brazil, Australia, Asia, and especially China, India, Japan, Turkey, Israel and Jordan, the most developed public-private partnerships in the United Kingdom, Italy, France, Germany, Australia, Scotland, the Netherlands, Spain.

The countries of Eastern Europe (Bulgaria, Romania, Poland, Croatia, Czech Republic, Hungary) are actively initiating and implementing projects on the basis of RFP. In 2014, in the EU, 18.7 billion euros were invested in PPP projects (in 2013 – 16.3 billion). For example, Turkey has tripled its GDP over 10 years, and not least this is due to the use of PPP mechanisms in the country. The country attracted \$ 115 billion in investments in 193 PPP projects. The main sectors of investment were energy (76 projects), roads and road infrastructure (29 projects), ports and port infrastructure (21 projects), airports (19 projects) and health (17 projects). Today, more than 50 airports (including 21 international ones) operate in Turkey, and private investment in the industry is 90%. The main spheres of application of PPPs in foreign countries are infrastructure facilities, administrative services, education, medicine, information and communication technologies, energy, transport, water supply and sewage

In 2017, in Ukraine, on the basis of public-private partnership, 192 projects were implemented (160 concession agreements, 32 joint activity agreements and 1 public-private partnership agreement).

Another common form of partnership between the public and private sectors is public-private companies. Participation of the private sector in the capital of a state-owned enterprise may involve corporatization and the creation of joint ventures. The degree of freedom of the private sector in the adoption of administrative and economic decisions is determined in this case, its share in equity capital. The smaller the proportion of private investors compared to the state, the more narrow the range of independent decisions they can take without state intervention [1]. In 2016, on the basis of public-private partnership, 186 projects were implemented, of which 153 concession agreements, 32 joint venture agreements and 1 public-private partnership contract were concluded (Table 1) [2].

Table 1

Forms of implemented projects on the basis of PPP in Ukraine in 2017

Region	Concession	Joint activity	PPP	Total
Transcarpathian	3	1	0	4
Zaporozhye	6	0	0	6
Ivano-Frankivsk	1	1	0	2
Kyivska	10	0	1	11
Kirovograd	0	1	0	1
Lviv	3	1	0	4
Mykolaiv	14	1	0	15
Odessa	0	14	0	14
Poltava	109	4	0	113
Ternopil	0	2	0	2
Kharkiv	1	0	0	1
Kherson	1	1	0	2
Chernihiv	0	1	0	1
Total	153	32	1	186

The use of PPPs in Ukraine is the collection, purification and distribution of water (30 projects), production, transportation and supply of heat (6), construction and operation of motorways, roads, bridges, railways, tunnels, sea and river ports and their infrastructure (16), tourism, recreation, culture and sports (1), exploration of mineral deposits and their extraction (1), waste management (112), production, distribution and supply of electricity (5), property management (2) and others (13). The benefits of using the mechanism of public-private partnership are presented in Table. 2.

Table 2

Benefits of using the RFP mechanism

State authority	Private sector (business)	Community (society)
Savings of state / local budget	Access to utilities, infrastructure	Improved quality service
Investment attraction	Longevity of relations (from 5 to 50 years old)	The best price that satisfies a wide range of consumers
Budget replenished at the expense from payment concession	Ability to get privileged loans under the public-private object partnership	Satisfied demand
Optimization of the structure of the state expenditures	State guarantees. improvement of the regulatory framework, increasing transparency of business	Growth of the region's economy
Accelerating processes	Increased transparency of permits systems and reduction of barriers	Ensuring quality conditions life activities of all regional community

Conclusion

Thus, the mechanism of public-private partnership, as one of the forms of interaction between the state and the private sector of the economy, is widely used in countries with a developed market economy. Cooperation between the public and private sectors of the economy provides the opportunity to achieve the desired level of efficiency in the implementation of large-scale projects important for the whole country. Prospects for further research are the analysis of the effectiveness of public-private partnerships and the identification of risks for their management.

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**7th INTERNATIONAL ACADEMIC CONFERENCE
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Question of the Quality of the Service of Cyclist Traffic

Mykola Bojkiv¹, Romana Bura²

1. Transport Technologies Department, Lviv Polytechnic National University, UKRAINE, Lviv, Bandery street 12,
E-mail: bojkiv.mykola@gmail.com

2. Transport Technologies Department, Lviv Polytechnic National University, UKRAINE, Lviv, Bandery street 12,
E-mail: romana_bura@ukr.net

Abstract – *In the work, existing methods of research and criteria for evaluation the effectiveness and quality of cyclist traffic service, which take into account a great amount of impact of environmental factors on its quality, are analyzed.*

Keywords – cyclist traffic, cycle path, quality of transport service, effectiveness.

Introduction

Cyclist traffic quality is the measure of to what extent the trip meets expectations of the cyclist, in other words, according to the need in space for movement, integral system of cycling routes, possibility to keep its speed on maximum long sections of the route etc. By its nature it is integral concept that consists from a lot of objective and subjective factors which determine the perception of safety, comfort, aestheticism etc.

The main part

Research on quality of cyclist traffic service is topical both for researchers and for public or private sector. Increasing of cycling service quality will lead first of all to the increase of demand, increasing of which will be followed by the contraction of private transport usage which, in its turn, will help to solve a broad circle of urgent questions about parking, air pollution, noise, energy consumption etc. [1].

There exists a set of research methods which mostly are based on subjective values of cyclists: questionnaire, experiment and video surveillance.

Exists also research on safety index where the model of interdependence of cyclists and road conditions, level of comfort of street for cyclist [2], condition of passage index [3] and cyclist traffic compatibility index [4]. In the research also takes into account the factor of parking rules offence for the optimization of model of cycling compatibility index.

Additionally, it should be admitted that in its terminology researchers quite frequently use interchangeable and identical definitions which correspond to the concept of transport service quality, such as “quality of service”, “level of service” or “performance measures”.

Research on cyclist safety on certain section of the road network as the function of different factors including traffic volumes and speeds, pavement condition, and the width of lane is mostly represented. So, for example, in the work [5] is proposed the model for evaluation the motion safety of cyclists during the passage of intersection as function of dependence of traffic volume, width of lane and distance between intersections.

Federal administration of highways of USA developed BCI – Bicycle Compatibility Index [4] where attention is aimed at sections between intersections. Given index proposes to give an evaluation according to norms, given in table 1.

Table 1

Evaluation of the level of Bicycle Compatibility Index

Level BCI	≤ 1,50	1,51-2,30	2,31-3,40	3,41-4,40	4,41-5,30	> 5,30
Level LOS	A	B	C	D	E	F
Evaluation of level	Very high	High	Moderately high	Moderately low	Low	Very low

Another approach to “Bicycle Level of Service” (BLOS) is based on account of the width of automobile and cyclist lanes, pavement condition, percentage value of heavy traffic, traffic volume etc. Value of BLOS proposes the evaluation of cyclist traffic quality, according to table 2.

Table 2

Evaluation of level BLOS						
Level BLOS	$\leq 1,50$	1,51-2,50	2,51-3,50	3,51-4,50	4,51-5,50	$> 5,50$
Level LOS	A	B	C	D	E	F

Nowadays, there is exist a great amount of developed methods of evaluation of level BLOS which take into account stress, comfort, safety, cyclist volume, intersection etc. In table 3, are given some of them which quite frequently are given in research publications. Each method tries to provide the evaluation of accepted comfort and safety of linear section of cyclist traffic. All methods, basically, adhere to the same general format, that is usage of scoring.

Conclusion

Existing methods take into account a great amount of environmental impact factors on cyclist traffic quality. To the main factors of impact relate existence of cycling infrastructure, volume and speed of movement, problems with parking etc. Given methods allow to plan and design cyclist traffic effectively that will lead to increase of demand for usage of bikes by citizens.

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Possibilities for Implementation the Bus Rapid Transit on City Expressways with Controlled Motion

Romana Bura¹, Sergiy Maksymiuk²

1. Transport Technologies Department, Lviv Polytechnic National University, UKRAINE, Lviv, Bandery street, 12,
E-mail: romana_bura@ukr.net

2. Transport Technologies Department, Lviv Polytechnic National University, UKRAINE, Lviv, Banderu street, 12,
E-mail: sergiy1999.volodymyr@gmail.com

Abstract – Variants of implementation the Bus Rapid Transit system on city expressways with controlled motion and also possibilities for improvement of traffic management on intersections considering movement of Bus Rapid Transit system vehicles are reviewed.

Keywords – Bus Rapid Transit, expressway, traffic light control, volume-capacity ratio.

Introduction

Today, due to increasing the number of vehicles in cities, urban public transport plays a significant role. World practice is increase of effectiveness of urban public transport by giving it a priority on road network. One of the most effective modes of public transport is Bus Rapid Transit system (BRT). But for its implementation detailed analysis of road network conditions is necessary, because quite often in cities appears the problem of absence the place for building separate lanes for movement of BRT as there already exists dense construction area.

Characteristics of implementation the BRT system on city expressways

For implementation of BRT system directly on road network, there exists a few variants among which arrangement of separate lanes for buses on curbside, in the middle of roadway, motion of buses in general flow, arrangement of tunnels or elevated roads for BRT system. But two last variants demand significant capital expenditure on facilities construction, and movement of buses in the flow will cause significant delays during their motion. That is why the most effective decisions are implementation of separate lanes for bus movement.

The simplest way is to implement such lanes on expressways because of their sufficient width and large number of lanes. But there often appear vehicle delays caused by bad design and traffic management, such as: unsuitably placed bus stops; narrow bridges and tunnels, absence of multi-level railway crossings; merging of traffic flows; bad regulated parking; not enough optimal calculation of traffic light control; improperly designed and directed intersections [1, 2].

Besides, quite often BRT system can cause contraction the number of lanes for mixed traffic flow. Although ideally movement of large number of buses from mixed flow lanes will allow avoiding increase of traffic jams on them, this happens not always and filling the mixed flow lanes can increase. On fig. 1 there is given filling by vehicles planned corridor BRT. With points A, B, E there are viewed intersections, with point C – narrowing of roadway (for example, bridge), with point D – place of attraction (for example, trade center), where transport delays are observed. As it can be seen from the figure, after implementation of BRT system without any additional engineering measures volume-capacity ratio in these points will increase to saturated [1, 2].

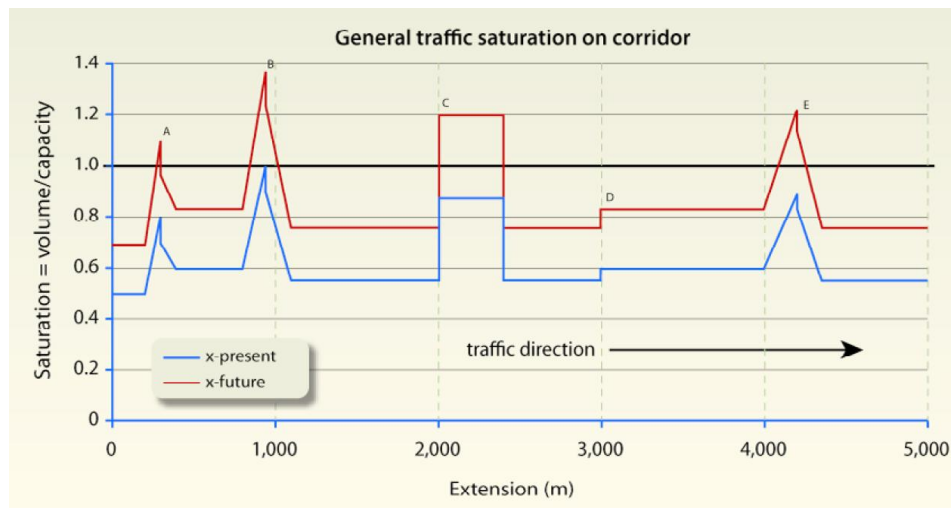


Fig.1. Change of volume-capacity ratio of the expressway after implementation of BRT system without additional measures.

As for narrow sections between intersections, the problem can be solved with the help of increase of control and tightening parking rules, narrowing the directional dividing line, improvement of streets that adjoining to reviewed expressway street, expansion the roadways etc. If such decisions are ineffective or they are impossible to implement, then on approaches to narrow street sections can be implemented traffic light control with sequential passing of general traffic flow and buses of BRT system.

As for intersections, for increase of their effectiveness are necessary organizational decisions. The value of volume-capacity ratio of bus movement on the intersection should not exceed 0,65, in another case usage of BRT system will be ineffective. That is why, it is necessary to review the next variants of traffic management on intersections: restriction of turns for general traffic flow, in particular left turn; allocation of separate phases for movement of BRT system; giving the priority to bus movement while crossing the intersection. Left turn restriction is an effective decision because it liquidates a conflict situation when buses move straight and automobiles make a left turn. But such decision is possible with presence of by-pass ways. Implementation of effective phase separation depends from conditions of intersection, number of lanes and traffic volume. Giving a priority to buses during approaching the intersection is possible again providing that it will not create additional significant delays in movement of general traffic flow.

Conclusion

So, for provision the effective operation of BRT system without additional delays of general traffic flow it is necessary to review given above organizational measures in complex with considering the features of every intersection of road network.

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Analysis of Pedestrian Speed of Movement Within Signaled Pedestrian Crossings

Oleh Hrytsun¹, Vladyslav Davosyr²

1. Transport Technology Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12,
E-mail: oleggrutsyn1993@gmail.com

2Transport Technology Department Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12
E-mail: davosir2012@yandex.ua

Abstract – *Mathematical model for determination the duration of the passing by pedestrians the crossing depending from roadway width is given. Depending from the speed different classifications of pedestrian flow are proposed. Within pedestrian crossings correspondence of speeds of movement to weather conditions and the length of crossing path is determined.*

Keywords – pedestrian flow, pedestrian speed of movement, crossing length, traffic light control, field research, weather-climatic conditions.

Introduction

Pedestrian movement is the most common type of people travel by the city territory. In city transport planning it covers, first of all, providing the comfort and safety of pedestrian movement on city streets, providing the movement of large masses of people in zones of trading, cultural and sport centers, near stations and large transfer facilities. Solution of this task depends from many factors, the main are: town-planning, road-planning, social and economic [1].

Research and methodology

Speed of pedestrian movement is the main factor which determine conditions of pedestrian movement, capacity of pedestrian crossing, traffic light control parameters etc. Investigation of speed of pedestrian movement on signaled pedestrian crossings is necessary for setting the determination of traffic light signal duration which allows pedestrian movement [1,2]. The aim of research of pedestrian movement parameters on signaled intersections is in receiving computing values of quantities which are used for desighning the traffic light objects. Working regime of traffic light control in this case depends from intencity of traffic and pedestrian flows; speed of pedestrian movement; existence of enough place for cumulating the pedestrians which wait for permissive signal of traffic light. On speed of movement by pedestrians have special impact age and social composition of pedestrians. On the crossings near schools and children`s institutions the speed of pedestrian flow is the highest, near passages of enterprises and organizations, especially in the end of day – the lowest [2].

Time, which is needed for pedestrian to cross the roadway after turning on the green traffic light, is determined including speed of pedestrian movement and time of delay [1,2]:

$$t_p = b_{RW} / V_p + t_{del} \quad (1)$$

where t_{del} – time, which is needed for pedestrian flow to cross from waiting zone to the start of crossing, sec.

Depending from speed it is proposed different classifications of pedestrian flow (km/hour) [2]: free – more than 4,5; unstable pedestrian flow – 4,4-4,5; stable pedestrian flow – 4,1-4,4; dense flow – to 4,0.

Results and discussion

Deriving from formulated task about research of speed of pedestrian movement within ground crossings it is performed range of measurements on the road network with different crossing length. Measurements are performed with the use of technical means of traffic management of city municipal enterprise LME “Lvivavtodor” in dry, solar and rainy weather.

During the measurements such factors could be determined: pedestrian crossing length (street width); traffic light cycle duration on signaled crossings and also its compounds (time of restrictive and permissive signals); time for cross by pedestrians the roadway.

In result of experimental research, conducted on motorway street of city-wide significance Horodotska in Lviv city, such amounts of speed of movement are received (fig. 1).

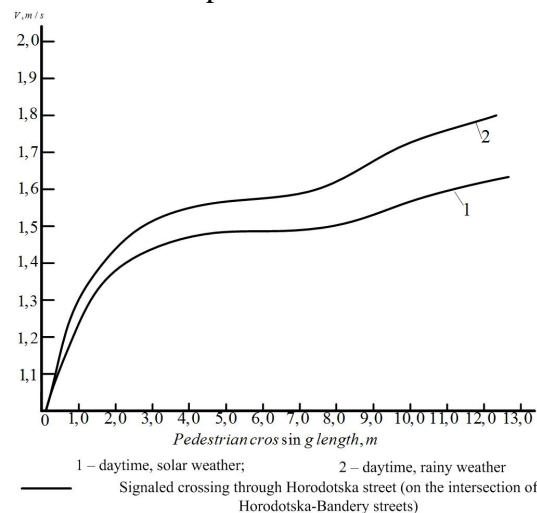


Fig.1. Results of experimental determination of speed of pedestrian movement on ground pedestrian crossings with two-way movement

From the fig. 1 it can be seen than the speed with distance from pavement increases from 1,3-1,4 to 1,7-1,8 m/sec. Pedestrians accelerate the movement as they wish to leave the most dangerous section of the crossing. In the middle of roadway speed reduction can be seen. This reduction the most abruptly appear in pedestrians which started the movement during restrictive signal of traffic light. We can assume that it is connected with the necessity for pedestrians to estimate again transport situation (but on the second half of the roadway) and make a choice of accepted interval in traffic flow.

Conclusion

So, further field research on pedestrian movement factors provide opportunity to: determine the character of pedestrian behavior depending from weather-climate conditions, time of day, location of the crossing and way of operating the movement on it; determine the reduction of capacity of CRN section in result of arrangement of pedestrian crossings; increase road safety in places of interaction of traffic and pedestrian flows.

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Scientific Approaches to the Provision of Dangerous Goods Transportation

Volodymyr Pyndyk¹, Roman Shevtsiv², Iryna Ratych³

1. Transport Technology Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery Str. 12, E-mail: pandawowaxd@gmail.com
2. Transport Technology Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery Str. 12, E-mail: atrapss@gmail.com
3. Transport Technology Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery Str. 12, E-mail: ratych.ira@gmail.com

Abstract – *This article described the latest one approaches to ensuring the transport of dangerous goods. Also, when dangerous goods are transported, the biggest role in providing safety traffic are including choise of a rational route and the ability to monitor a vehicle way.*

Keywords – dangerous goods, safety, road, vehicle, transport.

Introduction

Nowadays safety of dangerous goods transport is an interesting transportation planning topic. It regards road safety, goods storage, prevention and security. The key purpose is reducing the risk of hazardous accident (e.g.: harmful contamination, toxic emissions, fire and explosions) during travel or transport operations. The consequences of accidents involving dangerous goods may be very tragic for humans, especially when occur in urban areas densely populated, for environment (both for the life forms that live there and the economy which depends on it), or for property.

The international transport of dangerous goods by road, by rail or by internal water is regulated by European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) [1].

Scientific approaches in providing transportations of ADR type

Continuous global increases in the transportation of dangerous goods, transportation set-ups with a growing number of parties, and increasingly complex information flows result in growing complexity for each stakeholder to handle [2].

The transportation of hazmats is, therefore, subject to safety requirements to both their carriers and to the materials themselves. It has been recognized as important to find a balance between the safe requirements for transporting these materials, in order to protect the populations and the environment, and the economic viability of the operation [3].

It are necessary in organization the process of transportation dangerous goods, always take measures aimed at improving the technical equipment of transportation (rolling stock, containers, vehicle of mechanization the loading and unloading process); providing the safety transportation of dangerous goods by the established routes of traffic and realization training and raising the skills for the person involved in this process.

The main tasks of efficient transportation management are: routing, which allows transportation of dangerous goods to pre-selected and established safe routes [4]. A common political tool to reduce the risk of hazmat transportation is the interdiction to this transport of certain road sections identified as more vulnerable by the regulator. The carrier is free to choose the routes and manage their risk in the available network. The hazmats industry generally place safety at the centre of their business and the analysis of safe route definitely requires further studies [3].

Cost minimization is not given priority when transportation route are planning and choosing: carriers and government agencies authorized to issue permits for the transport of

dangerous goods are mostly guided by considerations of the minimum population and / or the minimum probability of occurrence of an unwanted event [5].

When the problems related to vehicles and the transportation of dangerous goods are solving we should always know the exact location of the vehicle and cargo carried, as well as the places of loading / unloading. Information about past work on specific routes must also be studied. This can allow us to manage all vehicles efficiently, as well as to avoid fires, explosions of dangerous goods or other accidents. Information about any deviations from the route and other related info must be recorded.

The rapid development of geoinformation technologies has an impact on the development of the telematics system. There are many systems that help driver and the end customer of such transportation. Transport telematics consists of the following aspects:

- transmission of information from and to the car (telecommunications);
- information processing (information technology);
- use of information for safe transportation and effective use of existing technological solutions.

Mobile positioning services provide information about the location of the mobile terminal. The end user or other person can carry the terminal, or it can be attached to the load. A wireless connection to the network is usually based on GSM or CDMA or wireless. The network based on mobile and satellite positioning technologies can determine the location of the terminal.

Road transport is supported by telepathic systems such as:

- equipment for monitoring traffic (sensors, detectors, video detectors), devices for television surveillance (cameras);
- -satellite navigation systems (GPS, GLONASS, EGNOS, GALILEO);
- derivative systems used in navigation;
- radio communication systems;
- GIS technologies;
- road info;
- electronic cards;
- monitoring of weather and measuring systems and others.

GPS is well known as a global navigation satellite system. Similar systems exist - in Russia GLONASS and the GALILEO systems are prepared by the European Commission and the European Space Agency. GPS is the basis of the current navigation systems. In fact, GPS is the only fully-fledged global satellite positioning system in the world.

Satellite positioning systems are widely used in the world, which allows us to determine the position of objects that are equipped with positioning equipment with the necessary precision. For accuracy and speed of estimation a geographical position is very important to track the object that quickly changes position (for example, car, ship or aircraft) on a digital map, especially when dangerous goods are transporting by any mode of transport [5].

Also, the main tasks are the appropriate and justified choice of rolling stock and type of packaging; specialization of departments of transport enterprises and establishments carrying out transportation of dangerous goods; ensuring timely and full information about dangerous goods properties.

The functions of control over the carriage of dangerous goods are borne by the relevant state control bodies of the countries whose territories the carriage is carried out and should aim at ensuring strict and strict compliance by all carriers with the requirements of applicable international and national regulations in the field of safety of the transport dangerous goods [6].

To solve the problem of adequate level safety of the transportation dangerous goods, a systematic approach should be applied, considering the technological process of transportation as the only complex, dynamic system, elements which constantly interact with each other. Structural elements of this system are:

- international and national legislatures;
- control bodies;
- organizations and institutions that carry out professional training of persons involved in the performance of transportation;
- industrial and transport enterprises, which carry out shipment,
- specialized fire, rescue, medical and sanitary services;
- enterprises - manufacturers of vehicles intended for the transportation dangerous goods;
- enterprises - manufacturers of large and small-sized containers that can be used for the transport of dangerous goods;
- persons involved in the transport operations and deal with the technological process of transportation.

The purpose of this system is to ensure the safty transportation of dangerous goods and to inform the population in a timely manner about the occurrence of accidents with dangerous goods, as well as to take urgent measures to eliminate their negative consequences.

For the successful functioning of the system, legislative and methodological bases are needed. That would regulate the process of transportation of dangerous goods and establish appropriate requirements for all its elements [4].

Conclusion

Improving the technical equipment of transportation, planning of safe routing, tracking the location of the vehicle and collecting transportation information, and applying the legislative and methodological framework for regulating the process of transportation dangerous goods, will allow us to balance the economic feasibility of the carriage and ensure an adequate level of safety in its implementation.

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Dependence of the Passenger's Functional State Changing from the Public Transport Service Quality

Yuliya Vovk¹, Oleh Furman², Oleh Masonkov³

1. Transport Technology Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12,
E-mail: vovkvovkyu@gmail.com

2. Transport Technology Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12,
E-mail: oleg.furman6@gmail.com

3. Transport Technology Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12,
E-mail: olegmasonkov@gmail.com

Abstract – one of the requirements of contemporaneity is the quality of public transport service. Regularity of traffic reliability, duration of trip, comfort, traffic safety, availability of stop are all those and many others factors that influence the quality of public transport service. There is the example of the influence of quality index of maintenance of passengers on their functional state.

Keywords – quality of public transport service, traffic safety, comfort, information support on transport, functional state.

Introduction

The studying of quality of public transport service – is one of the most important point that is before the necessities of society in the sphere of transport. The quality of public transport service depends on the employment psychophysiological state of a person etc..., all these factors influence the rhythm of different spheres of production and service. The improper quality of transport service causes the decline of passenger and bad mood at all.

Public transport service quality

According to many ideas of the specialists about the degree of quality of public transport service they decided to conduct a complex estimation of public transport that was offered by Shabanow [1]. The scientist takes into account such the points: the duration of trip, regularity of traffic, probability of faultless work of public transport, comfort, the price index and the level of informative providing.

$$S_{service} = S_1^{k1} \cdot S_2^{k2} \cdot S_3^{k3} \cdot S_4^{k4} \cdot S_5^{k5} \cdot S_6^{k6}, \quad (1)$$

where S_1^{k1} – reliability of movement in accordance with the schedule of movement (travel time);

S_2^{k2} – accessibility (frequency of public transport movement);

S_3^{k3} – safety (probability of non-failure work of public transport);

S_4^{k4} – comfort (travel quality);

S_5^{k5} – cost indicator (the amount of transport tariff);

S_6^{k6} – indicator of the level of information support;

There was done the analyse of this formula and it was modified according to our research. According to the rout researches of city passenger transport there are chosen the neassary skills to define the indexes of quality (Table 1).

There were done a lot of researches on the 10 routs with the help of «Polar H7» and HRV Lite in the real condition to define the influence of quality of public transport service. These researches were done by two persons at each rout. Before the getting to the bus at the last bus stop one of the researches puts on the «Polar H7» and placed the single seat on the right side (near the door) and begins to put down the facts. The other researcher asked the other passengers in the bus about quality of public transport service on this rout.

Table 1

Rout	Indexes of quality									
	Actual trip duration, min	The minimum possible trip duratio, min	Actual number of buses, units	Estimated number of buses, units	Actual number of order working buses, units	Number of buses that should get on the route, units	Amount of passengers' ratings about comfort, points	maximum number of passengers' ratings about comfort, points	The actual quality of information, points	Maximum possible quality of information, points
51 _{dir}	70	68	5	8	16	19	15	25	92	117
51 _{rev}	66	68	7	8	15	19	20	25	89	105
16 _{dir}	60	63	6	9	13	13	17	25	59	75
16 _{rev}	57	63	5	9	12	13	19	25	58	78

The same facts are done for the routes 30,13,3A,39,18,41,9,2A (of both sides). The results of the quality of the service are shown in Fig. 1.

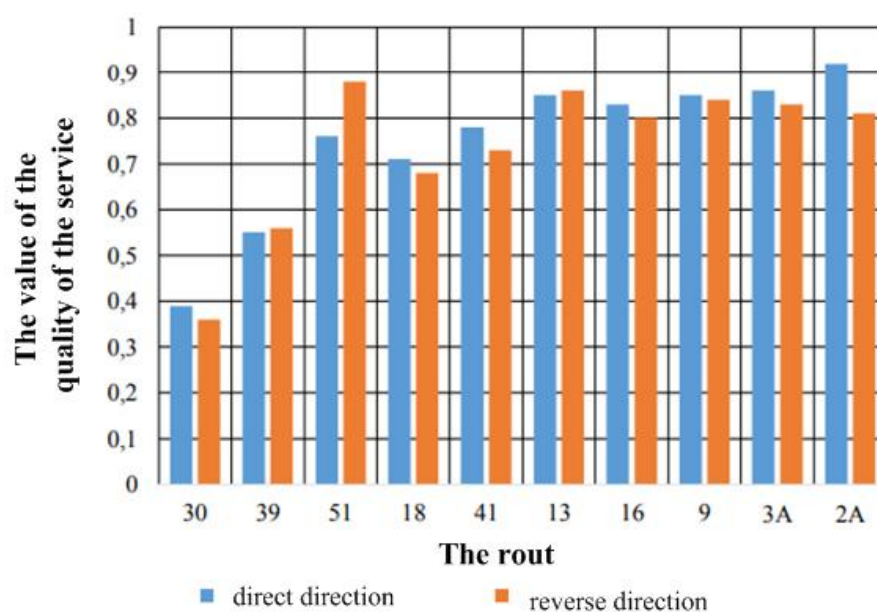


Fig. 1. Index of quality of public transport service.

According to Fig. 1 you can see that the quality of public transport service is hastated between 0.36 and 0.92. This chart shows the change of this fact according to the rout from the «worst» to the «best».

Functional state – is the complex of facts that characterized the man's possibility to go some action in the certain condition. [2] Also it is the possibility to save the capacity level of the bad influence of invironment. It is very important to the passenger to save the functional state after the journey by the public transport and to do his job correctly after this. That means that functional state of the person can show the capacity level of him.

This work shows the level of people's fatigue by transport like IRSA. Index of regular system activity (IRSA) – it is the sum of the conditional points according to different points of HRV. The value of this is shown by the point from 1 to 10 and shows the functional state of the passenger, where 1 is the physical norm and 10 – blowing the adaptation off. [3]

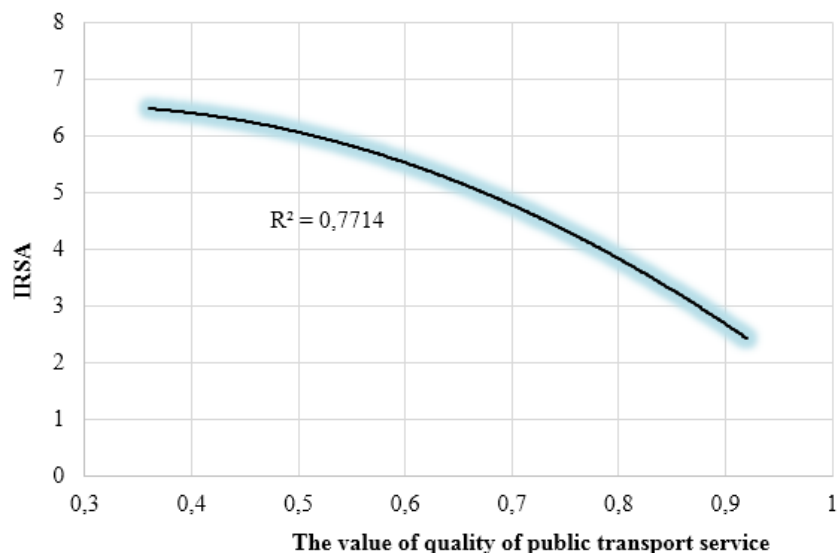


Fig. 2. Dependence IRSA of the passenger from quality of public transport.

It is decided that IRSA of a passenger changes inversely proportional to the quality of public transport service city passenger transport. IRSA reaches the maximal value at the route with the smallest level of the quality of public transport service, but minimal value are with the highest level of quality. It is set that when the index of quality increases to 0.9, IRSA falls to 2-3 points.

So this crooked line gives us the possibility to say that the quality of public transport service influences on the FS of a passenger.

Conclusion

It is well-proven that the change of FS of the passenger depends on the quality of public transport service. The smallest level of the passenger's tension is at the route with the highest level of the quality of the public transport service (0.85-0.92). Analysing the facts of the researches it is well-proven that the level of quality of transport service is getting worse. It can be explained that our transport is often overcrowded. It is decided that when the quality of transport service is better, the tension of the passengers will decrease and the FS will be better too.

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Study of Comfort Pedestrian Traffic Conditions

Vsevolod Prykhodko¹, Olexandr Zhytenko²

1. Mechanical Engineering and Transportation Technologies Department, Lviv Polytechnic National University, Ukraine, Lviv, Stepan Bandera street, 12, E-mail: satrapandfeller@gmail.com

2. Mechanical Engineering and Transportation Technologies Department, Lviv Polytechnic National University, Ukraine, Lviv, Stepan Bandera street, 12, E-mail: zhytenko@ukr.net

Abstract – A method is needed to assess the degree of difficulty a user will experience crossing an intersection. A field survey will be conducted to collect geometric, operational and traffic characteristics of crosswalks. A number of primary independent variables influencing pedestrian LOS (level of service) should be identified and tested in the stepwise regression analysis. Development of pedestrian LOS measure for intersection are intended to indicate the level of difficulty in crossing intersections. This study explains a method for the estimation of pedestrian LOS at intersections and also identifies the factors affecting pedestrian level-of service LOS at intersections.

Keywords – pedestrian facilities, heavily trafficked intersections.

Introduction

Since the pedestrian environment is multi-dimensional, the pedestrian in the roadside environment is subjected to a set of several factors significantly affecting his or her perception of safety, comfort, and convenience. Measurement of these factors is necessary to evaluate the pedestrian facilities and evaluation methods are needed to understand how well a particular street accommodates pedestrian travel. In order to appropriately plan for more walkable environments, methods are required that allow planners and decision-makers to effectively identify and assess the elements of the built environment that support or detract from walking. The quality of the pedestrian environment has been measured for many years using the Level-of-Service (LOS) approach. The LOS for pedestrian facilities is influenced by a lot of factors and different pedestrians have different perceptions on the LOS.

Analysis of previous studies and publications

Dixon (1996) proposed a pedestrian LOS evaluation criterion which involves the provision of basic facilities, conflicts, amenities, motor vehicle LOS, maintenance, and travel demand management, and multimodal provisions. There was no qualitative environmental assessment relating to walkability. This seems to be best suited to footpath assessments, applicability to intersections was uncertain.

Muraleetharan et al., (2004) used conjoint technique to combine the factors affecting pedestrian LOS. Total utility from the conjoint analysis represents an overall value, which specifies how much a user puts on a product or service. Even though this study proposed a method to determine overall LOS, it does not include all the factors affecting pedestrian LOS.

Muraleetharan et al., (2005) identified the factors affecting pedestrian level-of service at intersections and proposed a method for the estimation of pedestrian LOS at intersections. The study revealed that the factor turning vehicle has greater influence on pedestrian LOS than other factors. Furthermore, the factors delays at signals and pedestrian-bicycle interaction were also found to be significant factors in determining pedestrian LOS at intersections.

Hubbard et al., (2009) did a statistical analysis using a binary logit model that provides new insights into the factors that affect the likelihood that a pedestrian is compromised, delayed, altered their travel path, or altered their travel speed, in response to traffic turning right on green

during concurrent vehicle/pedestrian signal timing. Application of a binary logit model of pedestrian compromises shows that the probability of a pedestrian compromise increases with increasing right-turn vehicle flow rate, and is higher for crosswalks outside the CBD compared to crosswalks in the CBD for the same right-turn flow rate.

Based on literature review, much of the works dealing with pedestrian is limited to pedestrian facilities on uninterrupted sidewalks. On the other hand, there are a few studies dealing with pedestrian facility issues at intersections. This indicates that a reliable measure is needed to describe the pedestrian environment at intersections. Development of pedestrian LOS measure for intersection is therefore intended to indicate the level of difficulty in crossing intersections.

Formulation of the problem

Pedestrians constitute the largest group of users of the road network, and are also the most vulnerable road users. The pedestrian movement is not limited to lanes, as it is in the road transport, or specific routes, but limited only by the physical constraints around them, namely the presence of sidewalks or hiking trails. Therefore, pedestrian needs must be taken into account when designing a transport infrastructure. In order to know how the state of the road network provides a comfortable and safe pedestrian movement, there is a need to assess the conditions of pedestrian traffic and identify the main factors having a negative impact on the participants of the movement with the subsequent resolution of existing problems.

Main material

Comfort is a positive emotional reaction to the external environment or situation. The comfort of pedestrian traffic conditions can be considered as a certain emotional reaction to the external environment in different situations.

Separately distinguish the notion of physical, physiological and psychological comfort of pedestrian traffic. Under the physical comfort of the pedestrian movement, the minimum amount of effort spent traveling is understood, which is manifested in such parameters as adequacy, continuity and unimpeded design of the sidewalk, its convenience for certain categories of people, the state of coverage, and the availability of protection against adverse weather conditions. The psychological comfort is provided by the ability to maintain the desired speed of movement, as well as the ability to use the surrounding infrastructure. In addition, the level of noise and pollution determine the physiological state of pedestrians

All these types of comfort are interconnected and the overall feeling of comfort depends on the positive reactions of the pedestrian on all three levels.

Methods for estimating pedestrian traffic conditions can be divided into three types: 1 - those based on pedestrian flow characteristics; 2 - those based on the characteristics of the host environment; 3 - assessment based on the perception of pedestrians.

The assessment of pedestrian traffic according to HCM (Highway Capacity Manual) is determined by the LOS (Level-of-Service) level for sidewalks based on the results of calculating pedestrian velocity, available personal space and pedestrian flow intensity on the effective width of the sidewalk. That is, this method considers the pedestrian flow in the same way as the traffic flow, determining speed, density and intensity. Conditions are considered comfortable for movement when the pedestrian has a sufficiently individual space to choose the desired path and speed.

The various factors that can be considered in the development of the model can be grouped into three main categories, as follows:

1) Pedestrian Factors: Pedestrian Flow, Pedestrian Crossing Time, Pedestrian Delay, Pedestrian Sight Distance;

2) Crosswalk Factors: Pedestrian Holding Area, Crosswalk Width, Crosswalk Surface Condition, Crosswalk Marking, Roadway Factors, Number of Lanes, Roadway Width, Exclusive Left-Turn Lanes.

3) The various factors considered in the development of the present P-LOS model are as follows: Pedestrian Flow, Pedestrian Crossing Time, Pedestrian Delay Time, Crosswalk Surface Condition, Crosswalk width, Crosswalk Marking, Roadway width, Number of lanes.

The main objectives of this study are: 1) To identify factors which influence the level of service of crosswalks at signalized intersections; 2) To develop a regression model, this can be used to determine the pedestrian level of service of crosswalks at signalized intersections.

Methodology for development of P-LOS. The development of the P-LOS model involved:

- The collection of data by visual surveys and field surveys;
- A statistical analysis of the collected data using multiple linear regressions;
- A model validation process using several statistical tests.

For statistical analysis software SPSS is used. Originally it is called as “Statistical Package for Social Scientists” but now stands for “Statistical Product and Service Solutions”, one of the most popular statistical packages which can perform highly complex data manipulation and analysis with simple instructions.

Data analysis. The following are the assumptions made, prior to the development of the model using the multiple regression analysis method.

1) For each value of the independent variables (X), there is an array of possible values for the dependent variables (Y) which is normally distributed about the regression line;

2) The mean of the distribution of possible Y values is on the regression line, that is, the expected value of the error term is zero;

3) The standard deviation of the distribution of the possible Y values is constant regardless of the X values;

4) The error terms are statistically independent of each other, that is, there is no serial correlation;

5) The error terms are statistically independent of X values.

Data for the development and independent variables:

The P-LOS model consisted of a dependent variable and seven independent variables. The dependent variable was the P-LOS Score obtained through interviews and questionnaires. Pedestrians were asked to rate the crosswalks in terms of safety and comfort. The average rating of the pedestrians for each crosswalk is mentioned. Pedestrian flow (ped/hr), pedestrian crossing time (sec), pedestrian delay (sec), crosswalk surface condition (0- poor, 1 - moderate, 2 - good), crosswalk marking (0 - not visible, 1-slightly visible, 2 - highly visible), crosswalk width, and roadway width (m) were measured at the study locations. Comfort is a positive emotional reaction to the external environment or situation. The comfort of pedestrian traffic conditions can be considered as a certain emotional reaction to the external environment in different situations.

Separately distinguish the notion of physical, physiological and psychological comfort of pedestrian traffic. Under the physical comfort of the pedestrian movement, the minimum amount of effort spent traveling is understood, which is manifested in such parameters as adequacy, continuity and unimpeded design of the sidewalk, its convenience for certain categories of people, the state of coverage, and the availability of protection against adverse weather conditions. The psychological comfort is provided by the ability to maintain the desired speed of

movement, as well as the ability to use the surrounding infrastructure. In addition, the level of noise and pollution determine the physiological state of pedestrians

All these types of comfort are interconnected and the overall feeling of comfort depends on the positive reactions of the pedestrian on all three levels.

Methods for estimating pedestrian traffic conditions can be divided into three types: 1 - those based on pedestrian flow characteristics; 2 - those based on the characteristics of the host environment; 3 - assessment based on the perception of pedestrians.

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From the analysis, the regression equation to determine the P-LOS Score took the form of equation is Eq. 1:

$$P - LOS = 7,443 - 0,002PFH - 0,061PCT + 0,679CSR \quad (1)$$

where, CSR = crosswalk surface condition rating. (0 - poor, 1 - moderate, 2 - good) PCT = pedestrian crossing time (sec); PFH = pedestrian flow (ped/hr).

To aid in the determination of the P-LOS of the crosswalk, a LOS table, as shown in table 1, was developed as a basis for stratifying the model's numerical result into a level of service category.

Table 1

The range of values of P-Los

Pedest.level of service (P-Los)	P-Los score
A	$8.5 < x < 10.0$
B	$7.0 < x < 8.5$
C	$6.0 < x < 7.0$
D	$5.0 < x < 6.0$
E	$4.0 < x < 5.0$
F	$x < 4.0$

Conclusions

From this study, it was found that the following factors had a greater influence on the level of service of crosswalks at signalized intersections for the selected study site.

- a) Pedestrian Flow;
- b) Pedestrian Crossing Time;
- c) Crosswalk Surface Condition.

This study also produced a P-LOS Model which can be used to determine the level of service of crosswalks at signalized intersections.

Significance of P-LOS models:

1) Pedestrian LOS model for crosswalk provides a measure of a crosswalk's performance with respect to pedestrians' safety and comfort.

2) Using the value of pedestrian LOS at crosswalk, roadway designers can determine how well a particular intersection accommodates pedestrian travel. In other words, pedestrian LOS measures can provide an easy understanding about the condition of a crosswalk. Such a measure would help in evaluating and prioritizing the needs for pedestrians on existing intersections.

3) Pedestrian LOS at crosswalk can be used to develop a minimum LOS standard which could prescribe the minimum acceptable LOS for the adequate accommodation of pedestrians. Crosswalks at urban intersections should be targeted to maintain a minimum pedestrian LOS in order to provide a minimum level of accommodation for pedestrians.

4) Pedestrian LOS models could also be used to support the development of pedestrian facility improvements.

From the model and the observations made, it can be recommended that in order to achieve high levels of service of crosswalks at signalized intersections, the following can be practiced in the planning and design of crosswalks at signalized intersections:

- 1) Shorten pedestrian crossing time by reducing crosswalk length and increasing crosswalk width.
- 2) Increase pedestrian flow by providing a longer pedestrian green time and providing larger walking space.
- 3) Reduce pedestrian delay by shortening cycle length of the traffic signal system.
- 4) Improve the condition of crosswalk surface through routine checks and maintenance.
- 5) Make sure that crosswalk markings at intersections are visible both day and night through routine checks and maintenance.
- 6) Provide adequate space for holding or accommodating pedestrians while waiting to cross.
- 7) Provide minimum required roadway width at the intersections in order to shorten crossing distance and time.

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The Most Common Damage to the First Generation Bosch Unit Injectors

Krystian Szewczynski ¹, Mateusz Blach ²

1. Faculty of Transport, Silesian University of Technology, POLAND, Katowice, Krasinskiego Street 8, E-mail: krystian.szewczynski@gmail.com

2. Faculty of Transport, Silesian University of Technology, POLAND, Katowice, Krasinskiego Street 8, E-mail: black.fencer@gmail.com

Article – describes typical damages of unit injectors as a result of operation and errors of mechanics committed during technical services. Keystone for writing this article is a huge amount of vehicles equipped with the presented solution on the Eastern European market and a high frequency of damage.

Keywords – unit injectors, fuel injection system, unit injectors repair, diesel engines, unit injector damage

Introduction

Unit injectors are one of the technical solutions for fuel supplying of self-ignition engines. First generation unit injectors are responsible for the success of the 1.9 TDI Volkswagen group diesel engine. This solution has dominated the market of diesel engines until 2006, when the European emission standard EURO 4 was introduced.

A huge number of vehicles equipped with unit injectors is caused by the fact that the engines used in these vehicles are characterized by high reliability and long life. Everything, however, sooner or later is wearing, so it is with unit injectors. They may be subject to wear as a result of standard operation as well as as a result of mistake or oversight of the person providing maintenance. The most popular elements that are damaged include: seals, the injector's tip and the electric connector of the coil.

The company dealing in the regeneration of diesel engine components, on two Bosch EPS 815 diesel's test benches, employing three employees, is able to regenerate 4,000 - 5,000 unit injectors per year. The most popular elements that are damaged include: external seals, the unit injector's tip and the electric connector of the coil.



Fig. 1. First generation unit injector. [1]

I. Technical details of the unit injector

Simply put, it is a combination of a pump that produces high pressure and a part that directly injects the fuel into the combustion chamber. The biggest advantage of this solution is the lack of need to use high pressure pipes, which significantly shortens the distance needed to travel by fuel to the combustion chamber. As a result, injection pressure of 2200 bar was obtained with the possibility of dividing into a pilot injection and main injection. [2]

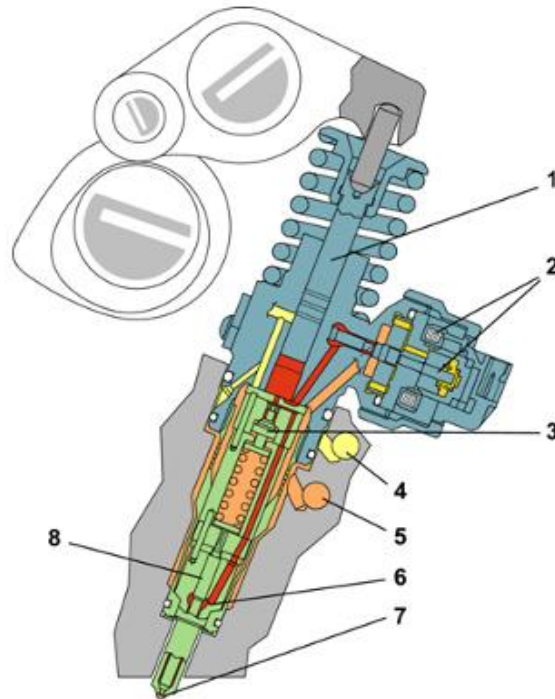


Fig. 2. Diagram of the injector drive from the camshaft [3]; 1) pump plunger, 2) solenoid valve, 3) intensifier piston, 4) fuel return line, 5) fuel supply line, 6) high pressure chamber, 7) nozzle, 8) needle.

II. Causes of the most common damage to unit injectors

Damage to unit injectors can be divided into two main groups. The first of them is damage due to daily operation, which can not be prevented, but only delayed in time through regular technical servicing and refueling at trusted distributors.

The second group includes damage resulting from human errors, which are caused by non-compliance with the manufacturer's instructions or the lack of required qualifications.

Wear as a result of operation

Unit injectors, like any other component, are subject to wear. The effect of wear of the injector parts is the incorrect engine's work, most often resulting in smoke from the exhaust system, loss of power or even starting problems. In the case of a unit injector, the seals and the ends of the injection part are most often damaged.

O-ring seals have a very responsible function. They separate the fluids needed for the injector to operate, such as inlet oil from the hot outlet oil and from the engine oil. The mixing of these substances is not a desirable phenomenon.



Fig. 3. Photos of external unit injector seals; A) old, B) new.

The pump injector tips overlap with the carbon coating over time (Fig. 4.) resulting from incomplete fuel combustion or in extreme cases - engine oil combustion.



Fig. 4. Example of wear of the injector tip [4]

Same mounting screws usage

In order to eliminate any movement of the injector in relation to the head, special assembly screws are used, which should be tightened with the tightening torque provided by the manufacturer. The injector screws are subjected to plastic deformation after a single tightening, which disqualifies them from re-use.

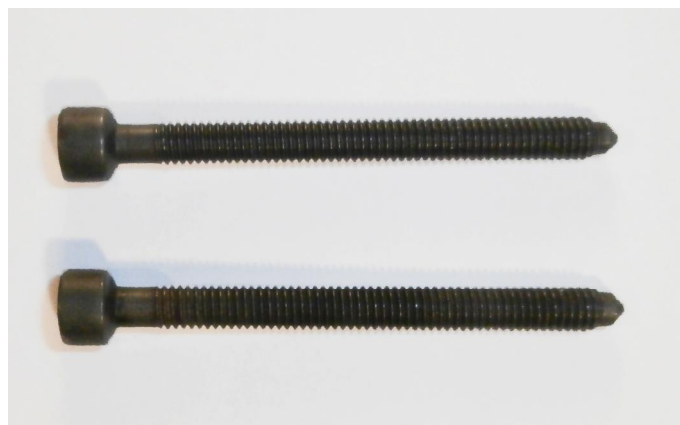


Fig. 5. Mounting screws; new (upper) and old (lower).

As part of the research, a set of used (4) and new (4) screws was measured. Each screw was measured five times with an accuracy of 0,01 mm. The average values of the results obtained are presented in Table 1.

Table 1.

The results of measurements of the length of assembly screws

Screw number	Average length of the used screw [mm]	Average length of the new screw [mm]
1	70,70	70,70
2	70,49	70,49
3	70,64	70,64
4	70,49	70,49

It can be easily calculated, one screw extends an average of about 0,2 mm, which excludes re-use.

Lack of lubrication of seals with oil before installation

The lubricant layer should be applied directly to the external seal of the unit injector right before the injector is installed in the hole in the motor head. This operation is necessary to prevent the seals from being damaged by being rolled up, abraded or torn. The effects of seal damage are described in previous sections.

Incorrect tightening torque of the mounting screw

Too much tightening torque also has a major impact on the durability of the pump injectors due to the negative effects. According to the Bosch instructions, the assembly injector screw must be tightened with a torque of 12 Nm and then turned by an angle of 270 degrees [5]. If the screw is tightened too much, there will be too much tension between the surfaces adjacent to each other. In combination with vibrations during operation of the engine and unit injectors, this can lead to damage to the engine head and unit injector parts.

Breaking off the electromagnetic coil connector

The effect of incorrect disassembly of the electric beam reaching the unit injector is the breaking of the connector made of plastic. This is the case when pulling the plug at the electromagnetic coil with excessive force. The effect of this action is the lack of contact at the ends of the coil, which in effect prevents the injection of fuel.

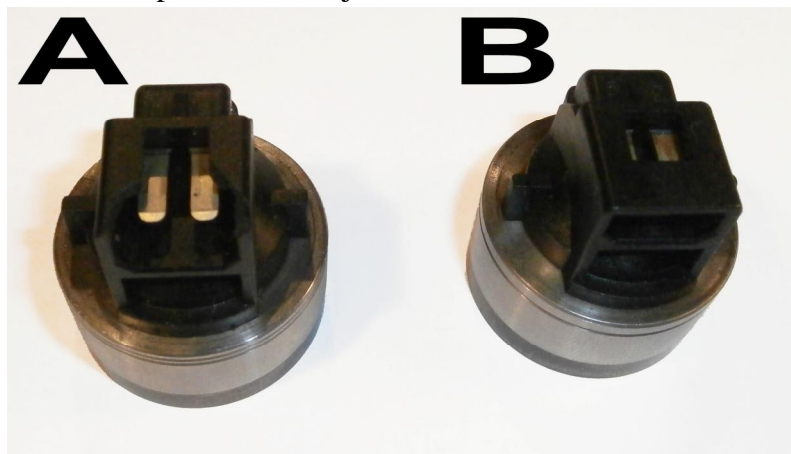


Fig. 8. Damaged (A) and undamaged (B) coil connector.

III. Procedure for the correct installation of unit injectors

The procedure looks as follows. First, clean the direct installation area of the unit injectors and the injector sockets. During assembly use, new, suitable thermal pads and sealing rings. Then the unit injectors are placed in the head after lubricating o-rings with oil. During installation, the assembly dimensions must be observed. Dimensions for individual cylinders, and torques are given in the manufacturer's documentation. Before tightening the screws, press the unit injector into the socket. Then check the condition of the adjustment screws in the rocker arm, which should be replaced if the cooperating surface is worn. In the drivetrain of each injector, set the appropriate clearance using a dial gauge. Unscrew the set screw by the angle required by the manufacturer and secure it. Finally, tighten all connections as recommended by the vehicle manufacturer [6].

IV. Summary

Repairing diesel engine injection systems is a very responsible job and should be carried out by specialized employees who have knowledge about this type of systems. Lack of such knowledge may result in improper engine operation, accelerated wear of components or their complete failure in a short time. During the remanufacturing it is recommended to follow strictly the repair procedures provided by the manufacturer or instructions of regeneration companies with the authorization of the manufacturer.

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Threats at Car Sprayer Job

Tomasz Ognik¹, Michal Solinski²

1. Faculty of Transport, Silesian University of Technology, POLAND, Katowice, Krasińskiego street 8, E-mail: tomaszognik@gmail.com

2. Faculty of Transport, Silesian University of Technology, POLAND, Katowice, Krasińskiego street 8, E-mail: m.solinski@op.pl

Abstract – A car sprayer is an important position in the modern production and car repair processes but this job is very dangerous for health of worker. Threats have been described; moreover, given were ways to protect against them and minimize the consequences of their impact.

Keywords – sprayer, safety, threats, car production, car repair.

Introduction

The preparation and painting of car bodywork is a very important stage of production and repair, because it has a huge impact on durability, the look and safety of the vehicle. This operation is not performed only at the production stage, but also during vehicle repairs and restorations. Unfortunately, due to the technologies used, it is a very harmful and dangerous process for the life and health of the painter. At the car production stage, the negative impact of the painting process is eliminated by the use of painting robots and the automation of this process. However, in paint shops which repair bodies and their components, actions are performed by the employee. Threats related to work in bodyshops are quite a serious problem, because in Poland is a great demand for their services. The reason for this is the growing number of cars in Poland i.e. about 22 mln, and a great number of collisions and road accidents in our country i.e. 32 760 road accidents and 436 469 collisions. These are data for 2017 given by the Polish National Police [2]. For this reason, quite a large number of people work in this type of workshop and is exposed to the risks associated with the exercise of this profession.

I Characteristics of the car sprayer workplace

The paint shop's workplace is factory halls or private car refinish workshops. Both of them must fulfill strictly defined ecological standards. However, it has not eliminated all health risks from work, despite the introduction of constantly improved technology. The necessary condition to ensure safe and beneficial for employees health conditions in the paint shop is adequate ventilation of the workplace. [3]

Air exchange is carried out through a natural ventilation system, which arises as a result of natural forces or forced forces, which is the result of the operation of mechanical devices introducing air into motion.[4]

In the premises of the bodyshop, both general mechanical ventilation is used, which causes the exchange of air in the whole room, as well as local ventilation, causing air exchange only in a specific space of the room. The paint shop must have free access to fire-fighting equipment.[4]

At each factory hall or in a private car refinishing company, it is also necessary to provide fire-fighting instructions and provide first aid resources. The permissible concentration of harmful substances must be observed in the spray booth. Spray booths must be equipped with self-regenerating filters.[4]

II Tasks and duties of a car sprayer

The sprayer should have basic vocational education, preferably with a car specialty. Qualifications can also be obtained through vocational training organized by vocational training institutions. The candidate for this position should be physically fit. This is required because the employee must work in an uncomfortable position, which he often has to maintain for a long time. Another important criterion is the efficiency of the respiratory system, because he resides in an environment where he is exposed to inhalation of dangerous fumes produced during work. The skill that a candidate should have for this position is primarily patience. Without this feature, it is not possible to perform the job correctly (polishing, painting, grinding). High accuracy and diligence are also required to make the end result satisfactory. [5][10]

the paint shop's employee performs such activities as preparing the vehicle for painting i.e. removing individual elements of the vehicle, cleaning of rust and dirt parts which will be varnished and protection against dirt remaining. Next the repaired element is leveled by applying sealing compounds, then it is grinded and polished to obtain a smooth surface. After the preparatory works, the lacquer coatings are applied, and then they are dried or fixed by other techniques. After painting, the employee must reassemble the car. [11]

III Threats at car sprayer job

At each stage of the work, the car sprayer is subjected to the harmful effects of by-products formed during the entire painting process. It is for example: chemical and toxic substances contained in varnishes, primers, solvents and other chemical agents used during the work. Dust and metal particles created during grinding and surface leveling. Appropriate temperature prevailing in the paint chamber, as well as special light required for a good distinction of colors of varnish affect the employee's well-being and physical fatigue. Another aspect is working in forced positions, which causes fatigue and may in the long run cause degeneration of the motor system.[9]

In paint shops, individual stages of work on the body are carried out in different rooms due to the specificity of the preparation and painting process, so the vehicle is transferred between the phases of the process. This action may involve the risk of hitting an employee. In order to prevent this type of events, tables, warning signs and proper layout of workplaces are used.[6]

Substances used to paint bodies are usually flammable. For this reason, in the paint chambers and other areas of the paint shop there is a risk of explosion of chemical fumes and then a fire. In order to reduce the probability of such a phenomenon, ventilation systems are used, as well as employees are properly trained and acquainted with basic safety principles such as the prohibition of using open fire. In the event of a fire, extinguishing agents are located on the premises, for example: fire extinguishers, fire blankets, etc.. Paintshops can be additionally equipped with smoke and sprinkler systems.[6]

The specificity of the refinisher's work means that substances used in technological processes are prepared on a regular basis from substances that are components of the agent used during painting works. Incorrect posture when lifting and moving heavy loads causes various injuries of the musculoskeletal system, such as: disc prolapse, tendon rupture, hernia formation, etc. In order to prevent such threats, the workplace is designed in such a way that the worker is not forced to carry heavy objects for long distances, as well as to lift at high altitudes.[1]

The car sprayer during preparation of the body and during its painting is often forced to work in a forced, unnatural position of the body, which causes increased fatigue, as well as pain in particular parts of the body, including: back, arms and legs. Physical discomfort also affects the feeling of mental fatigue, increased frustration, which results in a deterioration of the quality and

efficiency of the work performed. In order to improve the comfort of work, the station should be designed in such a way that it does not force unnatural position during work. Diversification of elements and their location in the vehicle requires the possibility of adjusting the work station in such a way as to facilitate the activities performed by the employee.[1]

Chemical threats

During works performed by the paint shop employee, various chemical agents are used, such as varnishes, primers, solvents. They are extremely dangerous for the health and life of the person exposed to their effects. Such factors can be divided due to the way they affect the human body, i.e.: toxic, irritant, sensitizing, carcinogenic and mutagenic. The most harmful substances get into the body through the fumes that are inhaled with the air by the worker and further through the respiratory tract and circulatory system are distributed throughout the body.[6]

Toxic factors are in a lots of varnishes. One of the components found in the varnishes is the isocyanate hardener. Prolonged contact with it causes severe and incurable asthma. Another substance contained in varnishes is benzene. It causes headaches and dizziness, general weakness, nausea and vomiting. With high exposure to benzene, visual disturbances, rapid and shallow breathing, tremor of the extremities, arrhythmia, paralysis and coma occur. Exposure to benzene in the long term may result in bone marrow aplasia. Chronic Benzene poisoning results in death after severe marrow aplasia, anemia, necrosis or fat degeneration of the myocardium, liver and adrenal glands. The next chemical is xylene. Xylene pairs are irritating to mucous membranes of the respiratory system. They cause headaches, dizziness, nausea and vomiting. In large quantities, it causes arrhythmias with the risk of ventricular fibrillation, loss of consciousness and death. Xylene in liquid form has an irritating effect, irritates the conjunctiva and causes redness. In chronic poisoning, nervous system disorders, long-term conjunctivitis.[6]

On the impact of irritants the car sprayer is exposed during preparatory work before painting. Particularly when degreasing the surface. For this purpose, various solvents are used which, in contact with the skin, cause it to dry, crack, peel and irritate. In the long term, they can cause burning wounds difficult to treat. Solvent pairs act on the neurological system. There are nausea, dizziness and headaches, as well as general weakness. Conjunctivitis may also appear.[6]

Some varnishes may contain isocyanates and resins that may cause sensitization. Inhaling the pairs of these substances is usually the cause of allergies and asthma. Carcinogenic and mutagenic substances contained in varnishes and solvents are benzene. This substance is associated with liver proteins, bone marrow, kidney, spleen, blood and muscle proteins, causing, among others, leukemia.[6]

In order to prevent the harmful effects of chemical agents and other threats described above, individual protective measures such as masks, gloves, goggles, aprons, paint suits and safety shoes are used (Fig. 1). Varnishing should take place in special paint chambers, where adequate ventilation is ensured.[6]

Physical threats

Slips, trips and falls are among the most common causes of accidents among employees. The risk of falling is most likely when moving on slippery or uneven surfaces. The most frequently mentioned are two types of falls: falls due to tripping, falls due to slipping. The stumble is related to the distance between the ground and the foot surface during the step phase, while the slip phenomenon is defined as a sudden loss of adhesion, leading to the slippage of the foot on the ground. This is caused by a smaller value of the coefficient of friction than is required. The formation of slips and trips is associated primarily with the quality of the substrate, but also with human factors such as age, weight, mobility and visual fitness.[6]



Fig.1. Personal protective equipment

1-mask, 2-glasses, 3-gloves, 4-overalls, 5-protective footwear

A major threat to the health of car painters in the bodyshop is the high noise level resulting from the need to use pneumatic systems with compressors, blowers and fans used in the booth equipment. People who are under the influence of noise for a long time are exposed to frequent headaches and fatigue.[6]

Lighting of workshop rooms is one of the most important factors affecting work efficiency. Natural lighting is definitely more beneficial than assisted lighting, which must be artificial (electric) lighting. Properly selected light color and hue causes less fatigue in the eyes, which is of great importance when choosing appropriate shades of car paints.[6]

When using shortwave infrared radiators for drying paint coatings, the maximum permissible irradiation of eyes and skin should be respected. Radiation can cause an increase in skin temperature and, consequently, burns. Very often, as a criterion of risk, thermal damage to the skin and conjunctiva, lens and retina is prevented.[6]

Static electricity and the phenomenon of electrification are the basis of the coating production process in powder coating plants. The causes of the formation and accumulation of electrostatic charges as well as improper methods of paint shop operation cause that static electricity is also a threat factor.[6]

There is a high risk of fire or electric shock in the premises of the painting facility. The influence of electric current on the human body can be direct when an electric current passes through its body, or indirect, causing various thermal or mechanical injuries arising without the flow of current through the body. Direct action causes many physical, chemical and biological changes in the body, disrupts the nervous system, so it can cause muscle cramps, stop breathing, blood circulation disorders, sight, hearing and balance disorders, or loss of consciousness. Electric shock may occur after human body contact with metal parts that are not normally energized, i.e. they are separated from the electrical circuit by insulation.

Danger of electric shock exists in all electrical devices where the operating voltages exceed the values of safe voltages (Table 1).[7]

Table 1.

Safety voltage		
Environmental conditions	Amplitude current [V]	Direct current [V]
normalne	50	120
szczególne	25	60

The indirect action of an electric current causes various types of injuries that arise without the flow of current through the body. One of the indirect effects of electricity on a man is an electric arc burn or damage to the eyes due to the high brightness of the electric arc. [7]

During the preparation work before painting a lot of dust is created, especially when sanding the body and sanding the surface on which additional material was applied in order to compensate for unevenness. The particles of the ground material and the abrasive get into the respiratory system causing in the long term pneumoconiosis. The visual system is also exposed because dust and debris can cause irritation and mechanical eye damage.[8]

IV Proposals of corrective actions for identified threats.

In order to prevent threats and the impact of harmful factors in the workplace of a car varnish, prophylactic and corrective actions should be used. To minimize the risk of explosion and fire, do not smoke in the paint booth as well as in the vicinity of flammable substances, use open fire and use electric heat sources. Any fault and malfunction of the ventilation system should be reported to the supervisor and repaired as soon as possible. Technical inspections of paint chambers and other devices should be carried out systematically, and also follow the attached technical and operational documentation for individual machines and devices. The measurement of harmful factors should be performed systematically, mainly noise, vibrations, dust, as well as chemical factors. In order to prevent accidents with chemical substances, all packaging with chemical substances must have appropriate and clearly visible markings. Another way to reduce the risks is to put paints and varnishes containing less harmful substances into use. The employee must be aware of the risks to which he is exposed during work, therefore he should be properly trained in the field of occupational health and safety and must have permanent access to the material characteristics sheets used at his workplace. He must be equipped with personal protective equipment, but also trained how to properly use it and how important it is for his health and life.[1]

Conclusion

There are many threats in the work of a car painter that are dangerous to the employee's life and health. Some of the most common threats include overloads of the musculoskeletal system, forced, static body position and industrial dust. In contrast, chemical hazards cause the most serious effects on workers' health and life. Actions aimed at limiting their impact are very important due to the large number of people working in such facilities.

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Colour reproduction with ecological flexographic inks

Marta Gajadhur, Paweł Skowroński

Department of Printing Technologies, Institute of Mechanics and Printing, Faculty of Production Engineering,
Warsaw University of Technology, POLAND, 00-217 Warsaw, 2 Konwiktorska Street,
e-mail: m.gajadhur@wip.pw.edu.pl

The purpose of the study was to examine the colour reproduction with ecological flexographic inks. The process colour inks such as: biodegradable and waterbase were used in the research. The laboratory prints were made with the use of Flexiproof 100 device to simulate the machine prints. Spectrophotometric measurements were made on the printouts and the collected data was used to generate ICC profiles. The colour gamuts were visualized on the basis of ICC profiles and Gamutvision software. The 3D and 2D visualizations were used in the evaluation.

Key words: Colour reproduction, ecological inks, colour gamut, ICC profiles, flexographic printing

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**7th INTERNATIONAL ACADEMIC CONFERENCE
“CHEMISTRY & CHEMICAL TECHNOLOGY 2018”
(CCT-2018)**

Investigation of Mechanical Properties of Composites Filled with Modified Hydroxyapatite

Denis Kalin, Maksym Chobit, Viktor Tokarev

Institute of Chemistry and Chemical Technologies, Lviv Polytechnic National University, UKRAINE, Lviv, 3/4 pl. Sviatoho Yura, e-mail: pochta.kalin.d@gmail.com

Abstract – The purpose of this work was to increase the compatibility of composite components by modifying the surface of hydroxyapatite particles. Oleic acid and peroxide copolymer VEP-MA were used as modifiers. It was shown that modified composites have higher impact viscosity and tensile strengths.

Keywords – modification, hydroxyapatite, composite.

In our days, the orthopedics and dentistry industry is interested in finding new biocompatible materials with high mechanical properties, which capable of interacting with bone tissues. Dispersed hydroxyapatite (HA) has a very high biocompatibility, but is not characterized by high mechanical strength [1]. The great solution to this problem is use polymer composite materials based on HA. However, this is complicated because of the significant difference in surface energy, and hence the poor compatibility of the components. One of the ways to improve the compatibility of composite components is modify the surface of the filler particles.

To solve this problem, we used next modifier: oleic acid (OA) and peroxide copolymer VEP-MA to modify the surface of hydroxyapatite. Synthesis of hydroxyapatite passed through the reaction:



Synthesis of peroxide HA was performed according to next method. A sample of the peroxide modifier was pre-dissolved in a solution of triammonium phosphate. To a solution of CaCl_2 at 60 °C with vigorous stirring, was added dropwise a solution of $(\text{NH}_4)_3\text{PO}_4$ and VEP-MA, after the reaction mixture was thermostated with stirring for 7 hours. At the end, the reaction mixture was filtered and washed three times with distilled water. The resulting precipitate was dried at room temperature to constant weight.

Modification of mineral filler modifiers was carried out in a solution of organic solvent (ethyl acetate), within 2 hours. Upon completion of the modification, the filler was filtered and dried at room temperature to constant weight. The polyacrylamide-based composite was prepared as follows: an aqueous solution of acrylamide was prepared, dispersed HA added to the solution, polymerized acrylamide at 60 °C in the presence of HA and initiator of potassium peroxide sulfate, the resulting composite was dried to constant mass. The polyethylene composite was prepared as follows: a mechanical mixture of crushed polyethylene and disperse

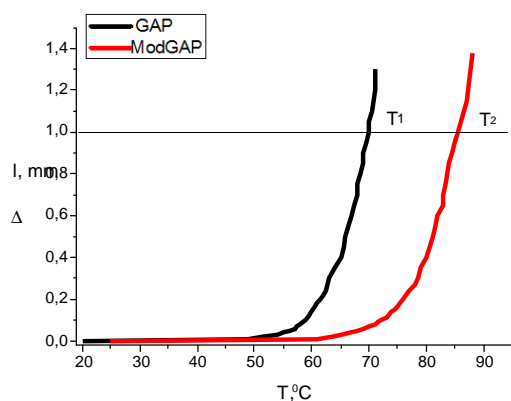


Fig.1. Thermomechanical curves of composites based on polyacrylamide filled with HA (degree of filling = 40% by mass) and HA (degree of filling = 40% by mass) modified with

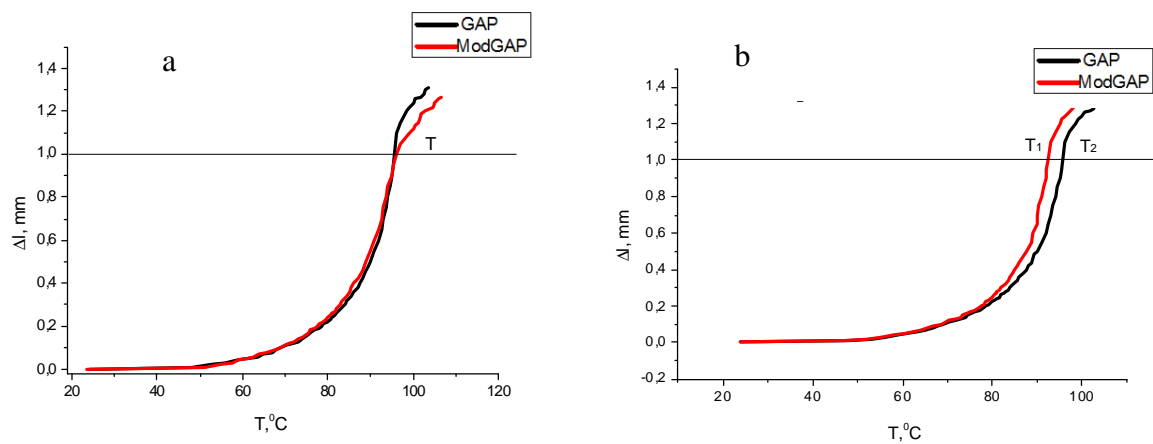


Fig.2. Thermomechanical curves of composite polyethylene filled with HA ((degree of filling = 40% by mass): a) HA which modified oleic acid (degree of modification = 2% by mass) $T = 97^{\circ}\text{C}$; b) VEP-MA (degree of modification = 2% by mass) $T_1 = 92^{\circ}\text{C}$, $T_2 = 96^{\circ}\text{C}$

hydroxyapatite was made, the mixture was filled into a mold and sintered at 180°C for 4 hours and then remained pressed to a constant temperature. To characterize the composites obtained, studies were carried out on thermomechanical properties, shock viscosity and tensile strength.

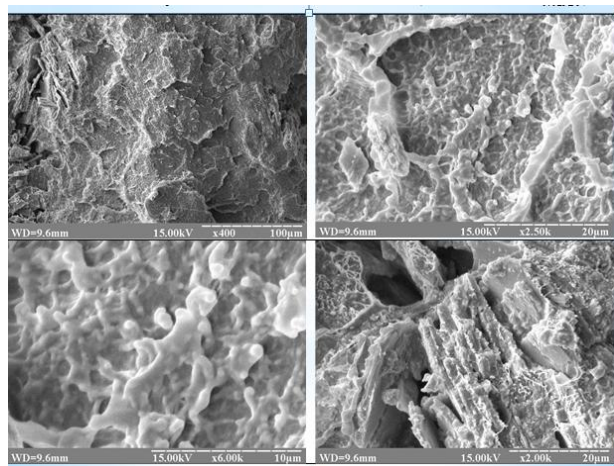


Fig.3. Microphotographs of the fracture surface of a HA-filled polyethylene composite (degree of filling = 20% by mass) which modified with oleic acid (degree of modification = 2% by mass).

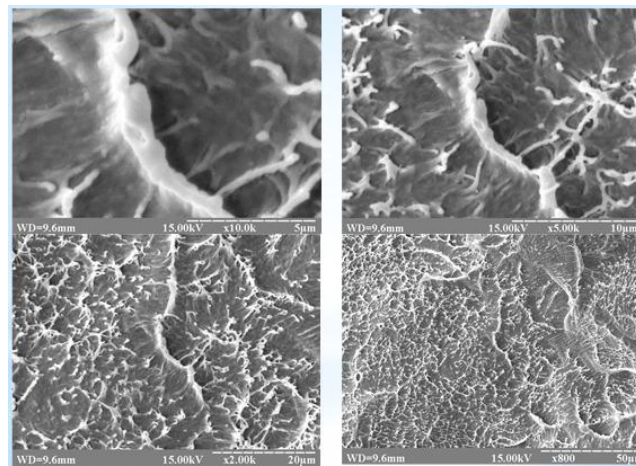


Fig. 4. Microphotographs of the fracture surface of a HA-filled polyethylene composite (degree of filling = 20% by mass) which modified VEP-MA (degree of modification = 2% by mass)

As a result of the conducted studies it was shown that the modification of hydroxyapatite with oleic acid and peroxide modifier increases the mechanical properties of the composites obtained. Composites based on polyacrylamide filled with HA (modified with oleic acid) have an increase of 30% impact strength and an increase in temperature of 20°C . Polyethylene samples filled modified HA (OA and VEP-MA) showed no significant changes in thermomechanical properties. At the same time, they demonstrated a significant increase ($> 50\%$) of the tensile strength.

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The Effect of Hydrothermal Treatment of Silica-based Catalysts on their Efficiency in Acrylic Acid Synthesis via Oxidative Condensation of Methanol with Acetic Acid

Iryna Shpyrka¹, Roman Nebesnyi¹, Oksana Orobchuk¹, Volodymyr Ivasiv¹, Svitlana Khalameida², Volodymyr Sydorchuk²

1. Technology of Organic Product Department, Lviv Polytechnic National University, UKRAINE, Lviv, S.

Bandery street 12, E-mail: iryna.i.shpyrka@lpnu.ua

2. Institute for Sorption and Problems of Endoecology of NAS of Ukraine, UKRAINE, Kyiv, Naumova street 13, E-mail: bilychi@ukr.net

Abstract – *The effect of modification of the catalyst of oxidative condensation of methanol with acetic acid on acrylic acid and methyl acrylate selectivity and yield was determined. Hydrothermal treatment of the catalyst has been shown to significantly improve its catalytic properties during the oxidative condensation of acetic acid with methanol compared to the untreated catalyst. The maximum total acrylates yield (54.7 %) was obtained on the catalyst modified at 150 °C.*

Keywords – acrylic acid, methyl acrylate, hydrothermal treatment, heterogeneous catalysis, oxidative condensation.

Introduction

Acrylic acid (AA) and methyl acrylate (MA) are valuable substances in the industry of organic synthesis, the total world production of which amounts to over 6 million tons annually [1]. One of the most promising methods of AA synthesis, which is of great interest to scientists, is based on formaldehyde (FA) and acetic acid (AcA) [2]. It is well known that in the industry FA and AcA are synthesized from methanol [3], produced from the synthesis gas, which in turn is produced from methane or coal. Considering a lot more abundant world reserves of methane and coal as compared to oil, use of these types of raw materials for organic synthesis is more promising.

The AA production by this method comprises of many stages, which can be reduced by combining methanol to formaldehyde oxidation stage with subsequent aldol condensation of formaldehyde with acetic acid stage on one catalyst in one reactor producing acrylic acid and methyl acrylate. However, currently there are no known catalysts that allow to efficiently produce the acrylic acid by the oxidative condensation of methanol with acetic acid.

It is well known that specific surface and porous structure of solid catalysts has a great influence on their catalytic properties in the processes of condensation carbonyl compounds. It was established that the preparation of catalysts has a essential effect on its physico-chemical properties, and therefore on catalytic properties in chemical reactions [4].

From previous studies[5], it is known that the catalytic system of the B-P-W-V-Ox is effective in the process of condensation of acetic acid with formaldehyde with the formation of acrylic acid and the porous structure of the catalysts has significant effect on the reaction parameters [6].

So, we decided to take this catalytic system as the base, modify it by hydrothermal treatment and test its efficiency in the process of oxidative condensation of AcA with methanol to AA and MA.

Experimental

To study the oxidative condensation process of AcA with methanol, catalytic systems were prepared based on mixtures of oxides of boron, phosphorus, vanadium and tungsten. First, a

support, such as silica gel of the KSKG brand (with a specific surface of 365 m²/g), was submitted to hydrothermal treatment (HTT) in the gas phase in temperature range 100 – 250 °C (K₁₋₇) in a steps of 25 °C. Atomic ratio of components in catalyst B:P:W:V=3:1:0.18:0.12. The catalyst properties were investigated in a flow type reactor with a fixed catalyst bed, at the process temperature 400 °C, residence time 8 s and molar ratio of M:AcA=1,2:1.

Results and Discussion

The effect of the temperature of the HTT on the total selectivity of AA and MA and the total yield of AK and MA (Fig. 1) has been determined. As can be seen from fig. 1, the total selectivity of AA and MA decreases with increasing temperature of the HTT, and the total yield of AA and MA increases up to a temperature of 150 °C, and further increase in the temperature of the HTT leads to a gradual decrease in the total yield of AK and MA. Best results were obtained on the catalyst based on the support with HTT temperature 150 °C – acetic acid conversion – 68,2 %, total selectivity of AA and MA 80,1 % and total yield of AA and MA 54,7 % under optimum conditions of the process temperature 400 °C and residence time 8 s.

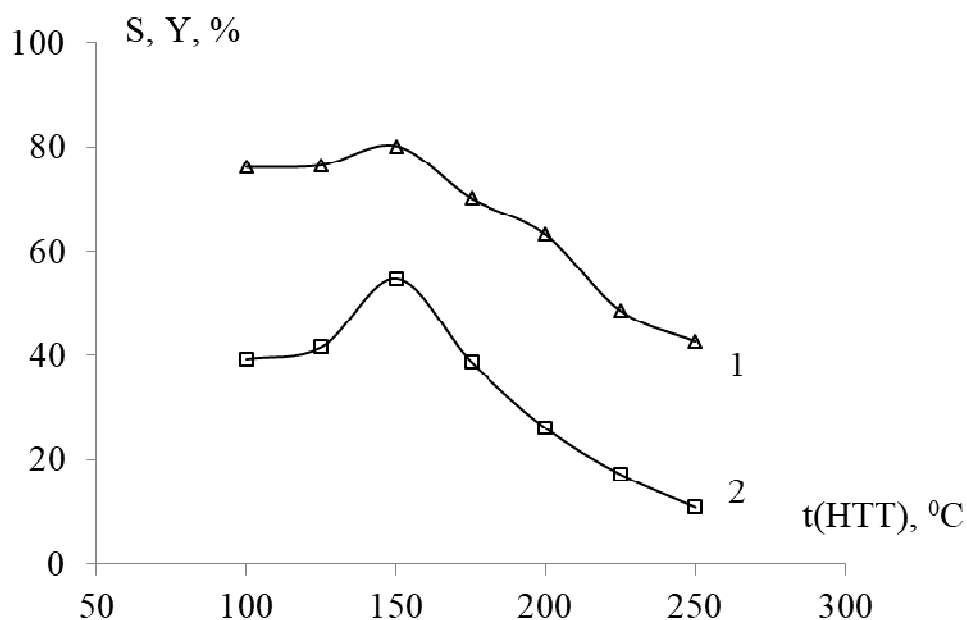


Fig.1. The effect of the support HTT temperature on the total selectivity of AA and MA (1) and the total yield of AA and MA (2). Residence time 8 s; temperature of the process 400 °C.

On the catalyst with untreated support maximum total yield of acrylates is 34,9 % with a total selectivity 76,1 % and AcA conversion of 47,9 %. Comparing the results obtained on a catalysts with treated and untreated support shows that HTT of the catalyst support can significantly improve its catalytic properties in the oxidative condensation of AcA with methanol in AA and MA (Fig. 2).

Conclusion

The silica gel of KSKG brand was hydrothermally treated and used as support for B₂O₃-P₂O₅-WO₃-V₂O₅ catalytic system with the atomic ratio of components B:P:W:V=3:1:0.18:0.12. It was found that the best catalyst for the process of acrylic acid and methyl acrylate synthesis by oxidative condensation of AcA with methanol is the catalyst with support treated with HTT at temperature 150 °C. Under the optimum conditions of the process temperature 400 °C and residence time 8 s it is possible to obtain acrylic acid and methyl acrylate with 54,7 % total yield

and 80,1 % total selectivity, at acetic acid conversion 68,2 %. It was confirmed that hydrothermal treatment of the catalyst's support can significantly improve its catalytic properties in the oxidative condensation of AcA with methanol in AA and MA compared to the catalyst on untreated support. Therefore the hydrothermal treatment of the catalyst's support can be considered as an instrument to control selectivity of the oxidative condensation of methanol with acetic acid to acrylic acid and methyl acrylate.

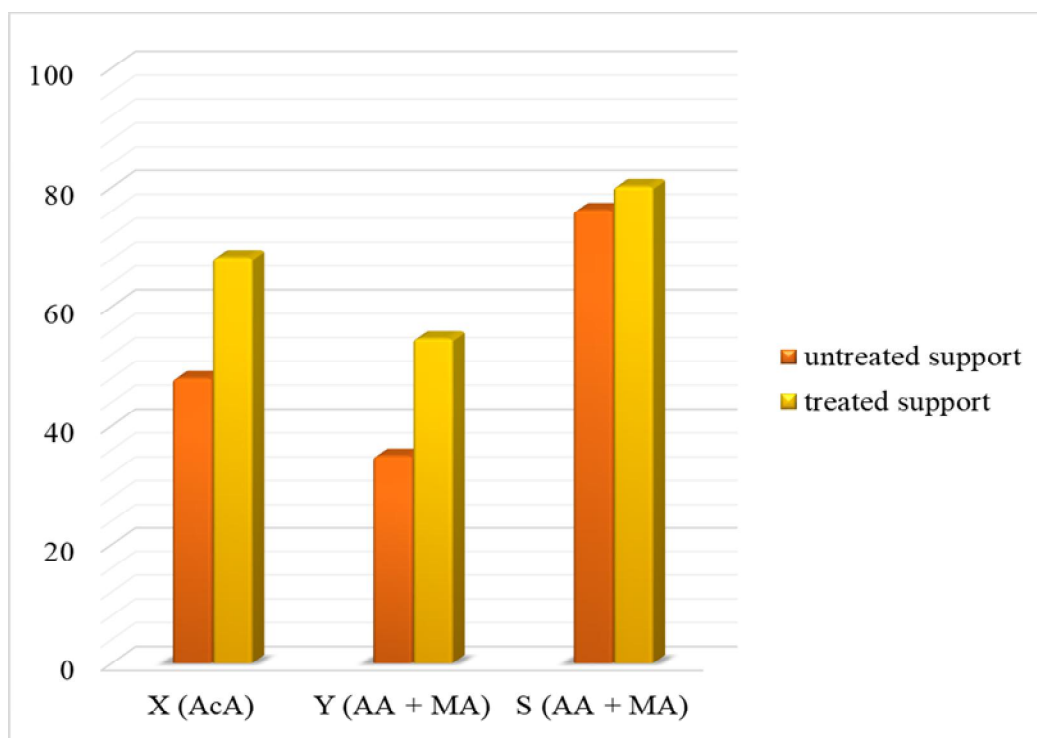


Fig.2. Comparison of catalytic activity under optimal conditions on the catalysts with treated and untreated supports in oxidative condensation of methanol with acetic acid.

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The Expression of Pleiotropic and Pathway-Specific Regulators of Secondary Metabolism in Clorobiocin Producer *Streptomyces Roseochromogenes* NRRL3504

Sofiia Melnyk, Bohdan Ostash

Department Genetics and Biotechnology, Biology Faculty, Ivan Franko National University of Lviv,
UKRAINE, Lviv, Hrushevskoho street 4, E-mail: sofiamelnyk@gmail.com

Abstract – Clorobiocin is potent aminocoumarin against resistant pathogens. We describe attempts to improve clorobiocin production via expression of pleiotropic (*adpA*) and pathway-specific regulatory (*cloG*, *novG*) genes in *Streptomyces roseochromogenes* NRRL3504. Positive influence of *adpA* on clorobiocin production was revealed. The effects of *cloG* and *novG* are under investigation.

Keywords – Streptomyces, clorobiocin, AdpA, StrR-like regulators, gyrase inhibitors.

Introduction

Streptomyces roseochromogenes NRRL3504 produces an aminocoumarin antibiotic clorobiocin. This antibiotic inhibits bacterial topoisomerases type II (or DNA gyrases) and topoisomerase IV [1]. The dual mechanism of action might prove beneficial in slowing the development of resistance against this antibacterial compound, so there is an interest in the development of new drugs based on clorobiocin. The level of clorobiocin synthesis by the strain NRRL3504 is relatively low, so there is a need to generate its overproducers. This would greatly accelerate the study of the properties of the antibiotic and its transformation into a medical product. The synthesis of clorobiocin in *S. roseochromogenes* is controlled by the positive path-specific regulator CloG [2]. The orthologue of *cloG* in *S. spheroides*, a producer of the aminocoumarin antibiotic novobiocin, is *novG*, the overexpression of which leads to the significant increase of novobiocin production [3]. It is also known that the global transcription regulator AdpA often participates in positive regulation of secondary metabolites [4]. Therefore, the introduction of additional copies of the *cloG*, *novG* or *adpA* into the strain-producer of clorobiocin might have an effect on the synthesis level of the latter.

Results and Discussion

We have constructed a number of strains containing additional copies of the above-mentioned regulatory genes. The *cloG*, *novG*, *adpA* were cloned into a vector pmoeE5script under the control of the promoter of hexose isomerase gene *moeE5*. Thus, the plasmids pSM2097, pSM2025, pOOB95d, respectively, were constructed. Also, previously described plasmid pOOB92a, in which the *adpA* was controlled by the strong constitutive promoter *ermEp*, was used.

The conjugative transfer of these plasmids from the F⁺ strain *E. coli* WM6026 to strain *S. roseochromogenes* NRRL3504 was carried out. The recipient was grown in a liquid media. In a 50 ml flask, 8 ml of SG1 or TSB medium and a 1 cm² of NRRL 3504, grown for 4-7 days in oatmeal, were added. The flask was incubated on a shaker (200 rpm) at 30 °C for 2-3 days. 100 µl of the resulting culture was transferred to a new flask with 8 ml of SG1 or TSB medium and grown for 14-19 hours. 1 ml of the mixture was centrifuged, the supernatant was poured out and resuspended in 300 µl of TSB. After that, the donor cells (from 1/2 cup) were added to the recipient, mixed and plated on the dishes (+25 mM MgCl₂). The dishes were incubated at 30 °C and were flooded with aqueous solution of apramycin (for selection of transconjugants) and phosphomycin (to kill the donor cells) after 24 h. The growth of transconjugants was observed after 72h of selection. For the comparison of the antibiotic activity of transconjugants and parent

strain they were grown in a liquid medium of GYM, chlorobiocin was extracted using ethyl acetate from a whole fermentation medium. Antibiotic activity of the extracts was detected by the diffusion of antibiotics from disks into agar. The results indicate that the level of antibiotic activity of some recombinant clones containing the *adpA* of *S. ghanaensis* ATCC14672 is higher than that of the parent strain. An analysis of the antibiotic activity of *cloG*⁺ and *novG*⁺ strains is currently under investigation.

We have used liquid chromatography coupled to mass spectrometry to monitor secondary metabolites in culture extracts of NRRL3504 and recombinant strains (MORT1, SM3). In the wild type strain, clorobiocin (695.20 Da, [M-H]⁻ ion) was revealed with Rt 12.12 min as a dominant product (Fig.1). In MORT1 and SM3 strains clorobiocin mass peak was revealed at a approximately the same retention time. Hence, all the analyzed strains indeed produce clorobiocin, and their quantitative analysis is underway in our laboratory.

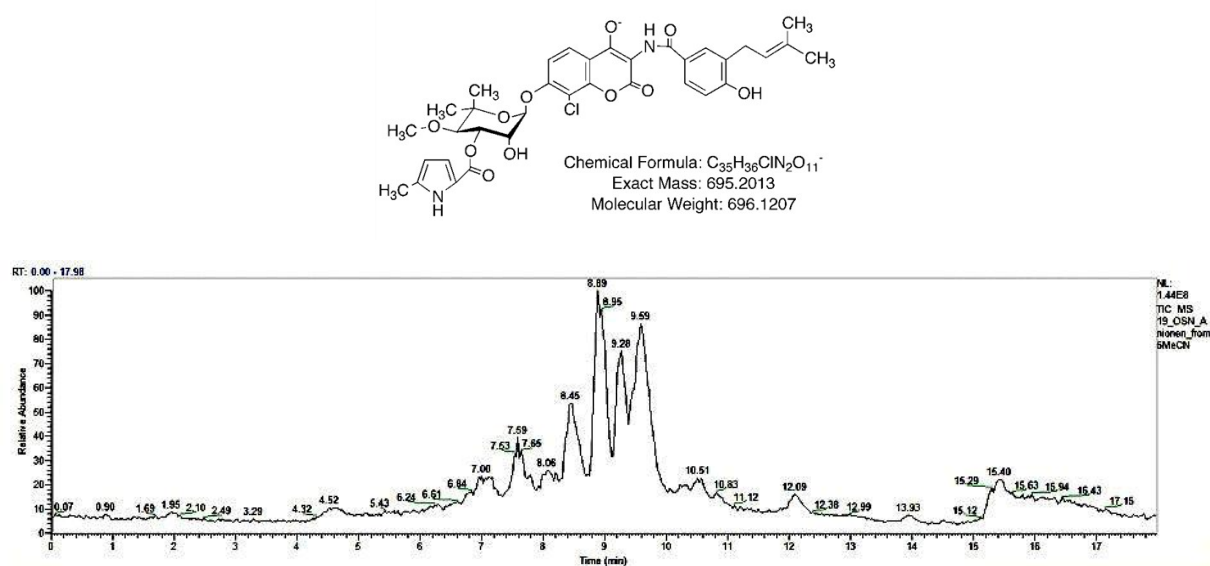


Fig.1. Chemical formula and results of mass spectrometry of clorobiocin (695.20 Da, [M-H]⁻ ion).

Conclusion

A number of strains carrying additional copies of genes *cloG*, *novG* and *adpA* were constructed. Experiments have showed positive influence of *adpA* on the biosynthesis of clorobiocin. The effects of *cloG* and *novG* are under investigation.

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Genes for Morphogenetic Proteins of Chaplin and Rodlin Families in Landomycin Producer *Streptomyces cyanogenus* S136

Pavlo Hrab, Oleksandr Yushchuk, Iryna Ostash, Bohdan Ostash

Department Genetics and Biotechnology, Biology Faculty, Ivan Franko National University of Lviv, UKRAINE, Lviv, Hrushevskoho 4, e-mail: pavlo.hrab@gmail.com

Abstract – *Streptomyces cyanogenus* S136 attracts attention due to rich secondary metabolism and aberrant morphogenesis. LC-MS analysis of S136 showed the production of novel compounds. Sets of genes for small morphogenetic proteins, chaplins and rodlin, are reduced in S136. We revealed rather diverse pattern of their location and abundance in *Streptomyces* clade.

Keywords – *Streptomyces*, *S. cyanogenus*, antibiotics, landomycin, phylogenetics, hydrophobins, rodlin, chaplin.

Introduction

Streptomyces cyanogenus S136 produces landomycin A (LaA), an angucycline compound exhibiting strong antiproliferative properties. There is an unmet need for gram amounts of LaA for preclinical trials, fueling the S136 strain improvement attempts. We showed recently that expression of heterologous pleiotropic regulatory gene *adpA* in S136 restores aerial hyphae formation and leads to increased LaA titers [1]. This result prompted us to pursue two lines of investigations. First, we explored the metabolome of S136 in order to see what kind of compound it produces besides LaA. Second, we used genomic sequence of S136 to catalogue all genes for morphogenesis, which in its turn led to a detailed scrutiny of the genes for chaplins and rodlin, small hydrophobic proteins involved in aerial hyphae formation.

Results and Discussion

S. cyanogenus strains were grown in liquid medium GYM, and butanol extracts of the supernatant were subjected to LC-MS analysis. We revealed a number of peaks of unknown chemical nature, implying that this strain might be source of novel compounds. In *adpA*⁺ strain extracts we revealed new mass-peaks absent in the parent (Fig. 1). Apparently, *AdpA* not only enhances LaA biosynthesis, but also could activate the expression of cryptic biosynthetic gene clusters.

Chaplin (*chp*) and rodlin (*rdl*) genes were collected from *S. coelicolor* M145, where they form operon *rdlB-rdIA-chpD-chpA*. A null hypothesis would be that each streptomycete genome carries identical operon. To verify this assumption, a large-scale phylogenetic analysis of *chp-rdl* families in *Streptomyces* was undertaken using *S. coelicolor* genes as an initial query. In contrast to the initial idea, the *chp* and *rdl* genes show significant diversity both in number of paralogs and their location. Genes *chpD-chpA* and *rdlA* were cloned from S136 into integrative expression vectors; their genetic analysis is underway.

Conclusion

S. cyanogenus possesses rich secondary metabolism and streamlined set of chaplin-rodlin genes. Deficiency in *chp* or *rdl* genes may underlie the inability of S136 to realize the transition from substrate to aerial mycelium stage of cell cycle. In the same time, importance of morphogenetic proteins for secondary metabolism remains to be studied.

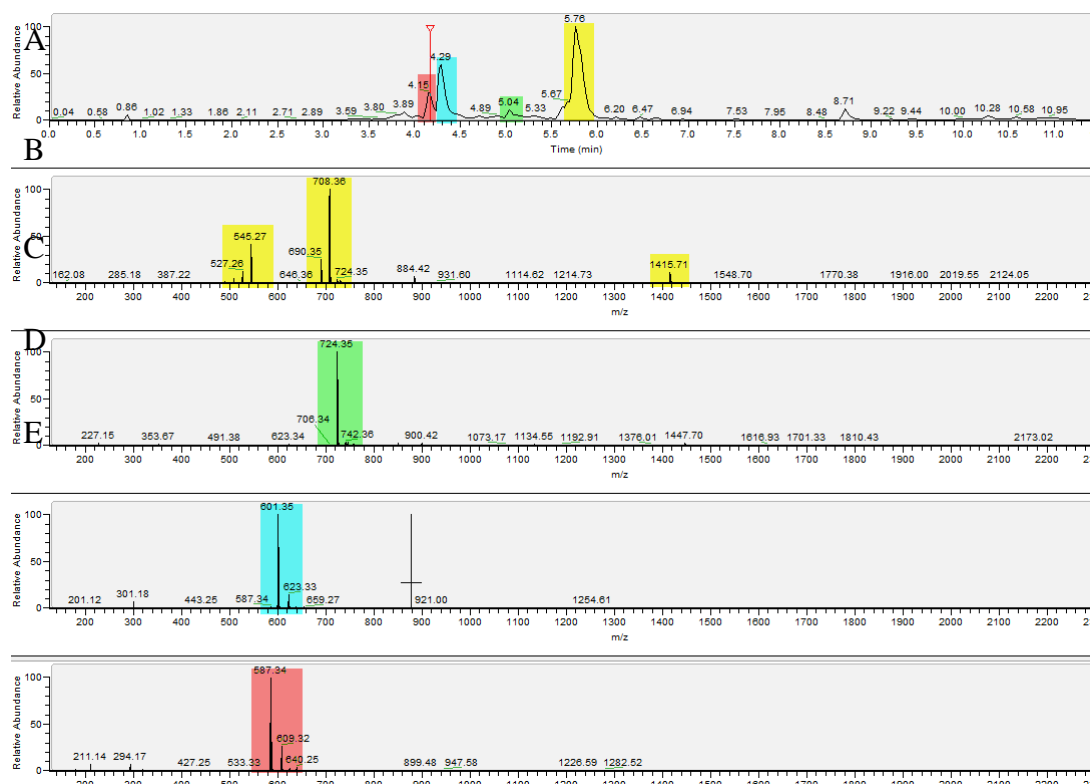


Fig. 1. Novel mass-peaks (highlighted with color) revealed in the butanol extracts of the *adpA*-expressing strain that were absent in the extracts of the parental (S136) strain. Lanes: **A**, overall trace chromatogram; **B-E**, extracted ion peaks (positive ionization). LC-MS conditions are described in [2].

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Effect of Phenol-Cresol-Formaldehyde Resin on Adhesive Properties of Road Bitumen

Yuriy Demchuk¹, Volodymyr Gunka¹, Iurii Sidun²
Serhiy Pyshyev¹, Yuriy Lypko¹

1. Department of Chemical Technology of Oil and Gas Processing, Lviv Polytechnic National University, UKRAINE, Lviv, S.Bandery street 12, E-mail: yuriy_demchuk@ukr.net

2. Department of Building and Environmental Engineering, Lviv Polytechnic National University, UKRAINE, Lviv, S.Bandery street 12, E-mail: siduniurii@gmail.com

Abstract – *The phenol-cresol-formaldehyde resin (PhCR-F) obtained from phenolic fraction of coal tar has been synthesized via the polycondensation method of “raw” phenols with formaldehyde. The modification of road bitumen by this resin was carried out. PhCR-F in different concentrations was found to be effectively used as a modifier of road bitumen. It was shown that PhCR-F is an effective adhesive additive for road bitumen.*

Keywords – bitumen, adhesion, modifier, phenol-cresol-formaldehyde resin.

Introduction

The main reasons for the destruction of road coatings are the increase in traffic volume, the growth of freight transport volumes, the masses of vehicles, axial load, as well as the weather impact. Today, traditional asphalt concrete based on unmodified bitumen is not able to provide the necessary physico-mechanical properties of coatings and their durability under existing density of traffic [1,2].

On the basis of previous studies [1,2] it was established that phenol-formaldehyde resins (PhFR) may be the effective modifiers of bitumen. But these resins, which are produced from pure phenol, are not widely used as polymer modifiers first of all due to their high cost. On the other hand, the phenolic fraction containing about 65 % of phenols and cresols is one of the products of coking process. Its cost is by 35–40 times lower than a pure phenol cost [2]. Therefore, this work is devoted to the detailed study of the possible improving the bitumen adhesion properties with the help of PhFR, obtained from cheap raw materials – the phenolic fraction of coal tar. The changes in colloidal structure of bitumen after adding PhFR, and thus the changes in the rheological properties, have been examined as well.

Experimental

The phenolic fraction of coal tar was withdrawn at JSC “Zaporizhkoks” (Ukraine).

To obtain the modified bitumen, we used the oxidized bitumen BND 60/90 produced by PJSC “Transnational financial and industrial oil company Ukrtatnafta” (Kremenchuk, Ukraine).

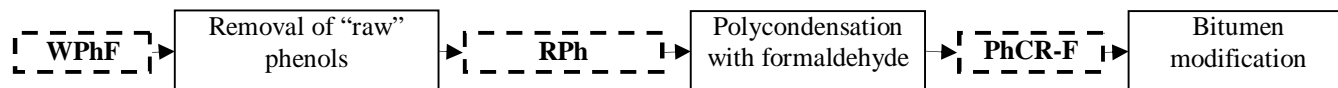


Fig.1. Scheme of researches: WPhF – wide phenolic fraction; RPh – “raw” (technical) phenols; PhCR-F – phenol-cresol-formaldehyde resin.

Novolac phenol-cresol-formaldehyde resin was obtained according to the scheme given in Fig.1 by the method of formaldehyde condensation polymerization with the “raw” phenols extracted from these fractions. As recommended by [3], the obtaining of novolac phenol-formaldehyde resins requires maintaining the mole ratio of phenol to formaldehyde at 1.12–1.42, while for novolac cresol-formaldehyde resin it should equal 2.27. Considering that the “raw” phenols that were derived from the phenolic fraction of coal tar, contain both phenols and cresols

at various ratios, the synthesis was carried out at the molar ratio “raw” phenols:formaldehydes equal to 1.42.

Results

In accordance with industrial requirements the amount of modifier approx. 1 wt % is technically and economically feasible; so we studied bitumen modification adding 1 wt % of PhCR-F and compared the results with previously obtained. Characteristics of the obtained PMB are given in Table 1

Table 1

Physico-mechanical parameters of pure and modified bitumen

Bitumen	Parameters							
	T_s , K	P_{298} , 10^{-4} m	D_{298} , $m \cdot 10^{-2}$	T_b , K	PR, K	I_p	Adhesion to	
							crushed stone, points	glass, %
BND 60/90	319	70	63	255	337	-1.5	3	33
BND 60/90 + PhCR-F (1.0 wt %)	321	68	46	255	339	-0.9	5	87
BND 60/90 + PhCR-F (2.4 wt %)	322	61	25	255	340	-1.0	5	94

The modification of BND 60/90 bitumen by different amount of modifier slightly increases the softening point, *i.e.* increases its heat resistance, reduces penetration and ductility, increases its hardness. However, the main effect of PhCR-F is a significant increase in bitumen adhesion to the crushed stone and glass (Fig. 2). The adhesion to crushed stone for BND 60/90 + PhCR-F (1.0 wt %) increases from 3 to 5 points, and the adhesion to glass – by more than 2.6 times. With increasing amount of PhCR-F additive (2.4 wt %), the value of adhesion to glass is somewhat higher (94 % *vs.* 87 %). Taking into account all mentioned above, the modifier amount of 1.0 wt % was acceptable for further investigations.

Conclusion

“Raw” phenols were extracted from the phenolic fraction of coal tar with the yield of 32.3 wt %. Phenol-cresol-formaldehyde resin (yield is 29.65 wt % relative to phenolic fraction) was synthesized *via* polycondensation of “raw” phenols with formaldehyde. The synthesized resin was used to modify oxidized road bitumen. The addition of modifier slightly increases the softening point of bitumen and significantly increases the adhesion to crushed stone and glass. The increase in modifier amount from 1 to 2.4 wt % does not significantly affect the adhesion, therefore the content of 1.0 wt % should be considered as an optimum one.

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Production of Fuel Briquettes from Waste Biomass Organic Agriculture

Khalaniia Oksana, Zoriana Hnativ, Volodymyr Atamaniuk

Department of Chemical Engineering, Lviv Polytechnic National University, UKRAINE, Lviv, 12 Bandera street,
E-mail: oksanka1092@ukr.net

Abstract - *The most energy-consuming process in technology produced by solid fuels is drying. At present, most enterprises use outdated and inefficient drying equipment, resulting in a high cost of fuel briquettes, and their manufacture and sale is a low-income business. Therefore, agricultural waste is used very limitedly and inefficiently.*

Keywords – drying, briquettes, biomass, filtration drying, corn stalks.

Introduction

The biggest problem with the use of agricultural waste is the seasonal nature of their formation and initial humidity, which is much higher than it is necessary for the production of fuel briquettes. Of course this waste can be burned their natural moisture, however, with lower calorific value of the fuel is low, and the available moisture in the furnace gases adversely affect the solid fuel boilers, both in terms of their mechanical loading, and their intense corrosion in ultimately this type of fuel is ineffective, and in some cases economically disadvantageous. However, in order to prepare biomass for the production of fuel briquettes, it must be ground and dried to 6 to 12% humidity.

Presentation of the Main Material

It is known that filtration drying [1,2] is one of the most intensive methods, and its application to drying agricultural waste will increase the competitive attractiveness of fuel briquettes production. The research is aimed at reducing the specific energy costs and environmental impact. One of the most effective drying methods is filtration drying. The subject of the study was filtration drying of crushed corn stalks. The advantages of this method are that the process takes place in a stationary layer, through which the thermal agent is filtered, and as a result, the presence of mechanical displacement of moisture, the maximum saturation of the thermal agent in the vapor, high coefficients of heat and mass return. For high-efficiency drying has been investigated and the optimum parameters such as temperature, heat flow agent, grain size and height of the layer of raw materials, since the change of each of which will change the drying time and the cost of thermal energy.

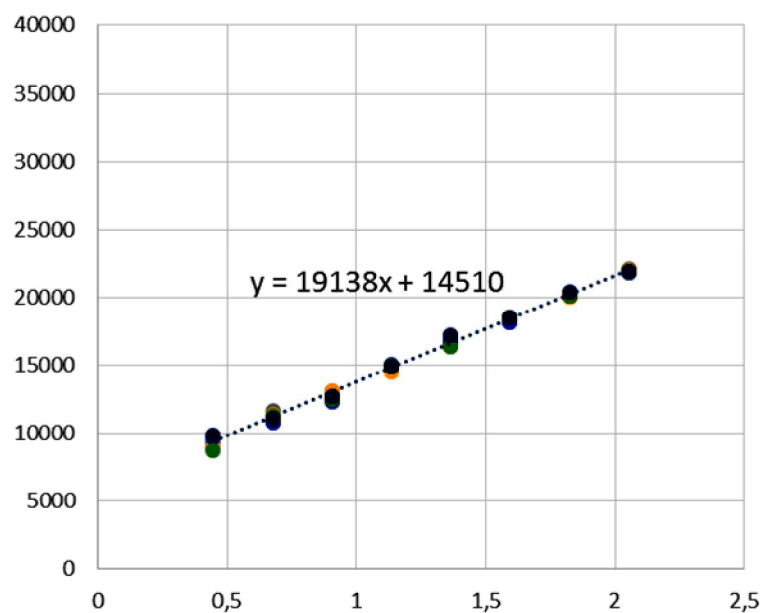
In the course of experimental studies, the hydrodynamics of the filtration of the thermal agent through a layer of crushed corn stalks was determined. To predict the loss of pressure in the stationary layer of crushed biomass, we used the modified binary Ergun equation, for which the unknown coefficients are A^* and B^* . To determine the coefficients A^* and B^* , the experimental results of pressure losses in a layer of ground corn were presented in the form of

functional dependence $\frac{\Delta P \cdot e^2}{H \cdot u_0} = f(u_0)$ shown in Fig. 1.

Conclusion

The kinetics of filtration drying of crushed maize stems for the variable height of the layer, temperature and velocity of the thermal agent is experimentally investigated and it is recommended to realize the process at a temperature of 70 ° C at a flow rate of the thermal agent of 1.14 m / s, which provides high intensity of the process.

$$\frac{\Delta P \cdot e^2}{H \cdot u_0}, \frac{Pa \cdot s}{m^2}$$



$u_0, m/s$

Fig.1. On the graphic dependence of rice. 1 shows the experimental data that were approximated by a straight line, according to which the coefficient $A^* = 14510$ and the coefficient $B^* = 19138$ were determined.

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Study of Changing the Group Composition of Bitumen When Modifying its Rubber Crumb at Different Temperatures

Andriy Nagurskyy

Department of Chemical Engineering, Lviv Polytechnic National University, UKRAINE,
Lviv, S. Bandery street 12, E-mail: andrii.o.nahurskyi@lpnu.ua

Abstract – *The change of group composition of construction bitumen BNB-70/30 was studied due to its modification of rubber crumb at high and relatively low temperatures.*

Keywords – bitumen, rubber-bitumen blinder, rubber crumb, bitumen modification, group composition.

Introduction

Oil bitumen is a very common building material. The main factors on which the quality of oil bitumen depends on the characteristics of the raw materials and the technology of obtaining bitumen. The discrepancy in the group composition of oil residues, high content of paraffins is often a cause of poor quality bitumen. The problem of the production of road bitumen at Ukrainian refineries is particularly acute, as they are mostly processed by paraffinic oil. Getting high-quality commercial bitumen from such raw materials is extremely difficult, and in some cases it's impossible at all[1]. In order to improve the individual properties of bitumen obtained from the remnants of paraffin oil processing, they can be modified with rubber crumb, which is obtained by grinding waste tires, the cost of which is much less than the cost of rubber and latex. Using rubber crumb in bituminous production, you can also partially solve an important environmental problem, which is the disposal of worn-out tires.

Experimental

It is known that rubber is a vulcanizate of rubber, which under normal conditions is in the form of a three-dimensional structure. This structure can not dissolve in bitumen, or its separate components at low temperatures. When heated to high temperatures, the destruction of the three-dimensional structure of rubber and the subsequent dissolution of the formed linear fragments in bitumen may be possible. That is why temperature is a decisive technological factor when modifying bitumen with rubber crumb.

As a result of carried out experiments it was established that when introducing bitumen rubber crumb almost all its characteristics, in particular, increases the softening and elasticity temperature, decreases penetration and ductility. Such changes in the properties of bitumen during the modification of rubber crumb, obviously, are associated with a change in its group composition. Therefore, the change in the group composition of the original bitumen and bitumen modified with rubber crumb at different temperatures was studied.

The change of group composition of bitumen BNB 70/30 was studied with modification of its rubber crumb. The modification process was carried out at temperatures of 150°C and 250°C for 2 hours. After that, bitumen was passed through a metal sieve to separate particles of rubber crumb. The results of the studies are shown in Table. 1. For comparison, the results of the group analysis of pure bitumen without additives are presented in the table.

Conclusion

As the results of studies have shown, the introduction of rubber crumb in bitumen has led to a change in its group composition. At the same time, this change depends on the temperature at which the modification was carried out.

Table 1

Group composition of bitumen BNB 70/30 modified rubber crumb			
Group composition of bitumen,% wt	Content of rubber crumb in bitumen,% wt		
	0	5	10
Temperatures of modification 150°C			
asphaltenes	23,62	25,00	27,06
resin	24,97	27,40	29,35
oils	51,37	47,00	43,10
carbenes and carbides	0,04	0,60	0,49
Temperatures of modification 250°C			
asphaltenes	23,62	22,49	21,47
resin	24,97	27,26	29,44
oils	51,37	50,12	48,73
carbenes and carbides	0,04	0,13	0,36

In particular, when using rubber crumb to modify bitumen in low temperatures (150°C), the content of resins and asphaltenes in them increases, and the content of oils decreases in comparison with unmodified bitumen. The content of oils decreases because some of the oils dissolve in the rubber crumb when swollen and is separated along with the rubber crumb on the metal sieve. The results for the number of carbenes and carbides are approximate because in the modified bitumen, small particles of rubber crumb may remain, not separated by a metal sieve.

When modifying bitumen rubber crumb in high temperature (250°C), the composition of the composition varies in the other. Resin content increase and asphaltenes and oils decrease. This change in group composition is due to the fact that at high temperature the rubber undergoes a process of vulcanization. Consequently, the linear fragments are mainly included in the group of resins and a little in the group of oils.

As a result of a decrease in the amount of olive components and, consequently, an increase in the content of resins and asphaltenes in bitumen modified with rubber crumb, an appropriate change in its operational properties is observed. This change is correlated with the change in group composition and is somewhat predictable. As a result of a decrease in the content of modified bitumen, the olive components increase its refractoriness, which is characterized by a softening temperature. Increasing the total content of resins and asphaltenes leads to an increase in the hardness of bitumen, which is characterized by its penetration, as well as to reduce ductility. Increasing the content of resins also results in increased elasticity of modified bitumen. Consequently, the principle of rubber crumb, as a modifier of oil bitumen, consists in the fact that when it is introduced into bitumen, the group composition of the latter changes. As a result, the operational characteristics of modified bitumen change.

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Electrochemical Reduction of CO₂ on the Modification Electrodes

Oksana Dobrovetska¹, Ivanna Mertsalo², Orest Kuntiyi²

1. Department of Chemical Engineering, Lviv Polytechnic National University, UKRAINE, Lviv, Sviatoho Yura Square, 9, E-mail: oksanadobrovetska@gmail.com

2. Department of Chemistry and Technology of Inorganic Substances, Lviv Polytechnic National University, UKRAINE, Lviv, Sviatoho Yura Square, 9

Abstract – *The comparative catalytic activity of the reduction of carbon (IV) oxide in 0.1 M KHCO₃ aqueous solutions saturated with CO₂ was studied on cathodes of copper of different structure. The analysis of cyclic voltammetric curves has shown that cathodes with a rough surface obtained by electrochemical deposition of metal from acidic sulfate electrolytes are marked by increased catalytic activity.*

Keywords – electrochemical reduction, CO₂, copper, bimetal.

Introduction

Increasing the content of CO₂ in the atmosphere is one of the global environmental problems of humanity over which in recent years intensive research. One of the most promising areas in the ecological, technological and economic aspects is the electrochemical conversion of CO₂ into valuable products – CO, methane, ethane, formic acid, methanol and other organic substances [1-8]. However, the reduction is a complex multistage and multifactorial catalytic process, where the nature of the surface of the cathode, its structure, composition of the electrolyte, regimes of electrochemical reduction significantly affect the rate of conversion of CO₂ and the selectivity of the products. The most studied cathode materials are metals and bimetal systems, among which in recent years the predominant there are nanostructured surfaces [1,2]. Moreover, a large proportion among them occupies copper, precious metals and structures M₁-M₂ (table 1). The nature of the metal and the binary system, the surface morphology, the geometry of the nanoparticles are decisive in the conversion rate of CO₂ and the selectivity by the products.

Table 1

Cathodic materials, products of recovery and conditions of electrolysis

Metal	Conversion products	Potential, V	Composition of the electrolyte	Literature
Nano-Cu	CO, CH ₄ , C ₂ H ₆ , C ₂ H ₅ OH	-1.0...-1.5	KHCO ₃	[3]
Nano-Au	CO	-0.8...-1.5	NaHCO ₃	[4]
		-0.6	KHCO ₃	[5]
AuAg	CO	-0.8...-1.5	NaHCO ₃	[4]
AuCu	CO	-0.77	KHCO ₃	[6]
AgPd	HCOOH	-0.18...-0.52	LiClO ₄	[7]
PdCu	C ₂ H ₅ OH	-0.5...-1.5	KHCO ₃	[8]

Results and Discussion

The saturation of the CO₂ solution and the polarization of the sample from metallurgical copper in 0.1 M aqueous solution of KHCO₃ + CO₂ (pH = 6.8) leads to the emergence of a maximum currents density of cathode reduction which occurs at $E = -1.3$ V, $i = 3.2$ mA·cm⁻², it is evidence of the electrocatalytic activity of a copper electrode for the reduction of CO₂ it was established. The cathodic reduction of CO₂ is a reversible process, ie the speed of direct and

reverse processes is much higher than the diffusion rate of mass transfer. The increasing the speed of scanning of the potential leads to an increase of the current density of reduction and a decrease overvoltage by 0.2 V of the beginning of the reaction it was established. This suggests that the reaction of the reduction of CO₂ on the electrode from metallurgical copper occurs with the diffusion component, which is associated with the adsorption of the products of the reaction of reduction.

The electrolytic copper deposited on the electrode surface from the acid sulfate solution causes a change in the voltamper dependence – two peaks of the cathode reduction of CO₂ appear, indicating the ability of the (Cu_{met}/Cu_{ac}) electrode to reduction CO₂ to two or more compounds. On such electrode, the reduction of CO₂ starts at a lower overvoltage and with a higher current density compared with the metallurgical copper electrode, which is associated with a change in the structure of the surface layer of the metal and an increase in the true surface area. The reduction of CO₂ is occurring by the potentials $E = -1.1$ and -1.5 V with maximum current densities $i = 3.2$ and $4.2 \text{ mA}\cdot\text{cm}^{-2}$, respectively. The wide range of boundary currents also observed, which may indicate significant adsorption processes during the reduction.

Conclusion

The processes of CO₂ reduction is occurring with the diffusion component, which is associated with the adsorption of products of cathode reactions.

Acknowledgments

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Decomposition of Benzene with Periodic Excitation of Cavitation

Zynovii Znak, Yurii Sukhatskii¹, Olha Zin

Department of Chemistry and Technology of Inorganic Substances, Lviv Polytechnic National University, Ukraine,
Lviv, S. Bandery Str., 12, E-mail: znak_zo@ukr.net; sukhatsky@i.ua; zin.olha@gmail.com

Abstract – *For treatment of the benzene-containing wastewater, it is proposed to carry out their cavitation treatment in a cyclic mode. For periodic excitation of cavitation, the process of decomposition of benzene (both under adiabatic and under isothermal conditions) continues even during exposure to the medium.*

Keywords – cavitation fields, benzene, decomposition, ultrasonic magnetostrictive emitter, periodic treatment.

Introduction

Industrial waste water from chemical and petrochemical enterprises contains aromatic compounds (both mono- and polycyclic) and their derivatives that exhibit carcinogenic, mutagenic and teratogenic properties, and therefore difficult to biodegrade by microorganisms. Therefore, the promising direction of the treatment of such sewage is the use of cavitation fields to generate high-level compounds [1] (hydroxyl, peroxide radicals, atomic Oxygen, oxygen, hydrogen peroxide, ozone, etc.), which are directly involved in the decomposition and oxidation processes of arenes and their derivatives.

The degree of transformation (mineralization) of arenes in the cavitation fields depends on the intensity of the development of cavitation phenomena, which, in turn, is determined by the technological parameters of the processing process (the values of pressure at the entrance to the cavitator, the temperature of the reaction medium, the frequency of its circulation, the pH value, the concentration of the pollutant), and structural features of cavitation generator (shape, size of cavity elements, their number and spatial configuration, etc.) [2, 3].

It has been established that the cavitation efficiency (the ratio of the mass of the pollutant destroying in the cavitation fields to the energy expended on the implementation of this process depends on the structural features of the sonochemical reactors (cavitation generators)) for the degree of destruction of toluene about 80% increases by 8 times (from $4,02 \cdot 10^{-3}$ to $32,2 \cdot 10^{-3}$ mg/J) in the transition from the device with openings to the vortex diode [4]. This is due to the fact that for the occurrence of cavitation in the vortex diode a much smaller pressure difference is required than in a device with openings.

An increase in the degree of transformation of benzene in cavitation fields at a temperature of 303 K from 73.8% to 84.2% was found during the transition from the stationary treatment regime (specific power of treatment - 68 kW/m^3) to the mode of initiation of the reaction (specific power of cavitation treatment - $22,7 \text{ kW/m}^3$). That is, initiating the process of sonolysis of water molecules allows to reduce energy costs for cavitation transformation of benzene at least 3 times while increasing the degree of its transformation [5]. At the same time, the rate constant of benzene decomposition in the mode of reaction initiation is 2.2 times higher than in the stationary mode ($(17,4 \cdot 10^{-4}$ and $7,94 \cdot 10^{-4} \text{ s}^{-1}$, respectively).

The purpose of the research was to study the process of decomposition of benzene in the cyclic mode of excitation of cavitation.

Research Results

The cyclic mode of excitation of cavitation provides a periodic introduction of acoustic energy, which contributes to the periodic formation of radicals and, as a consequence,

prolongation of the decomposition and oxidation of benzene. Investigations with periodic excitations of cavitation were performed under adiabatic and isothermal ($T = 298\text{ K}$) conditions. The content of benzene in the system of imitation wastewater was determined by its maximum solubility in water under given conditions (temperature, pressure). An ultrasonic magnetostrictive emitter "Ultrasonic Disintegrator UD-20" with a frequency of 22 kHz was used to generate cavitation phenomena. The concentration of benzene in the immitate was determined by UV / Viz spectroscopy on the SPECORD M40 Carl Zeiss JENA two-beam spectrophotometer using a quartz cuvette in the thickness of 10 mm in the wavelength range 200-400 nm. The medium of comparison is distilled water.

In the case of the process of adiabatic conditions, depending on the concentration of benzene from time to time there are four areas with different angles of inclination (Fig. 1). Areas with a relatively large angle of inclination, that is, at which speed the process grew, correspond to periods when the cavitation was excited in the system. At these very periods there was a rise in temperature by 4.5 ... 5 K. A slight decrease in temperature in the periods of exposure to the solution is due to certain losses of heat in the environment. The process speed during cavitation is about twice as high as during exposure periods. Thus, in the I and III periods (excitation of cavitation), the rate of benzene decomposition is equal to $4,13 \cdot 10^{-3}$ and $3,13 \cdot 10^{-3} \text{ mol/(s} \cdot \text{m}^3)$, while during the exposure (periods II and IV) - $1,32 \cdot 10^{-3}$ and $1,63 \cdot 10^{-3} \text{ mol/(s} \cdot \text{m}^3)$. An increase in the rate of expansion of benzene in the IV period, as compared with II, that is, during exposure, can be explained by an increase in the temperature of the reaction medium to about 298 K [5].

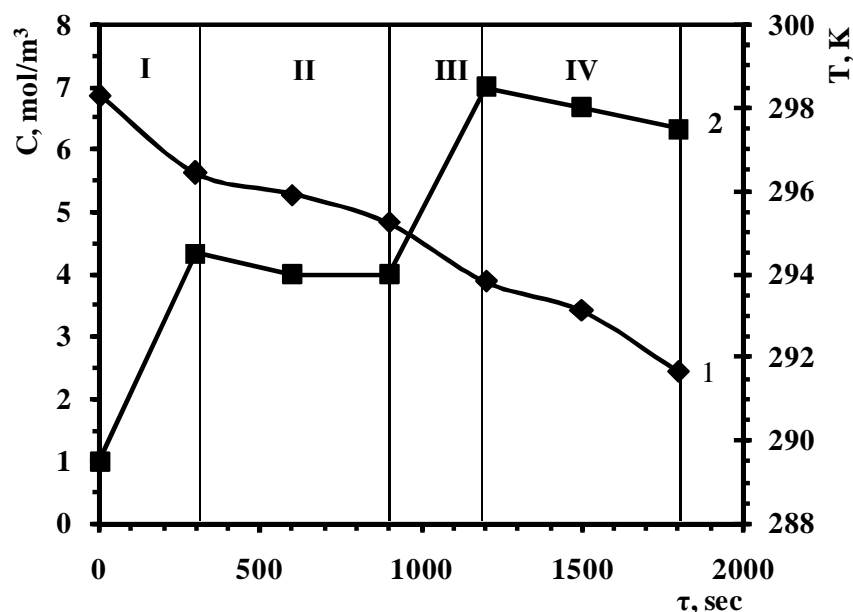


Fig.1. Dependence of benzene concentration (C , mol/m³) (1) and ambient temperature (T , K) (2) on time (τ , sec) under adiabatic conditions; periods: I, III - excitation of cavitation; II, IV - exposition of the environment

Within 30 minutes it was achieved the degree of conversion of benzene, which was 64.4%. The estimated duration of the process until the maximum permissible concentration of benzene is reached is 48 minutes. The comparatively small value of the degree of conversion and the rather long duration of the process, probably due to the fact that the process started at a rather low

temperature - 288 K. At this temperature, the value of the constant of speed is 6.3 times less than 303 K (for stationary mode).

In isothermal conditions at a temperature of 298 K (Fig. 2) in periods I and III (excitation of cavitation) the rate of the benzene decay is equal to $3,10 \cdot 10^{-3}$ and $0,77 \cdot 10^{-3}$ mol/(s·m³), and under time of exposure (periods II and IV) - $6,40 \cdot 10^{-3}$ and $0,95 \cdot 10^{-3}$ mol/(s·m³).

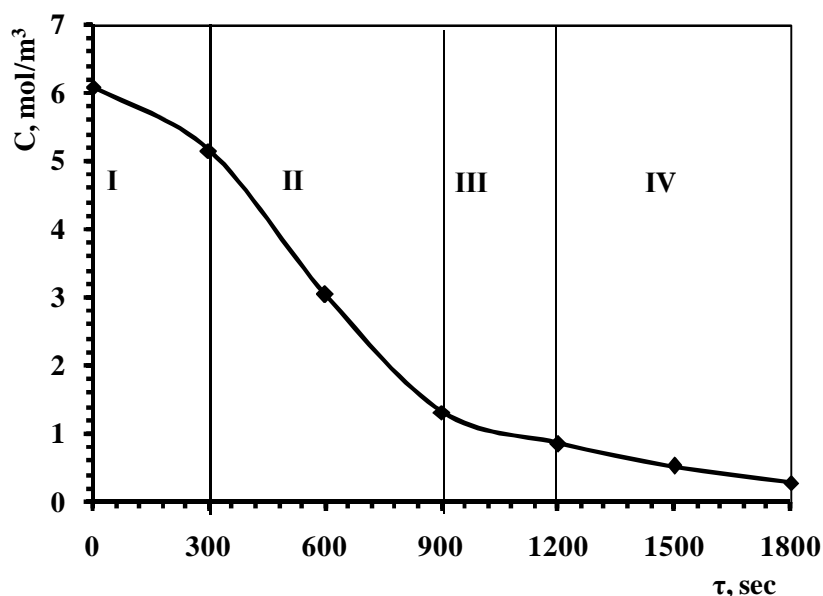


Fig. 2. Dependence of benzene concentration (C , mol/m³) on time (τ , sec) under isothermal (298 K) conditions; periods: I, III - excitation of cavitation; II, IV - exposition of the environment

The rate of expansion of benzene during exposure (period II) is almost twice as high as during the period of cavitation excitement (period I); in the fourth (exposure) period the speed is also greater (almost 20%) than during the cavitation (III period).

Obviously, the lower velocity of the process during the course of cavitation is due to the accumulation in the liquid of isothermal conditions of significant amounts of mechanically and diffusely stable bubbles that are split during the medium exposure (due to the pressure drop) with the formation of a large number of radicals that significantly intensify the process of benzene decomposition.

Conclusion

Consequently, for the periodic excitation of cavitation, the process of decomposition of benzene (both in adiabatic and in isothermal conditions) continues even during exposure to the medium. This indicates that the processes of decomposition and oxidation of benzene in cavitation fields are radical and occur in a chain mechanism.

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Study of the Possibility of Using Indene-Coumarone Resin with Methacrylate Fragments as Polymer Applications for Petroleum Road Bitumen

Mariia Shved, Yuriy Prysiashnyi, Olha Zubal

Department of Chemical Technology of Oil and Gas Processing, Lviv Polytechnic National University,
UKRAINE, Lviv, S. Bandery Street 12, E-mail: mari4ka.ved@ukr.net

Abstract – *The effect of indene-coumarone resin with methacrylic fragments amount on the main characteristics of bitumen-polymeric compositions has been studied. It was found that this resin can be used as adhesion additive. It was found that the addition of 1 % indene-coumarone resin to the mixtures does not substantially affect the softening temperature, penetration and ductility, but doubles the adhesion to glass.*

Keywords – indene-coumarone resin, bitumen-polymeric compositions, adhesion, softening temperature.

Introduction

The world consumption of bitumen is an average of 87 million tons per year. About 85% of bitumen is used as binder in various types of stacking: pavements, roads, airports, etc. This is the main binding material used in the construction of roads. When using road bitumen a number of problems arises, but the most acute is the insufficient high stiffness and adhesion properties of commercial bitumen (even if they meet the requirements of normative documents) [1].

One of the most promising directions in improving the quality of binders to obtain a pavement with good performance is their modification of polymeric materials [1]. However, the use of modifiers is limited by their considerable cost. Therefore, it is important to search for inexpensive substances, which would improve the performance characteristics of bitumens, first of all adhesion.

In the Department of Chemical Technology for Oil and Gas Processing at the Lviv Polytechnic National University research is being conducted to improve the adhesive properties of road petroleum bitumens by modifying them with an indene-coumarone resin (CIR), which is obtained using a light coal-tar resin fraction [2]. To get the maximum positive result in the structure of the CIR there is a need to introduce a functional group that improves the adhesion properties of the products that contain it.

This work is devoted to study of the possibility of using indene-coumarone resin with methacrylate fragments as adhesion additive of petroleum road bitumen.

Experimental

The indene-coumarone resin is obtained under optimal conditions, which are described in [3]. The resulting resin (CIRM-V) is characterized by yield of 25.5 %, softening temperature of 364 K and molecular weight of 600 g/mol.

Bitumen characteristics: softening temperature 319 K, penetration 70·10⁻⁴ m, ductility 63·10⁻² m, adhesion to glass 47 %.

The number-average molecular weight (M_n) of the synthesized CIR was determined using cryoscopy in benzene. The softening temperature, penetration, ductility and adhesion were determined according to the standard techniques.

Bitumen was heated in a reactor till definite temperature, then CIRM was added and mixed (Re = 1200) for a definite time.

Results and Discussion

To create bitumen-polymeric compositions (BPC), we used bitumen, the characteristics of which are given in subsection 1.1. CIRM was used as a polymer component. It was necessary to determine the effect of polymer component amount of BPM preparation on its characteristics. The results are shown in Tables 1. Bitumen without the addition of CIRM was studied for the comparison (Table 1). The amount of resin was 1, 2, 3 and 5 wt% relative to the total BPM amount. The introduction of resin from 1 to 5 wt % virtually leads to a slight increase in a softening temperature but penetration and ductility decrease. At the same time, the adhesion of the formed mixtures increases significantly.

Table 1

Effect of polymer component amount on BPM characteristics

BPM composition, wt%,	Softening temperature, K	Penetration at 298 K, 0.1 mm	Ductility at 298 K, cm	Adhesion, %
Bitumen100.0, CIRM 0.0	319	70	63	47
Bitumen 99.0, CIRM 1.0	320	68	60	96
Bitumen98.0, CIRM 2.0	320	69	58	95
Bitumen 97.0, CIRM 3.0	321	67	55	94
Bitumen 95.0, CIRM 5.0	320	66	56	95

Notes: temperature 463 K, time 1 h.

From Table 1 it can be concluded that the best results related to adhesion are achieved with CIRM amount of 1 wt %. Under these conditions, the characteristics of the resulting mixture practically coincide with the characteristics of bitumen without a polymeric component, except the adhesion, which is twice higher.

Conclusion

Regarding the possibility of using synthesized resins as polymeric additives to bitumen-polymeric mixtures, it was found that the addition of 1 % CIRM to the mixtures does not substantially affect the softening temperature, penetration and ductility, but doubles the adhesion to glass. Therefore, based on the obtained results it can be argued that this resin can be used as adhesion additive to the petroleum road bitumens.

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The Effect of pH on Emulsion Oligomerization of C₉ Fraction in the Presence of an Anionic Emulsifier

Oksana Orobchuk, Roman Subtelnyi, Bohdan Dziniak

Technology of Organic Products Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: roman.o.subtelnyi@lpnu.ua

Abstract – *Publication presents the results of research of emulsion oligomerization of mixture of unsaturated hydrocarbons of C₉ fraction of liquid diesel fuel pyrolysis by-products. An emulsion oligomerization of C₉ fraction in the presence of an anionic emulsifier and water-soluble initiator has been studied at various pH values.*

Keywords - emulsion oligomerization, critical concentration of micelle formation, surface tension, oligomer, pH regulator.

Introduction

The production of olefins followed by a large number (30-35 % wt.) of liquid pyrolysis by-products. Liquid by-products (LBP) of pyrolysis are divided into separate fractions, for example: C₅, C₆₋₈, C₉. Based on LBP hydrocarbon fractions C₅ and C₉ respectively, are obtained aliphatic and aromatic (co)oligomers hydrocarbon/petroleum resins. Hydrocarbon resins have a wide range of applications. Particularly, hydrocarbon resins are used as film forming agents in lacquer-paint and anticorrosive coatings [1].

Such co-oligomers are obtained by of ionic, radical initiated and radical thermal co-oligomerization methods. Ion cooligomerization is carried out at low temperature. Its disadvantage is a high color index and an additional technological energy-consuming stage of the catalyst compartment from the reaction mixture. Cooligomerization using peroxide initiators (initiated co-oligomerization) is widely used in the industry. It allows obtaining cooligomers (hydrocarbon resins) high yield and good properties. The disadvantage of radical co-oligomerization is the high temperature of the process (453-473 K) and the complexity of the target product. The hydrocarbon resin is separated by distillation from a solution of unpolymerized fraction components. The aromatic hydrocarbon resins obtained on the basis of the C₉ fraction mainly consist of styrene-cyclopentadiene co-oligomers [1, 2].

The disadvantages of the industrial method of radical co-oligomerization of the C₉ fraction can be eliminated by using low-temperature dispersion co-oligomerization. Emulsion and suspension cooligomerization of hydrocarbons of fraction C₉ is considered [1, 2].

We propose to use emulsion method of oligomerization of unsaturated hydrocarbon of C₉ fraction of diesel pyrolysis liquid by-products. This method can significantly reduce the process temperature and reaction time compared to the industrial methods of oligomers (hydrocarbon resins) synthesis. Emulsion cooligomerization is widely used in industry to make products that replace expensive and scarce materials of natural origin. This process is preferred because the reaction medium (which is usually water) makes it easier for promotes mixing, heat and mass transfer, and provides a safe process [2, 3].

Anionic surfactants have been used in various chemical fields. The ionic forms of their molecules also change with the pH of their aqueous solutions. Since the properties of the aqueous solution also change considerably with pH, accompanying the change of the ionic forms of the emulsifier. There have been many reports about the fundamental properties of their aqueous solutions depending on the pH values, e. g., micellization, surface tension, critical micelle concentration [4].

Emulsion polymerization is a method of polymerization of monomers dispersed in a dispersion medium to form a polymer/oligomer using inorganic initiator. As known, the system consists of dispersion phase (C₉ fraction), dispersion medium, a surfactant and a water-soluble initiator [3].

Experiments

The experiment was carried out at different values of reaction medium pH.

Composition of the reaction mixture of emulsion oligomerization:

- the dispersion medium - water;
- the dispersed phase – fraction C₉ of liquid pirolisis by-products (density – 936 kg/m³; bromine number – 68 g Br₂/100 g, molecular weight – 102, the content of unsaturated compounds to 45% wt. especially: styrene - 17,85% viniltoluene - 6,99%, dicyclopentadiene - 18,00%, indene 1,25 %.);
- water-soluble initiator - potassium peroxodisulfate (K₂S₂O₈) (1,0 %wt. calculated on the C₉ fraction);
- the emulsifier – E-30 a mixture of linear alkanesulfonates with length of the carbon chain - C₁₅ (0,7% wt. calculated on the dispersion medium);
- pH regulator – 40-% aqueous solutions of sodium hydroxide and hydrogen chloride.

Synthesis was carried out under the following conditions:

- temperature – 323 K;
- duration – 3 hours;
- volume ratio [fraction C₉]: [water] = [1 : 2];
- mixing intensity – Re = 10120.
- pH medium values – 0,5-12,0

The emulsion oligomerization of the C₉ fraction was carried out in a three-necked flask equipped with a rotary stirrer. The flask heating was carried out on a water bath. After loading, the reagents were vigorously stirred with a rotary stirrer and simultaneously heated to a temperature of 323 K for 3 hours.

The resulting mixture was separated by centrifuge (4000 rpm). As a result, a lower layer - an oligomer was separated. The oligomer was further dried. The liquid phase contains water and unreacted fraction C₉ hydrocarbons in its composition. If necessary, the liquid phase after centrifugation was separated by atmospheric distillation (pressure 0,11 MPa, cube temperature 453 K) and vacuum distillation (residual pressure 3 - 4 hPa, temperature 450 K). In this case, the oligomer was obtained in the cube, which was not separated by centrifugation.

Results and Discussion

To investigate the effect of reaction medium pH on emulsion oligomerization we define oligomers yield for different medium pH values. The pH values 2,8 corresponds to the reaction mixture (fraction C₉, water, initiator, emulsifier) without the addition of pH regulators.

Chromatographic analysis revealed that at this stage, the styrene and derivatives are introduced into the cooligomerization reaction. In the reaction mixture remaining after the separation of the co-oligomer and distillation of the precipitant there are high-boiling reactive dicyclopentadiene, indene, residual styrene and its derivatives.

The dependence of the medium pH values on the yield of oligomers is shown on Fig. 1.

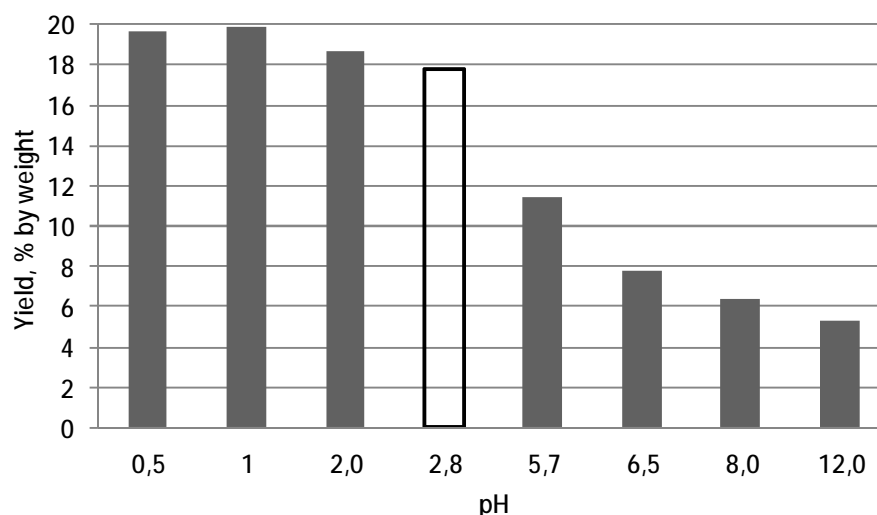


Fig.1. The effect of reaction medium pH values on the oligomer (hydrocarbon resin) yield in emulsion oligomerization.

As shown in Fig. 1, the maximum value of the oligomers yield is achieved in an acidic medium (pH = 1,0) and equals 19,9% by weight. Obviously, the reduction of pH to 0.5 has no significant effect on oligomer yield. With an increase in the pH value from 0,5 to 12,0, the yield of the oligomer decreases from 19,9 to 5,3% by weight. An emulsion oligomerization of the reaction mixture without the addition of pH regulators produced an oligomer with a yield of 17,8% by weight. Thus, we can conclude that increasing the pH value leads to increasing the yield of oligomers.

The emulsion oligomerization of the fraction C₉ hydrocarbons corresponds to the known theoretical laws [5, 6].

Physical and chemical characteristics of hydrocarbon resins (Table 1) obtained by emulsion oligomerization depend on the pH of the reaction mixture medium.

Table 1

Physical and chemical properties of (co)oligomers

Characteristic	pH							
	0,5	1,0	2,0	2,8	5,7	6,5	8,0	12,0
Bromine number, g Br ₂ / 100 g	23,1	23,0	24,7	30,3	34,8	35,9	39,7	42,0
Softening point, K	358	358	356	351	344	349	355	350
Color by iodometric scale, mg I ₂ /100 ml	80	60-80	30-40	30	40	40-60	40-60	60

As can be seen from the above results (Table 1), the bromine number (unsaturated value) correlates with the output of the polymer. The bromine number decreases with an increase in the of the oligomers yield. The color index of the oligomers (on the iodometric scale) increases with the addition of pH regulators. Color index increases from 30 mg I₂/100 ml (pH = 2,8 - oligomerization without the addition of pH regulators) to 80 mg I₂/100 ml (pH = 0,5). A high color index is undesirable for hydrocarbon resins (restricts their use in acquer-paint and anticorrosive coatings).

Infrared spectroscopy of the products obtained at the C₉ fraction emulsion oligomerization was carried out. Intense absorption bands of valent C-H-aromatic and CH₃-oscillations (region 2950-2916 cm⁻¹). Intense peaks in the region 1440-1600 cm⁻¹ (valence fluctuations of the

aromatic nucleus) indicate the presence of benzene nuclei in the structure of the co-oligomer, as well as fragments of the peroxide initiator. The high intensity of absorption bands in the region of 1000 - 1175 cm^{-1} indicates the presence of 1,2-, 1,4- and 1,2,4-substituted compounds. In the region of 680 - 800 cm^{-1} , less intensive bands of monosubstituted aromatic compounds and intense 1,2-substituted compounds (724 cm^{-1}) are observed.

There is a positive effect of acidic pH values on the oligomer yield. The process of emulsion oligomerization is influenced by many factors. One of the most important factors is emulsifier concentration. The critical micelle concentration is a relatively narrow concentration range, which indicates the limit below which no micelles are and above which almost all the surfactant, which is added to the solution, forms micelles. Evidence of surfactant micelles formation is bending dependencies property - concentration. The pH regulator (chloride acid) is an electrolyte. It is generally known that electrolytes reduce the critical micelle concentration.

Conclusion

The effect of medium pH on the process of emulsion oligomerization (oligomers yield) has been investigated. The optimum pH value has been determined. It is established that in the acidic medium the oligomer yield is growing. The resulting oligomers have a higher color index and softening temperature, the bromine number is not depending of medium pH.

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Pressure Drop Determination in a Novel Cyclon Separator by Using Numerical Modeling Technique

Roman Havryliv, Vladyslav Bodnaruk, Vitalii Trynchuk

Department of chemical engineering, Lviv Polytechnic National University, UKRAINE, Lviv, St. Yura square, 9, E-mail: havrilivroman@gmail.com

Abstract – *This study presents numerical simulation results of the pressure drop determination in a novel cyclone design separator. ANSYS Fluent 16 software was used to numerical modelling. The Reynolds-averaged Navier–Stokes equations with the $k-\varepsilon$ RNG, $k-\varepsilon$ Realizable and Reynolds Stress turbulence Models (RSM) were used in the analysis.*

Keywords – cyclone separator, pressure drop, numerical modeling, turbulence model.

Introduction

Cyclones as centrifugal separation apparatus have been used in chemical engineering for many decades. It's a very simple construction device with high separation efficiency. The recent year's tendencies to reduce energy costs in the industrial processes require the creation of the new cyclone separators design such as cyclones with the co-flow work zone [1,2].

Because experimental studies in industrial conditions are very expensive as a powerful tool for assessing the effectiveness of created cyclones, CFD (Computational Fluids Dynamic) technique can be used. In the present study, ANSYS Fluent 16 software was used to numerical simulation and the pressure drop determination in a novel cyclone design separator.

Experimental Setup and Modeling Results

The pressure drop and separation performance strongly depend on the structure and length of the gas swirling flow formed in the cyclone. These are the main technical parameters that characterize the perfection of the any cyclones design and are affected mainly by the cyclone geometry. Analysis of velocity fields with different shapes and configurations of the various cyclones design shows that use of a direct-flow zone to improve the separation performance and pressure drop reduces, will be effective.

The modeled novel cyclone with the co-flow work zone is shown in Fig. 1 and the structural dimensions are given in Table 1. The computational 3D domain of the cyclone geometry was discretized with unstructured mesh. The resulting mesh contains about 855000 Nodes and 4400000 Elements. All geometric transformations were done in a software module Design Modeller, and the mesh was created in ANSYS Meshing.

To simulate the swirling flow inside the cyclone the basic equations of hydrodynamics, namely the continuity Eq.1 and the equation of momentum conservation Eq.2 were used:

$$\frac{\partial \mathbf{r}}{\partial t} + \nabla(\mathbf{r}\mathbf{u}) = S_m \quad (1)$$

$$\frac{\partial}{\partial t}(\mathbf{r}\mathbf{u}) + \nabla(\mathbf{r}\mathbf{u}\mathbf{u}) = -\nabla p + \nabla(\mathbf{t}) + \mathbf{r}g + \mathbf{F} \quad (2)$$

where ρ – density, \mathbf{u} – overall velocity vector, S_m – the mass added to the continuous phase from the dispersed second phase or any user-defined sources, p – static pressure, \mathbf{t} – stress tensor, ρg – the gravitational body force, F – external body force.

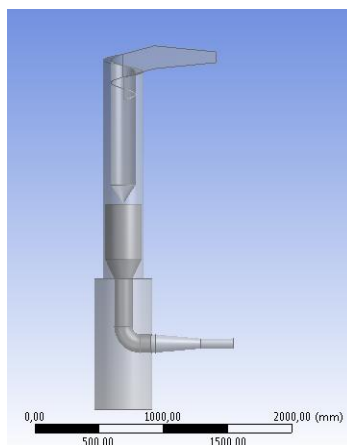


Fig.1. Geometry of cyclone.

In addition to the basic model equations of the medium flow, several turbulent models are available in Ansys Fluent software. The k- ϵ RNG, k- ϵ Realizable and Reynolds Stress turbulence Models (RSM) were used in the modeling. The system of differential equations was supplemented by relevant boundary conditions for the inlet, wall and outlet. Operation modes of the cyclone for inlet flow velocity was changes from 15 to 25 m/s.

Table 1

Dimensions of the cyclone tested in this study

Cyclone dimensions	Size, mm
Cyclone diameter	310
Work zone height	980
Central pipe height	960
Inlet pipe	175x60
Bunker diameter	450
Bunker height	1000
Coax insertion pipe diametr	286

The simulation results were compared with the measured pressure drop experimental data. It's was found that the RSM simulation results match the experimental pressure drop profile. The relative error between experiment and CFD was less than 10%.

Conclusion

The pressure drop results of movements swirling turbulent flow inside the cyclone separator had great deviation when using RNG and Realizable k- ϵ models. But the prediction results by RSM well consistent with the experimental value. In addition, a novel cyclone design to have a lower pressure drop (800 Pa) than the standard cyclone CN-15 (1200 Pa).

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Study of Composition Based on Bacteria of *Rhizobium* and *Azotobacter* Genera to Develop Three-pillar Biofilm Fertilizer

Maksym Korniiichuk, Nataliya Zayarnyuk

Department of Technology of Biologically Active Substances, Pharmacy and Biotechnology, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandera Street 12, E-Mail: portaworkua@gmail.com

Abstract – *Bacteria of the genera Rhizobium were isolated from nodules of Pisum sativum and Azotobacter - from the rhizosphere of Lactuca sativa to pre-study the bacteria composition for further development of biofilm fertilizer. Bacterial composition caused a growth-promoting effect. The development of a bioinoculant in the form of a biofilm based on this cultures is promising.*

Keywords – biopreparation, biofilm, growth-promoting activity, *Rhizobium*, *Azotobacter*, *Lactuca sativa*

Introduction

Microbiological fertilizers are the basis of organic farming. At present, representatives of the agronomically beneficial microflora (PGPB - Plant growth-promoting bacteria) are used, in the free-living (planktonic) form, to produce biopreparations. PGPB improve growth and plant resistance to biotic/abiotic environment factors, solubilize insoluble soil phosphorous, carry out nitrogen-fixation and produce growth-promoting factors. Applying of biofilm biopreparations is a new route in the development of microbiological biofertilizers. Biofilms are mass colonies of bacteria of one or more genera that create a matrix of extracellular polymers, keep up a contact with the help of quorum and adhere to biotic or abiotic substrates. Microorganisms in the form of biofilms have a significant advantage over planktonic bacteria, since the cells are protected from adverse environmental influence. Antimicrobial resistance develops in bacteria that live in biofilms. This improves their survival in the competitive environment of the rhizosphere, in addition, the activity of enzyme systems is changing, and horizontal gene transfer is enhanced [1].

A marketing survey has shown that on the Ukrainian market monobiopreparations are known, as well as biopreparations containing compositions of representatives of different families of bacteria. The range of biopreparats is presented in «A list of auxiliary products for use in organic agriculture, in accordance with the ACI (Accredited Certification International) standard for organic production and processing, equivalent to EU Regulations No. 834/2007 and No. 889/2». In this list biopreparations based on bacterial and fungal monocultures, such as: *Rhizobium*, *Bradyrhizobium*, *Azotobacter*, *Bacillus*, *Trichoderma* and s.o. genera are represented, but biofilm fertilizers are absent. This fact determines the importance of developing new type of biofertilizers in a biofilm form [2].

Literature Review

The analysis of scientific publications allowed us to choose bacteria of the family *Rhizobiaceae* - the genus *Rhizobium* as an object for the composition of the bioinoculant in a biofilm form. These bacteria are capable of phosphate-solubilisation, nitrogen-fixation, biocontrol by synthesis of hydrolytic enzymes, the release of biologically active substances, for example, antibiotics of trifolitoxin and rhizobutoxin, as well as competition with pathogens for free Fe and living-place in the rhizosphere. One of the benefits of working with *Rhizobium* is the ability to easily isolate them. Promising is the production of biopreparations based on

compositions of bacteria of the genus *Rhizobium* with other microorganisms to which it does not exhibit antagonism [3-5].

Bacteria of the *Rhizobiaceae* family are able to successfully interact with biotic matrices to form biofilms. An example of such an interaction is *Bradyrhizobium elkanii* SEMIA 5019, which interacts with the fungus *Pleurotus ostreatus*, forming a biofilm on the hyphae- a biotic substrate. This type of interaction alters activity of the *Bradyrhizobium elkanii* enzyme-nitrogenase and promotes the nitrogen fixation [6]. Confirmation of activity altering of this enzyme is also reviewed in the study of free-living rhizospheric microorganisms that can fix nitrogen only in microaerophilic conditions, in particular *Pseudomonas stutzeri* A1501. The nitrogen fixation effect emerges only if the biofilm is formed. The ability to nitrogen fixation is possible due to the release of extracellular polysaccharides (EPS) by bacteria. EPS protects the oxygen-sensitive cell enzymes from inactivation, creating microaerophilic environment [7]. Since *Rhizobiaceae* family members are capable of nitrogen fixation in microaerophilic conditions, namely in the form of biofilms, the selection of a bacterial partner for the genus *Rhizobium* in the formation of biofilm fertilizer should be based on its ability to produce the EPS and belong to the PGPB group.

Building upon bacterial partner requirements and scientific data, bacteria of the genus *Azotobacter*, which belong to PGPB, are promising for utilization in the polybacterial biofilm biopreparations. This group of microorganisms is highlighted by the ability to produce a significant amount of EPS [8], fix atmospheric nitrogen, as well as synthesize phytohormones. An important property of the genus *Azotobacter* is the ability of some species (*A. vinelandii*) to decompose environmental pollutants such as tetracyanone-nickelates. It is important to note that *Azotobacter* bacteria can be used both as a monoculture and in combination with the genera *Clostridium*, *Pseudomonas*, *Bacillus*, *Azospirillum*, *Agrobacterium* and, most importantly, root-nodulating bacteria (*Rhizobiaceae* family) [9]. Literature data gives evidence for promising utilization of dual-cultures of *Rhizobium* and *Azotobacter* bacteria, due to the enhancement of their valuable properties. Building upon aforesaid facts, *Azotobacter* and *Rhizobium* genera were chosen for the research. *Lactuca sativa*, which has a short growing season and is widely used in greenhouses, was selected as the plant object for the preliminary determination of the growth-promoting activity of the planktonic bacterial composition.

The goal of this work was to isolate and pre-study the composition of bacteria of the genus *Rhizobium* and *Azotobacter* for further development of biofilm fertilizer.

Experimental

In order to isolate nodule bacteria of the genus *Rhizobium*, we used isolates from the surface-sterilized roots of *Pisum sativum*. Incubation was carried out on bean agar for 2 days at a temperature of 28 ± 2 °C. As a result, we obtained large rounded colonies of stearyn color with a drop-shaped profile and a homogeneous structure, indicating that it is a member of the genus *Rhizobium*. To isolate *Azotobacter* sp., we used the *Lactuca sativa* rhizosphere soil. The selection was performed on Ashby's agar (pH 7-7.2) for 7 days at a temperature of 28 ± 2 °C. These conditions allowed us to identify 4 cultures of nitrogen-fixing bacteria in the rhizosphere of lettuce. Microscopic examination of the culture showed the presence of capsules with diplococci, polymorphism, from rods to cocci, significant release of capsular mucus, round colonies with a uniform structure, pigmentation on MPA. These data indicate that it is a member of the genus *Azotobacter*. As a biopreparation for comparison of growth-promoting activity of isolated cultures we used Azotofit-P, based on *Azotobacter chroococcum*. To determine the growth-promoting activity, the groups of seeds were investigated: No. 1-treated with a bacterial

suspension of *Rhizobium*; No. 2 – with bacterial suspension of *Azotobacter*; No. 3 - bacterial mixture of *Rhizobium* and *Azotobacter*; № 4 – with Azotofit - P; No. 5 - control without inoculation. Seed viability was tested on a wadded disk moistened with water; on day 3, it was found that 100% of the seeds were germinated. Non-sterile growth was carried out in a tray with a perlite layer about 5 cm thick. The exposure time was 10 days at a temperature of 16-18 ° C and natural light. Samples of bacterial suspensions were prepared by washing the cells from agar slants until $1 \cdot 10^9$ CFU/ ml was achieved. The composition of *Azotobacter* + *Rhizobium* was prepared by mixing the equal portions of bacterial suspensions under sterile conditions. Azotofit-R biopreparation was prepared according to the added instructions for seed treatment.

Results

Bacteria of the genus *Azotobacter* were isolated from the rhizosphere of *Lactuca sativa* and from the nodules of the pea roots of *Pisum sativum*, bacteria of the genus *Rhizobium*. The morphology of sprouts treated with the bacterial composition of *Rhizobium* and *Azotobacter* was noted for the best growth parameters: longer roots and stem, formed leaves of saturated green color. The sprouts obtained from seeds treated with *Rhizobium* monobacterial suspension also had long roots, but did not differ in intensive vertical growth. Sprouts obtained from seeds treated with the Azotofit-P control preparation and bacteria of the genus *Azotobacter* isolated from the rhizosphere of *Lactuca sativa* had a visually shorter stem and roots, a smaller area of leaves capable of photosynthesis. Utilization of the polybacterial composition based on bacteria of the genera *Rhizobium* and *Azotobacter* increased the mass of *Lactuca sativa* sprouts in non-sterile conditions by 39.9% compared to non-inoculated seeds and 49.6% compared to seeds treated with the Azotofit - P preparation (Fig. 1).

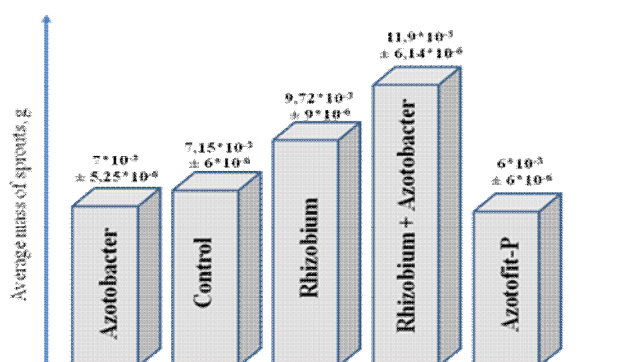


Fig. 1. Average mass of sprouts $1 \cdot 10^{-3}$ g in non-sterile conditions

Based on the results, it can be argued that the bacterial composition of free-living bacteria of the genus *Rhizobium* and *Azotobacter* has a positive effect on the mass of *Lactuca sativa* sprouts, and the creation of a complex biological preparation based on the composition of bacteria of these genera is promising.

The literature review allowed us to select *Aspergillus*, *Mucor*, *Penicillium*, *Trichoderma* fungi genera as a biotic substrate for establishment of the biofilm bacterial composition. Fungi of these genera can solubilize insoluble phosphates, produce auxins and promote the distribution of bacteria, associated with them, in the soil. The main object of the study is *Trichoderma* sp., which is used for biocontrol of phytopathogens of plants and successfully forms biofilms with such genera of bacteria as *Azotobacter*, *Bacillus*, *Pseudomonas*. A literature review also has shown that there are currently no studies that would characterize the properties of the three-pillar system *Rhizobium* sp. - *Azotobacter* sp. - *Trichoderma* sp. (*Aspergillus* sp., *Mucor* sp., *Penicillium* sp.) [10].

Conclusion

Thus, the bacterial composition of planktonic bacteria of the genus *Rhizobium* and *Azotobacter* has a positive effect on the mass of *Lactuca sativa* sprouts. The development of a bio-inoculant in the form of a biofilm based on this bacterial composition is promising. The next step of our research will be using of *Aspergillus*, *Mucor*, *Penicillium*, *Trichoderma* cultures as biotic matrices for biofilm fertilizers creation and the survey of growth-promoting properties of the three-component *Rhizobium*- *Azotobacter*- Fungus system.

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Features of Properties of the Polylactide Composites

Khrystyna Levytska, Andrii Masyuk, Volodymyr Skorokhoda, Sofiia Melnyk

Department of Chemical Technology of Plastics, Lviv Polytechnic National University, UKRAINE, Lviv, S.
Bandera Street 12, E-mail: masyukas@gmail.com

Abstract – *The results of rheological studies of polylactide-polycaprolactone composites filled with hydroxyapatite are presented. It has been established that polylactide-polycaprolactone composites are characterized by technological efficiency during processing in the viscous-fluid state, while the introduction of polycaprolactone into polylactide increases the fluidity of the composite.*

Keywords – polylactide, polycaprolactone, hydroxyapatite, rheology, composite.

Introduction

The search for optimal materials for implants, the development of various biodegradable biocomposites based on polymers from natural raw materials is a promising trend in the technology of polymer and composite materials. Implants, in particular, bone tissue, based on biocomposites, can have the same physical and mechanical properties as bone tissue. And the ability to biodegrade over time, optimal for bone defect recovery, and the absence of products of decomposition of unwanted biological activity are mandatory requirements for such materials. A promising polymer for biodegradable composites is polylactide [1] due to its advantages: biological safety, non-toxicity; lack of shrinkage; not solubility in alcohols and water; biodegradability; solubility in most organic solvents. Polylactide (PLA) are biodegradable biocompatible thermoplastic aliphatic polyester, with a monomer of lactic acid. It is a transparent colorless thermoplastic polymer, it is resistant to ultraviolet light, illuminates and burns with low smoke emissions. PLA has many properties at room temperature close to the oriented PP, but has a 20% lower density and a higher modulus of elasticity at bending.

Experimental

In order to obtain biocompatible composite materials, an additional polymer component is added which would help to increase the rate of bioresorption and would not cause inflammatory reactions in the body and also a filler. Perspective are composites based on polylactide-polycaprolactone (PLA-PCL) filled by hydroxyapatite (HA), which makes it possible to regulate the period of biodegradation and the rate of bioresorption of the composite. The ability of polymer composites to be processed in a viscous fluid state, the choice of rational methods and technological parameters of the processing are largely determined by their technological properties, in particular, the rheological. Therefore, the study of rheological and biodegradative characteristics of composites based on polymers with different transition temperatures in the viscous fluid state (for PLA - 190-210 °C, for PCL - 58-60 °C) and the effect on them of the content of the filler - hydroxyapatite is an urgent task.

Results and Discussion

In this paper the rheological and bio-degrading properties of thermoplastic composites based on polylactide-polycaprolactone-filled by hydroxyapatite have been determined. Because of the cholera nature of lactic acid, there are L- and D-stereoisomers of lactide, which are a mirror image of each other. The properties of the resulting polylactide will depend on the relative content of these isomers in the polymer. Polylactides with 100% L-lactide (L-PLA) has a high degree of stereoregularity, which gives it crystallinity. L-PLA usually has the following characteristics: $T_{gl} = 54 - 58$ °C, $T_m = 170 - 180$ °C. Use in the polymerization of the mixture of

D- and L-lactide allows to obtain amorphous polylactide (L, D-PLA), with a glass transition temperature of 50 – 53 °C. The melting temperature of the L-PLA can be increased by 40-50 °C, and the temperature of the heat-resistance deformation from 60 to 190 °C by physically mixing the polymer with the D-PLA. L-PLA and D-PLA form a highly regular stereo complex with a high degree of crystallinity.

Biological degradation of polylactite is carried out at the expense of the process of hydrolysis by special enzymes - hydrolases of esters, which are released by microorganisms. As a result, insoluble in water, the polymer decomposes into soluble components (organic acids and oligomers), which in the process of metabolism transform into CO₂, H₂O and biomass. The environmental impact is also greatly influenced by the decomposition rate. Thus, during composting at 55-70 °C and 80% relative humidity, the polymer destruction process takes place in one month. However, at lower temperatures and humidity, this process is slowed down, which allows the products of polylactite to fulfill their functional purpose.

It has been found that the injection of HA into polylactide results in a decrease in the fluidity of the composite, in particular, the value of the melt flow index (MFI) when adding 3.5% by weight and 10% by weight of hydroxyapatite is 6.4 g/10 min and 4.8 g/10 min respectively, the MFI of the unplanned PLA - 9.5 g/10 min. Thus, the values of MFI compositions for the content of PCL 1, 2 and 10% by weight are respectively 17.1; 21.9 and 28.4 g/10 min. The obtained values of the MFI and the character of the curves of the flow confirm the plasticization effect of polycaprolactone. For PLA-PCL composites with HA it is logically also observed change in the yield of composite, so the content of HA 3.5% by weight and PCL 2% by weight of the MFI is 10.2 g/10 minutes.

Based on flow curves, it was found that the molds of a polylactide filled with HA show a higher sensitivity to the shear stress during the course of the current, as evidenced by the greater effect of the stresses of shear on effective viscosity. At the same time, the introduction of PCL into the composition of the composite with hydroxyapatite reduces the viscosity of the composition, but the nature of the viscosity dependence on the strain of shear compared to the non-filled PLA does not change. The different inclination of the maturational viscosity dependence curves on the shear stress of polylactides composites modified by polycaprolactone, as compared to unmodified, indicates the redistribution of intermolecular interactions in the system and the presence of additional bonds between PCL and PLA macromolecules. The increase in temperature naturally contributes to the reduction of the effective viscosity of melting of composites, and the effect of shear stress on it is less noticeable.

Conclusion

Based on the performed studies, polylactide-polycaprolactone composites with hydroxyapatite have been characterized by increased technological compatibility between the components of the system in the viscous-fluid state, increased ability to biodegradation and, due to the directed regulation of rheological characteristics, can be further processed into product by injection molding, extrusion and 3D printing.

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Yeast Growth in Spelta Wheat Worts

Liubov Palianytsia, Natalia Berezovska, Zorian Pikh, Anastasiia Krykhta, Iryna Androsiuk

Department of Organic Products Technology, Lviv Polytechnic National University,
UKRAINE, Lviv, S. Bandery street 12, E-mail: liubapal@ukr.net

Abstract – It was investigated that the rate of yeast growth in spelta wort is greater than in common wheat wort. This is due to the chemical composition of the wort. Possibility of effective growing of yeast in spelta wort with the purpose of their using in alcohol technology was shown.

Keywords – yeast, *Triticum spelta* L., common wheat, wort, enzymes, growing.

Introduction

Yeast is an important microorganism which reduces carbohydrates into carbon dioxide and ethanol. The propagation of active maintain yeast and its importance in alcohol technology has been going on for a long time and is still an active research area. Therefore, the conditions used for propagating and maintaining yeast need not be identical to those used for fermenting grain wort.

The most important factors affecting the growing and maintaining of yeast are oxygen, pH, temperature and wort composition. Wort composition determines yeast growth and fermentation performance and is important in maintaining and storing viable, stable yeast. In terms of fermentation, wheat wort contains most of the ingredients necessary for fermentation. Problems arise only if the nitrogen composition is low. In terms of generation, the closer the starter medium is to the fermentation wort the better.

Wheat wort with higher concentrations works well for most fermentation and is recommended for use in most cases of alcohol production, but it does not contain enough nutrients to grow yeast. Thus, the research has established that the generation of yeast on a grain wheat (concentration 19%) provides the best degree of carbohydrate conversion and biosynthesis of alcohol [1]. The addition of yeast nutrients (amino acid/peptide and vitamin) and certain salts can also improve yeast growth and are a worthwhile addition to starters. Thus starter worts should be supplemented with yeast nutrients so that nitrogen is not limiting.

Triticum spelta L is an alternative culture with undermanning growing requirements. Spelta shows a very good adaptability. According to [2] it belongs to the ecological crops. The use of spelta wheat can solve both the problem of growing yeast and the expansion of grain raw materials sources in the alcohol production. Also spelta is used in other branches of the food industry [2,3] Spelta contains more protein, fats and vitamins than common wheat. Therefore, an important problem is the study of yeast growth in a spelta wort.

Materials and Methods

The experimental materials comprised cultivars of common wheat (*Triticum aestivum*), and spelta wheat (*Triticum spelta* L.) were obtained from Ukrainian Research Institute of Selection. The grains were hammer milled in a laboratory mill fitted with 1 mm opening screen. In this study used commercial («SternEnzym») *Saccharomyces cerevisiae* yeast Quickferm Super and commercial enzymes («Danisco»): Amylex 5T (alpha-amylase), Diazyme SSF (glucoamylase), Laminex BG2 (source of cellulase). Wort was inoculated with 0,1 g/L of dry yeast slurry and this was estimated to give an initial yeast count of $18\text{--}20 \times 10^6$ viable cells/mL. Yeast propagations were carried out in flasks capped with cotton wool at 30 °C for 24 hours. The number of yeast cells was determined by Goryaev chamber.

Results and Discussion

The wort preparation modes for fermentation are determined in a previous study. In this work the spelta wort was obtained using enzymes Amylex 5T, Diazyme SSF and Laminex BG2 for the hydrolysis of non- starchy polysaccharides contained in the filmy part of the spelta grains. The thermo-enzymatic treatment conditions of spelta were established: the temperature of batch preparation 46 ± 1 °C, the duration of liquefaction 2,5 hours at a temperature of 79 ± 1 °C, saccharification – 30 min at 56 ± 1 °C. Common wheat wort (control) was obtained under similar conditions.

The dynamics of yeast cell count during the generation shown on fig.1 It indicates that the largest yeast number is observed in wort obtained using spelta. Yeast content in spelta wort is higher as compared with the control (common wheat worts) sample by 12 - 15%. Yeast growing in spelta wort showed a more rapid generation at the first hours (4-8 h) and then slow growth rate by 16 hours generation (fig 2). The growth rate of yeast at the beginning of the process (4-8 hours) increased by 20% compared with control.

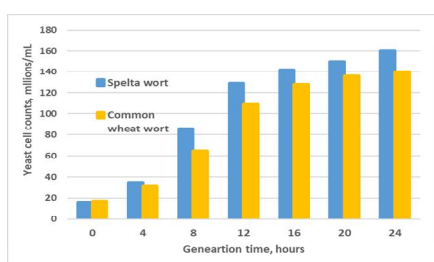


Fig.1. Effect of spelt wort on yeast cell number.

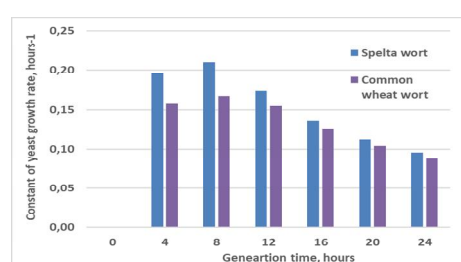


Fig.2. Rate of yeast growth

The best experimental results of the study of the yeast growing in spelta worts compared to control can be explained as follows: the nutritive value of spelta wheat is higher and contains all the basic components such as proteins, saccharides, lipids, vitamins and mineral. Lysine is contained in more quantities in the spelta than in common wheat. This amino acid was chosen because it is a Group A, meaning that it is among the first amino acids assimilated by yeast [4]. They are useful for preparing a nutrient medium for yeast growth.

Conclusion

In this paper, the results demonstrated a possibility of effective growing of yeast in spelta wort with the purpose of their using in technological processes. Thus, the use of spelta wort for the yeast generation at the expense of nutrients can increase the rate of yeast growth.

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Modification of the Silicon Surface by the Gold Nanoparticle by Galvanic Replacement

Mariana Shepida¹, Galyna Zozyly¹, Oksana Dobrovetska²

1. Department of Chemistry and Technology of Inorganic Substances, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery St. 12, E-mail: maryana_shepida@ukr.net

2. Department of Chemical Engineering, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery St.12, E-mail: oksana_dobrovetska@ukr.net

Abstract – *The results of studies of the deposition of gold nanoparticles on the surface of silicon by galvanic substitution are presented. The process conditions under which a nano-sized precipitate is formed in the organic aprotic solvents are investigated. The effect of temperature and duration of galvanic substitution on the morphology of the modified surface, the geometry of the sediment particles and their size distribution is studied.*

Keywords – galvanic replacement, nanoparticles, gold, nanofilm, silicon surface, aprotic solvents.

Introduction

One of the promising methods of depositing nanoparticles of metals on a semiconductor surface is galvanic replacement. This method is easy to perform and does not require external current source or reducing agent in solution [1-4]. Gold is often used to modify the surface of silicon, due to its unique physical and chemical properties [5-8]. Galvanic replacement on the surface of silicon occurs by the electrochemical mechanism and therefore it is characterized by the same electrode processes, as in electrodeposition. However, the spontaneity of the process makes it difficult to obtain nanoparticles with a given geometry and size distribution. Therefore, it is important to establish the basic parameters that affect these characteristics. In order to reduce and avoid the flow of undesirable processes on the surface of silicon, in the last decade there is an interest in the study of galvanic substitution in the environment of organic solvents [9], in particular aprotic [10, 11]. In addition, high-donor properties of such solvents cause the formation of surface complexes on the embryos of recovered metals, which also positively affects the sediment nanostructure.

The purpose of this work is investigate the influence of the composition, temperature and duration of the process on the size and shape of deposited gold nanoparticles on the surface of silicon by galvanic replacement in dimethylsulfoxide (DMSO) solutions.

Experimental

The metals deposition was carried out by galvanic replacement on the silicon surface from solutions of their compounds in the presence of HF (3 wt%): gold – 0.004M ($\text{HAuCl}_4 \cdot 3\text{H}_2\text{O}$, 99.99%, Alfa Aesar) in dimethylsulfoxide (DMSO, 99%, Alfa Aesar).

For investigations we used p-type Si(100) plates (Crysteco company) with a resistivity of 7–12 Ohm-cm. The silicon plates were divided into squares $1 \times 1 \text{ cm}^2$. The silicon surface was pre-washed with isopropanol and then etched in 1% solution of fluoride acid and DMSO. The samples were immersed in metal salt solution and kept under a hydrostatic mode at the temperature of 40-70 °C for 1 min. After applying the metals, the samples were successively washed with corresponding organic aprotic solvent, isopropanol, acetone and dried in the air at 60 °C [10].

The morphology of the resulting deposits on the silicon surface was investigated using ZEISS EVO 40XVP scanning electron microscope. The images of the modified surface were

obtained by recording secondary electrons using an electron beam with energy of 20 kV. The chemical composition of the deposits was investigated using energy dispersion analysis (EDX).

Results and Discussion

Deposition of gold on the surface of silicon in an environment of organic aprotic solvents, in particular dimethylsulfoxide DMSO, has been investigated. Such environment, as shown by the authors [11], ensures even distribution of nanoparticles by size over the substrate's surface.

For the recovery of metal from complex ions - $[\text{AuCl}_4]^-$ ($K_H = 1 \cdot 10^{-19}$), the high stability of which causes significant cathode polarization, there is a tendency for the formation of nanoparticles up to 100 nm with a relatively small range of their sizes. Moreover, for gold the formation is characteristic - nanostructured porous films (Fig.1).

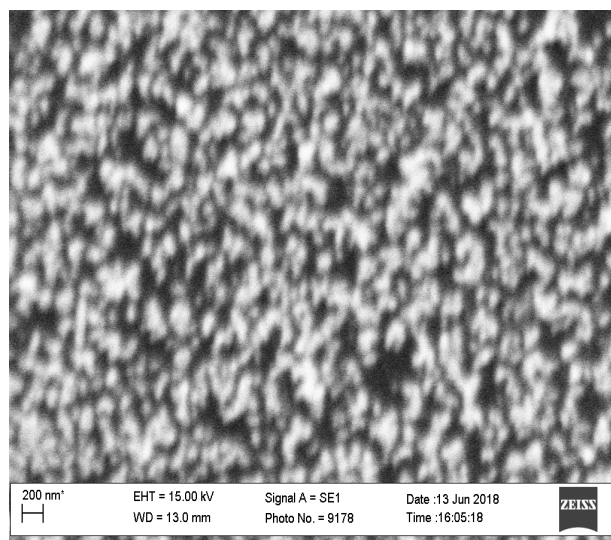


Fig.1. SEM images of n-Si (100) surfaces of silicon with gold deposited by galvanic replacement in DMSO solutions at the temperature 40 °C

Compared the SEM image of gold formed on the surface of silicon with a temperature rise of 40 to 70 °C, observe a change in the structure of the sediment from the film (Fig.1.) To the dispersion (Fig. 2, b, c). Such a significant effect of the temperature factor is due to a significant increase speed of the electrically generating reaction. This, accordingly, causes an intensification of cathode processes due to the sharp increase in the densities of currents on microcathodes (i_{cathode}), which is typical for galvanic replacement. So, with an increase in temperature by 10 °C, the rate constant for the recovery of gold increases in 1,3 ... 2 times [10]. Since there are no side processes in the environment of organic aprotic solvents, the generated current is directed only to the recovery of the metal. The last reaction passes through the diffusion catheter, therefore, at low concentration of ions $[\text{AuCl}_4]^-$ the limit values (i_{cathode}) are reached. As a result, rough film and dispersible precipitates are formed, which is characteristic of electrochemical precipitation of metals and their renewal by galvanic replacement in high i_{cathode} . In addition, as the temperature rises, adsorption of organic aprotic solvent molecules with gold nanoparticles becomes weaker. Accordingly the inhibitory effect of the surface complexes on the growth of nanoparticles decreases, and the "smoothing" effect is leveled. As a result of cathodic depolarization, the size of the particles increases. At the same time, there is a tendency towards 3D growth of siege. Moreover, 2D growth prevails, which contributes to uniformly filling the substrate (Fig. 2, a, b, c).

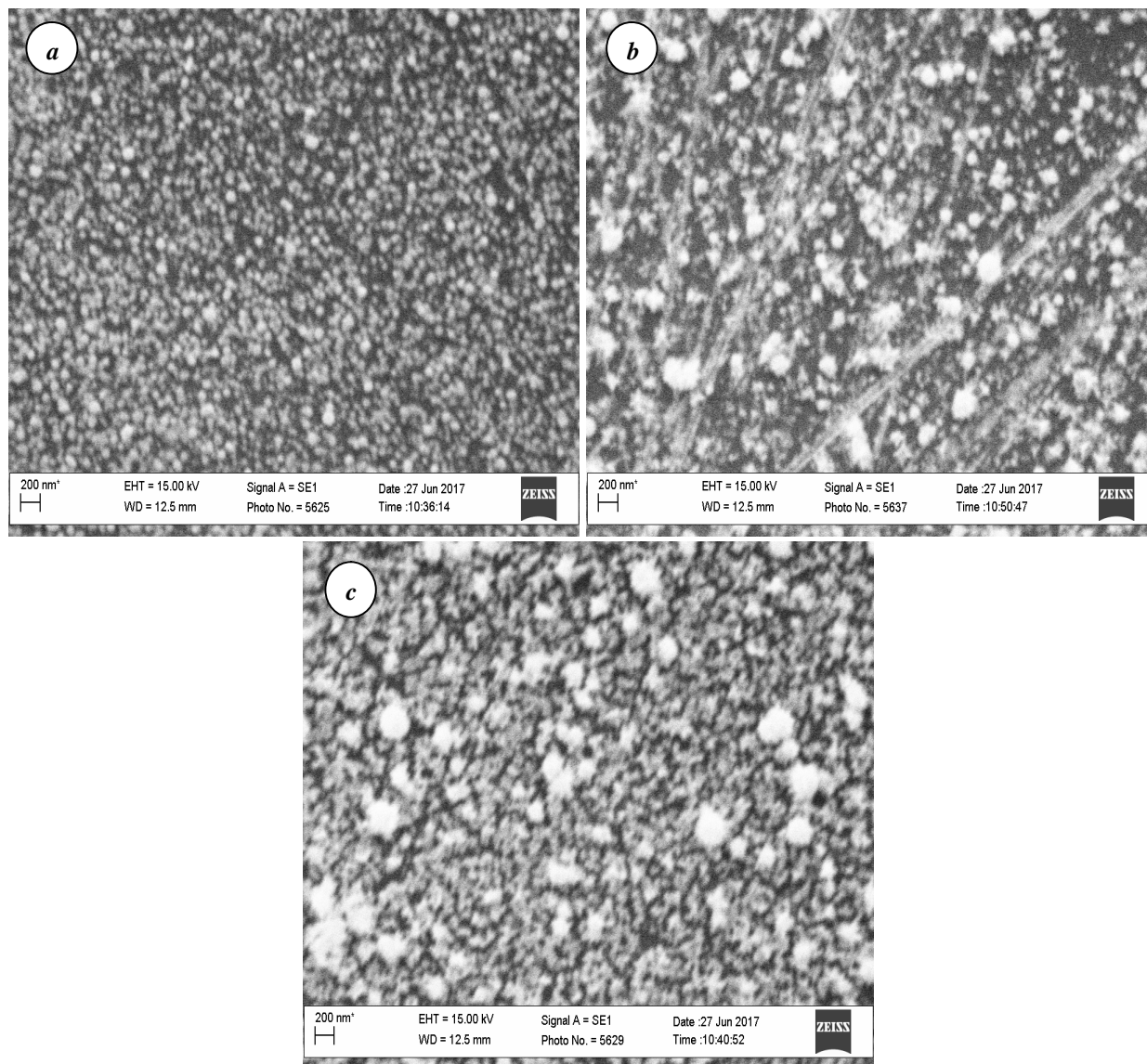


Fig.2. SEM - images of gold nanoparticles deposited from a solution of 4 mM HAuCl_4 in DMSO on a silicon surface for 1 min at a temperature of 50 (a), 60 (b), 70 (c) $^{\circ}\text{C}$

As the length of the galvanic replacement process increases, the size of the nanoparticles of the recovered metal increases. This is due to nucleation almost exclusively in the initial period during the formation of microcathodes and microanodes on the substrate surface. In the future there is only their growth. Consequently, the long process of galvanic replacement causes the formation of sintered precipitate with a large dispersion of nanoparticles in size. The main factors influencing the sediment morphology and the size of its structural particles are the composition of the solution, the temperature and the duration of galvanic replacement.

Conclusion

1. With the temperature increase, there is a tendency to 3D fill the substrate with nanoparticles of metals to form rough and disperse sediments. This is due to the significant increase in the speed of the electroenergizing reaction of the dissolution of silicon on microanodes. Accordingly, current densities on microcathodes increase to values that cause high diffusion polarization.

2. In the environment of organic aprotic solvents, namely DMSO galvanic replacement on the silicon surface passes without any side processes. This contributes to the formation of gold nanoparticles and homogeneous in size and evenness of their distribution on the surface.

3. The tendency of decreasing the size of deposited gold particles is revealed by decreasing the concentration of the corresponding metal ions.

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Ways of Practical Application of Allyl-1,3,4-trimethylcyclohex-3-enecarboxylate

Irina Kostiv , Roman Havryliv, Anastasiia Bolokan, Ihor Yarovyi

Department of Chemical Engineering, Lviv Polytechnic National University, Ukraine, Lviv, st. Bandery 12,
E-mail: kostiv.irina@gmail.com

Abstract – *The synthesized alkylcyclohexenecarboxylates have the ability of polymerization and can be used as a raw material for preparation of polymeric materials, compositions and hyper plasticizers for concrete mixtures. Polymer compositions made with allyl-1,3,4-trimethylcyclohex-3-enecarboxylate are recommended for manufacture of contact lenses and artificial crystalline lenses.*

Keywords - 2,3-dimethylbuta-1,3-diene, allyl methacrylate, allyl-1,3,4-trimethylcyclohex-3-enecarboxylate, hyper plasticizeris, polymeric materials.

Introduction

Alkylcyclohexenecarboxylates, as products of organic synthesis, belong to an inadequately studied class of substances. Published information on the methods of synthesis, chemical properties and areas of application are practically absent and relate mainly to saturated derivatives of cyclohexene carbonic acids. Besides, Alkylcyclohexenecarboxylates are raw materials for preparation of food flavors, perfumery compositions, plasticizers, comonomers, plant growth regulators, drugs and hydro-aromatic hydrocarbons.

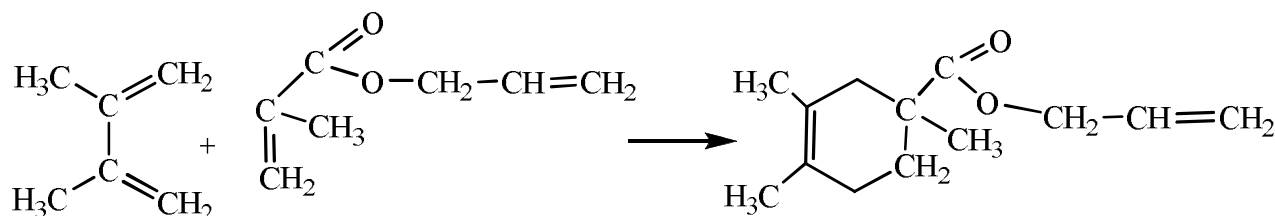
Alkylcyclohexene compounds are increasingly being used as monomers in production of new polymeric materials. Alkylcyclohexenecarboxylates are the basis for synthesis of polyfunctional polymers of diverse structures with a predefined set of physical-chemical characteristics [1-3].

Availability of homologous series creates a practical possibility of synthesis of secondary, tertiary and hydro-aromatic hydrocarbons and production of perfumery compositions [2]. Much of the esters of alkylcyclohexenecarbonic acids are structural fragments of vitamins, hormones and alkaloids.

Alkylcyclohexenecarboxylates are starting materials for drugs, as well as modifiers, plasticizers, epoxyresins, and co-monomers [1, 3]. They are used to create lotions, body emulsions, shampoos, day and night creams, perfumes, and food flavors [2].

Results and Discussion

In this work we propose ways of practical application of alkylcyclohexenecarboxylates on exemple of allyl-1,3,4-trimethylcyclohex-3-enecarboxylate. The allyl-1,3,4-trimethylcyclohex-3-enecarboxylate was obtained by reaction of cycloaddition 2,3-dimethylbuta-1,3-diene and allyl methacrylate [4-7]:



The synthesized allyl-1,3,4-trimethylcyclohex-3-enecarboxylate has the following physical and chemical characteristics: $T_{\text{boil}}=375/4$ K/gPa, $n_D^{293} = 1.4758$, MR=61.31 (found), 61.09 (calc.)

NMR ¹H spectrum of allyl-1,3,4-trimethylcyclohex-3-enecarboxylate. The NMR ¹N spectrum is completely consistent with the allyl-1,3,4-trimethylcyclohex-3-enecarboxylate

structure. The spectrum has signals at 1.38, 1.82, 1.82, 1.84, 1.91, 2.01, 2.09, 2.15, 2.40, 4.75, 5.23, 5.24, 6.06 ppm. The protons of the allyl fragment are recorded at 6.06 ppm. in a form of a multiplet, at 5.23, 5.24 ppm. in a form of a triplet and at 4.75 ppm in a form of a doublet. Six protons of the cyclohexene fragment give four doublet signals at 1.84, 1.91, 2.01, 2.09, 2.15, 2.40 ppm. The methyl groups in the cycle in 1, 3, 4 positions resonate as two singlets at 1.38, 1.82, 1.82 ppm.

Alkylcyclohexenecarboxylates can be used as monomers for manufacture of hyper plasticizers. Output of experimental batches of esters of alkylcyclohexenecarboxylic acids was realized in accordance with the developed technical specifications TU U 24.1-02071010-159: 2013 at the pilot plant of Galichina Scientific and Production Co.

Previous studies were conducted with the use of a new monomer of allyl-1,3,4-trimethylcyclohex-3-enecarboxylate for synthesis of concrete hyper plasticizers [7]. These samples of hyper plasticizers obtained by copolymerization of allyl-1,3,4-trimethylcyclohex-3-enecarboxylate with methacrylic acid and monocaprylate of polypropylene glycol have shown positive results in concrete mixtures (Table 1).

Table 1

Influence of addition of hyper plasticizer on concrete mixtures

Indicator	Cone settling, cm	Cone spread, cm	Setting time, days	Freezing resistance, F	Impermeability to water, W	Freezing point, K	Movableness, hrs
With no hyper plasticizer	18–20	50	30	100	7–9	268	1–2
With hyper plasticizer	>25	>60	15	500	>16	253	3–6

The use of hyper plasticizers enables cone settlement more than 25 cm and cone spread over 60 cm which greatly accelerates the process of concrete solidification, increases frost resistance and, consequently, up to 5 times higher durability of concrete (from F100 to F500). Adding of the hyper plasticizer increases impermeability to water by several degrees, up to W 16 and higher. Accordingly, it is not necessary to apply special waterproofing measures for the final product. Hyper plasticizer in concrete mixtures has the ability to reduce freezing point of concrete to 253 K which ensures work at any time of the year. Concrete with addition of hyper plasticizer has the effect of preserving mobility of the concrete mixture from 3 to 6 hours without reducing the cone settling, thereby allowing transportation of concrete over long distances without degradation of its quality. Addition of hyper plasticizer makes it possible to obtain a glossy surface in manufacture of decorative concretes.

Such concrete mixtures possess hyperplastifying properties and enable preparation of a self-compacting concrete that does not require vibration. This is due to force out air pores which is important in monolithic concrete construction, manufacture of prefabricated elements with a highly developed reinforcement system by the cassette method.

The essence of this production process consists in the use of a hyper plasticizer liquid enabling change of physical and mechanical properties of concrete mixtures due to the plasticizing effect. In this case, parameters are obtained with specific requirements of durability, mobility, useful life as well as frost resistance, water impermeability and other important characteristics. The advantage of adding hyper plasticizers in concrete mixtures is not only to improve their parameters but also reduce the cost of final products as the need for additional processing of concrete mixtures disappears.

Polymer compositions created with participation of allyl-1,3,4-trimethylcyclohex-3-enecarboxylate are recommended for making contact lenses and artificial crystalline lenses as they free eyes from the feeling of dryness, redness and edema of the cornea. Due to sufficient moisture content (50–60 %), they provide comfortable wear and allow people to wear each pair of lenses for a month without removing them. An important indicator for contact lenses is air permeability. Because of its unique structure, the iris has no blood vessels and its cells receive oxygen from atmospheric air. The lens inevitably complicates this process and in a case of lack of air permeability, it can cause hypoxia of the iris and germination of blood vessels in it. In this way, organism compensates oxygen starvation of the cells. The bottom threshold of air permeability established in the course of numerous ophthalmological studies is 125 units. These polymeric materials can provide this indicator at a level of 150 units.

No less important is the radius of curvature. To make the eyes comfortable and prevent the contact lens from "swimming off" caused by blinking, its inner radius should correspond to the size of the eyeball. If the lens is large, it is badly fixed on the iris and can easily fall out and if the radius is less than necessary, the lens will compress the cornea that results in dryness and discomfort of its wearing. The radius of curvature must be within the range 8.2–8.9 BC. The radius of curvature of the manufactured contact lenses from the polymeric materials based on allyl-1,3,4-trimethylcyclohex-3-enecarboxylate was found to be 8.4 BC.

Taking into account all of these indicators, the allyl-1,3,4-trimethylcyclohex-3-enecarboxylate based polymeric materials are recommended for the manufacture of contact lenses.

Since the crystalline lens is one of the main optical elements of the eye which focuses the image of objects on the retina, its removal because of cataract requires mandatory optical correction. The artificial crystalline lens consists of an intraocular lens and supporting elements completely covered with a carbon diamond-like envelope and is intended for internal eye prosthetics in the reconstructive surgery. Its main technical characteristics are thickness of the film on the intraocular lens which should not exceed the degree of roughness according to the class of purity. Thickness of the film on the supporting elements should be within $1^{\circ}5$ microns. The use of allyl-1,3,4-trimethylcyclohex-3-enecarboxylate based polymeric compositions for making the intraocular lenses can provide satisfactory technical characteristics of artificial crystalline lenses and therefore can be used in the process of their manufacture.

Conclusion

The synthesized alkylcyclohexenecarboxylates are recommended as a raw material for production of polymeric materials for contact lenses, artificial crystalline lenses and hyper plasticizers of concrete mixtures.

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Correlation Between Structural Parameters and the Charge of Ln-heteroatom Nuclei in Isostructural Salts $\text{Na}_9[\text{Ln}(\text{W}_5\text{O}_{18})_2]\cdot 35\text{H}_2\text{O}$ (Ln = Nd, Eu, Gd, Tb, Dy, Ho, Er)

Oleksandra Mariichak¹, Yuliia Oleksii¹, Vyacheslav Baumer², Georgiy Rozantsev¹, Serhii Radio¹

1. Educational and Scientific Institute of Chemistry, Vasyl' Stus Donetsk National University, UKRAINE, Vinnytsia, vul. 600-richchia 21–215A, 21021, E-mail: o.mariichak@donnu.edu.ua

2. SSI STC "Institute for Single Crystals" of National Academy of Sciences of Ukraine, UKRAINE, Kharkiv, 60 Nauky ave, 61001, E-mail: baumer@xray.isc.kharkov.com

Abstract - Comparison of structural parameters in the isostructural sodium heteropoly decatungstolanthanidates(III) with Peacock–Weakley type anion $\text{Na}_9[\text{Ln}(\text{W}_5\text{O}_{18})_2]\cdot 35\text{H}_2\text{O}$ (Ln = Nd, Eu, Gd, Tb, Dy, Ho, Er) showed the linear dependences for decreasing of Ln—O_b(W) bond lengths and O...O interatomic distances in the $[\text{Ln}(\text{W}_5\text{O}_{18})_2]^{9-}$ anion vs. the charge of Ln–heteroatom nuclei.

Keywords - heteropoly decatungstolanthanidate, peacock–weakley anion, FT-IR spectroscopy, X-ray single crystal analysis, lanthanide.

Introduction

The paper presents the results of investigation of synthesized neutral salts $\text{Na}_9[\text{Ln}(\text{W}_5\text{O}_{18})_2]\cdot 35\text{H}_2\text{O}$ with lanthanides as a heteroatom by elemental analysis, X-ray Single Crystal analysis, FT-IR spectroscopy. It also confirms the linear dependence between bond lengths and interatomic distances, and the charge of Ln-heteroatom nuclei.

Experimental

The synthesis of $\text{Na}_9[\text{Gd}(\text{W}_5\text{O}_{18})_2]\cdot 35\text{H}_2\text{O}$ was carried out as follows. Sodium tungstate solution ($V = 19.27$ mL, $C = 0.5190$ mol/L) was added to 56.19 mL of distilled water, and then HNO_3 solution ($V = 23.07$ mL, $C = 0.3467$ mol/L) was added dropwise with vigorous stirring. After that $\text{Gd}(\text{NO}_3)_3$ solution ($V = 1.47$ mL, $C = 0.5749$ mol/L) was added dropwise very slowly with vigorous stirring. For synthesis of $\text{Na}_9[\text{Er}(\text{W}_5\text{O}_{18})_2]\cdot 35\text{H}_2\text{O}$ instead of gadolinium nitrate, the solution of $\text{Er}(\text{NO}_3)_3$ (1.03 mL, $C = 0.9751$ mol/L) was used, and the initial volume of distilled water was 56.63 mL. Isolated salts investigated by elemental analysis, X-Ray Single Crystal, and FT-IR spectroscopy.

Results and Discussion

The results of X-ray Single Crystal analysis and the analysis of literature showed that among the compounds with Peacock–Weakley type anion, one can distinguish a number of isostructural salts $\text{Na}_9[\text{Ln}(\text{W}_5\text{O}_{18})_2]\cdot 35\text{H}_2\text{O}$ (Ln = Eu [1], Gd [this study], Tb [2], Dy [2–3], Ho [2], Er [this study, 2, 4]), mainly with lanthanides of the yttrium subgroup. It is worth mentioning that only $\text{Na}_9[\text{Nd}(\text{W}_5\text{O}_{18})_2]\cdot 32\text{H}_2\text{O}$ has similar crystallographic characteristics, and differs in crystallohydrate H_2O molecules content [5].

It was interesting to compare some of the structural parameters of these salts. For this purpose, we selected and analyzed the following parameters: bond lengths Ln—O_b(W); interatomic distances between Ln and five-coordinate oxygen atoms O_C; interatomic distances O...O in the planar fragments of lacunar isopoly anions $[\text{W}_5\text{O}_{18}]^{6-}$, by which they are coordinated to Ln heteroatom; values of the bond lengths W=O_t, which are on the same axis with Ln heteroatom.

Comparison of structural parameters of isostructural neutral salts $\text{Na}_9[\text{Ln}(\text{W}_5\text{O}_{18})_2]\cdot 35\text{H}_2\text{O}$ (Ln = Eu, Gd, Tb, Dy, Ho, Er) allowed us to establish linear dependences between decreasing

lengths of Ln—O_b(W) bonds and interatomic distances O...O in Peacock–Weakley type heteropoly anions, and the charge of Ln–heteroatom nuclei (Fig. 1).

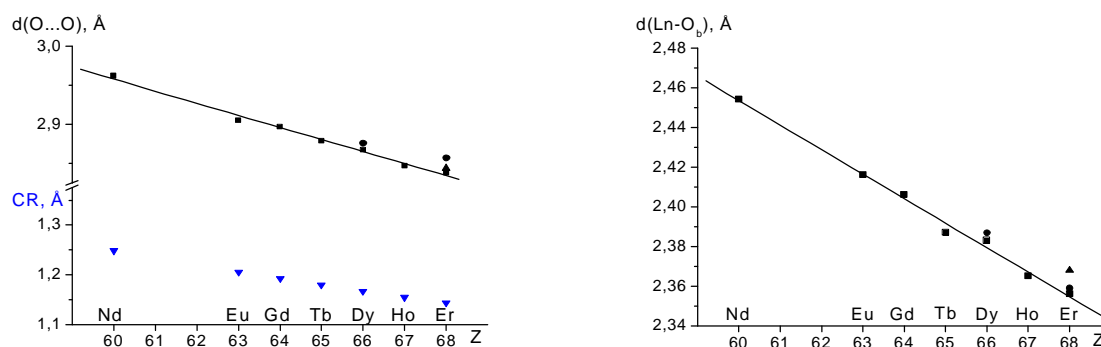


Fig.1. Left — Dependence of the mean values of interatomic distances O...O in the planar fragments of lacunar isopolyanions $[W_5O_{18}]^{6-}$ vs. the charge of Ln–heteroatom nuclei. The blue color indicates the dependence of crystalline radii (CR) in the row of ions Ln^{3+} (Ln = Nd, Eu–Er) for coordination number 8 vs. the charge of the lanthanide atom nuclei (coefficient of determination $R^2 = 0.9916$); Right — Dependence of the mean values of bond lengths Ln—O_b(W) vs. the charge of Ln–heteroatom nuclei (coefficient of determination $R^2 = 0.9932$).

Conclusion

In present research the linear dependences between decreasing of Ln—O_b(W) bond length and interatomic distances O...O vs. charge of Ln–heteroatom nuclei in the row of isostructural heteropoly salts $Na_9[Ln(W_5O_{18})_2] \cdot 35H_2O$ (Ln = Nd, Eu, Gd, Tb, Dy, Ho, Er) were established.

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Right to public information in polish legal system¹

Igor Gontarz

Law and Administration Department, Adam Mickiewicz University, POLAND, Poznań, al. Niepodległości 53, E-mail: igorgontarz7@gmail.com

Abstract –The main purpose of this paper is to describe model of access to public information in polish legal system. Author present main institutions and regulations connected with execution of right to public information.

Keywords – democracy, public information, jurisprudence, politics, transparency, public authorities, civil society

Introduction

Access to public information is one of the guarantees of public life transparency. In opposition to PRL Constitution (1952) [1], which obligated citizen to „cover the state’s secret” and „to be vigilant to state enemies”, current Constitution (1997) [2] gives citizen the right to obtain and receipt public information. This situation shows the difference between two political systems: communism, where the governing party want to be anonymous, and democracy, where the principle of law is public life transparency. The main purpose of this paper is to describe how this right can be executed, to specify scope of this right, and to show situations when it can be limited. [3]

I. Sources of right to „public information”

In the European Union, right to public information is guaranteed by Regulation (EC) No 1049/2001 of the European Parliament and of the Council of 30 May 2001 regarding public access to European Parliament, Council and Commission documents. Nonetheless, it empowers citizens of European Union to request only for the information possessed by european institutions. Access to public information in Poland is guaranteed by another regulations. At first, it’s The Constitution of the Republic of Poland (Article 61), which enable citizens to obtain information „on the activities of organs of public authority as well as persons discharging public functions”. Right to information also include „receipt of information on the activities of self-governing economic or professional organs and other persons or organizational units relating to the field in which they perform the duties of public authorities and manage communal assets or property of the State Treasury.” The procedure for the provision of information is regulated in statue called: The Access to Public Information Act [4].

II. Methods of access

There are four methods of the access on the grounds of The Public Information Act. It’s uploading that information onto special site called „BIP”, requesting that information by citizen, entry to sittings of collective organs of public authority formed by universal elections, with the opportunity to make sound and visual recordings and making them available in general central system.

III. The „public information” term

The Access to Pubic Information Act enshrines the definition of „public information” term, which oblige us to understand it in only one specific way. According to that definition „Public information is every information regarding to public matters”. In judicature, it’s said that the definition doesn’t explain precisely, what kind of matters are public. That’s classic logic error, called in latin *ignotum per ignotum*. As a consequence, polish jurisdiction created it’s own

definition: „Public information is every information created by public authorities or addressed to public authorities, and every information addressed to subject performing public function, if it's connected with performing public tasks.” [5] In the statute, we can find a list of information, which is treated like public. It is information about: „interior and foreign policy, subjects, who are obliged to give an access to public information and organization of that subjects, public data and public property. Nonetheless, there is much more data outside of this list, which can be obtained by citizen.

IV. Limitations

Right to information is not an absolute one and in some cases it can be limited. As a general factor determining limitation of access to public information jurisprudence find protection of some secret. In some cases it can be limited in the event of collision with another statute, like The Tax Ordinance Act or Banking Law. In another disputes, it is being limited because of privacy of the third party. In the rest of situations, citizen can't execute his right to information, if it's connected with economic secret of unit possessing that information.

Conclusion

After year 1989 polish citizens was empowered with right to public information, guaranteed by Constitution and statute. Various methods of access and wide range of subjects who are obliged to respond to citizens requests ensure transparency of public life.

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Central bank in system of national currency and consequences of access to Eurozone

Remigiusz Chęciński

Faculty of Law, Administration and Economics, University of Wrocław, POLAND, Wrocław, Uniwersytecka 22/26, remik.checinski@gmail.com

Abstract – In this speech author presents position of central bank in system of national currency, particular in the example of Polish national bank: legal acts determine functioning of central bank, his objectives, bodies, and competences. Next, describe construction of Eurozone and consequences of monetary integration in the euro zone for the economic security of the country.

Keywords – central bank, Eurozone, Treaty on Functioning of the European Union (TFEU), European Central Bank (ECB), Eurosystem, monetary policy.

Introduction

In the system of national currency, central bank is a constitutional body that is separated from the three powers - legislative, executive and judiciary. Central bank conducts monetary policy and has its own objectives, bodies and competences. According to Treaty on Functioning of the European Union (TFEU), in the eurozone the body which administers monetary policy is the European Central Bank (the ECB). Countries, which were accessioned to European Union bound themselves to join Economic and Monetary Union (EMU). Also Poland did not decide for an opt-out that would cause it unnecessary to become a part of the eurozone.

I. Central bank in system of national currency: example of Poland

Polish central bank was named: Narodowy Bank Polski - National Bank of Poland. Principles of operation of National Bank of Poland are regulated in The Constitution of the Republic of Poland, 2nd April, 1997, The Act on Narodowy Bank Polski and The Banking Act. In its functioning, National Bank of Poland is guided by Basic and Additional objectives. The basic task of the NBP is implementing the monetary policy guidelines determined by the Monetary Policy Council. To achieve this, the NBP can choose from two forms of intervention: direct and indirect. There are three bodies of NBP: President, Monetary Policy Council and Management Board. Central bank is independent of state authorities in three aspects: personal, financial and functional. The central bank has the exclusive right to issue money as well as to formulate and implement monetary policy. It can lead direct and indirect interventions, like determining the official interest rates, reserve requirement, open market operations, credit-deposit operations.

II. Central banking in eurozone

In the eurozone the body which administers monetary policy is the European Central Bank (the ECB). The basic objective of monetary policy of ECB is to maintain stable inflation on the level chosen by the governing bodies. Levels of inflation in particular national parts aren't important in this but. Level inflation is giving for whole Eurozone. ECB is directed by the Governing Council and the Executive Board. The main decision-making body of the ECB is the Governing Council. It consists of the governors of the national central banks of all euro area countries and the six members of the Executive Board. The Governing Council is responsible for adopting the guidelines and taking the decisions necessary to ensure the performance of the tasks entrusted to the Eurosystem and determining the monetary policy for the euro area. The Executive Board is a less important body of the ECB. It contains of the President, the Vice-President and four other members. All of them are appointed by the European Commission.

III. Joining to Eurozone and economic stability

Monetary integration in the euro zone have advantages and disadvantages for the economic security of the country. entry to the euro zone pulls behind both positive as well as negative consequences and economic security of the country. The threat is the loss of freedom in monetary politics and the possibility of coordination of fiscal and monetary politics. The common currency is less safe in the case of asymmetric shocks. This limits the possibility of intervention of the monetary authority, which must take into account the economic conditions across the eurozone, and not just a country. Different parts of the euro area may require different actions (in country A there is inflation in country B - unemployment in the country C - excessive debt). The effectiveness of a common currency promotes large opening economies, the high mobility factors of production and the similar structure of the national economy.

Conclusion

Joining the eurozone by Poland will mean a great change in the role of the NBP. It will be required to transfer competences on formulating and implementing monetary policy as well as money creation to the European level. . That is why it will be necessary to change article 227 of the Constitution. If we rebuild the NBP, we will have to also rebuild whole system of Polish economy. Monetary policy will be then formulated and implemented not only by an authority out of the system of balanced powers, but also out of the system of Polish internal law.

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A hundred years of activity of the Association of Polish Cities

Paweł Grobelny

Faculty of Law and Administration, Adam Mickiewicz University in Poznań, POLAND, Poznań, Wieniawskiego 1,
E-mail: pgrobelny1@gmail.com

Abstract – The paper presents an outline of the history and activity of the Association of Polish Cities. One of the oldest and most important Polish self-government organizations. A special emphasis was placed on its legislative activity and the impact on the appearance of the local government system in Republic of Poland.

Keywords – self-government, Poland, political system, Polish legislation, local-government

Introduction

The Association of Polish Cities is the oldest Polish organisation of local governments dating back to the times when Poland was regaining its independence in the inter-war period. Its traditions from that era are very rich. In 1917–1939 the Association was actively involved in legislative lobbying as well as economic and cultural promotion of cities. It was also involved in publishing and training as well as broad experience sharing. In addition, it cooperated with similar organisations from other countries.

After the Second World War the Association could no longer operate. However, immediately after the first free local elections after the war (27 May 1990) an initiative was put forward to revive it. Within a few months councils of nearly 60 cities decided to join it and in January 1991 Poznań, the statutory seat of the Association, hosted its Reconstitution Congress.

Since 1990 the Association of Polish Cities has featured prominently in the most recent history of the revived local self-government in Poland. It is the biggest organisation of this type in Poland, representing 301 cities inhabited by over 72% of the country's urban population. The APC is an association of cities seeking to support the idea of local government as well as to bring about economic and socio-cultural development of Polish cities.

I. One Association - two epochs

The 100th anniversary is a beautiful jubilee. From among Polish self-government organisations, only The Association of Polish Cities has such a long tradition. However, it was allowed to act only half the time since its foundation. Between the years 1917-1939 and 1991-2017, there was a 50- year long gap. Therefore, this is a story about two different organisations that have the same name, the same mission, a similar network of cities, also similar problems of them, but different social, national and geopolitical contexts. These contexts made a huge difference between the pre- and post- war union. When the association was reactivated in 1991, it was only known that this pre-war one really existed but nothing more.

In the rich literature today concerning the history of the second Republic of Poland there is not much information on The Association of Polish cities- the self-government organisation that acted in 1917-1939. The reason for that, it should be assumed, is that historians themselves are not very interested in the problematics of territorial self-government, in its institutions, organisations and associations. How important the association was is the fact that it included 84% of Polish towns from among of 94 % of urban population. How important the (pre-war) association was is the fact that it included 84% of Polish towns from among of 94 % of urban population.

The main reason why the cities created a federation was that thanks to it they could affect both the government and the parliament. The description of legislative actions is therefore the

principal part of this essay. Needless to say, it is impossible to include the whole history of such a big and active organisation in one piece of work-even legislative problems are discussed here selectively focusing only on the problems and periods when the activity of the association appeared to be something special in a general historical context of Polish self-government.

The wealth of a general subject matter of The association of Polish cities comes out not only from a huge activity of the union but also from its role against other self-government organisations. Among them this union is the most diversified internally structure. It includes both Warsaw and thousand times smaller towns., more peripheral than communes from metropolitan districts. Hence, the full range of interests and problems connected with the union from local to European ones.

The subject of the activity of the association of Polish cities is especially worth mentioning in the midst of preparations for the commemoration of the 100 year anniversary of the rebirth of our state. It should also be remembered how much municipal self-governments contributed into this work. The Polish people do not know much about it. In the popular message, the legionary theme dominates. However, a state is built not only on battlegrounds, not only during heroic spurts and breakthroughs. The daily inefficient work of self-government organisations also served this purpose.

Conclusion

This work only deals with the main aspects of the Union's activities and the circumstances of its creation and restitution. As already mentioned, the Association of Polish Cities dealt with all the problems related to cities. In 1917-1939, as in 1990, it attached proper importance to matters related to municipal management, education, culture, health, social care, unemployment, and communication. It reacted to all the ills and needs of local self-government. At the same time, promoting entrepreneurship and urban initiatives, he organized economic exhibitions and competitions. He provided many services at the request of cities.

The Association of Polish Cities dealt with all the problems related to cities. In 1917-1939, as in 1990, it attached proper importance to matters related to municipal management, education, culture, health, social care, unemployment, and communication. The Association reacted to all the ills and needs of local self-government. At the same time, promoting entrepreneurship and urban initiatives, it organized economic exhibitions and competitions. It provided many services at the request of cities.

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On the unemployment of young people

Nataly Ortynska¹

1. Department of Administrative and Informational Law, Lviv Polytechnic National University, UKRAINE, Lviv,
S.Bandery street 12.,
E-mail: natalius2008@ukr.net

Abstract – the key reasons of unemployment of the young people are considered. The article focuses on the necessity of improvement the educational programs to struggle with this problem.

Key words – young people, unemployment, educational programs, computer skills, labor market.

Introduction

The status of the young people in today's globalised society has a special nature. Due to the political and economic changes their legal status undergoes essential changes which is unavoidable due to the civilization progress of modernity. Analyzing the legal warranties of the young people the dynamics of changes may be observed which is characteristic of the subject of this research.

I. The problem of unemployment

The key task of modern country is to provide the appropriate conditions for the social establishment and development of a young person which will allow realizing all declared rights to the fullest extent. Analyzing the international experience the greatest attention is focused mainly on the employment of the young generation, as this is the subject of law which suffers most from the unemployment as compared to the older generation. This peculiarity is connected with several factors which influences the global unemployment level. Due to the age peculiarities, the young people do not have enough work experience which is not attractive for the employers and reduces the competitiveness of the potential worker. Next factor is a sharp technological progress which led to the disappearance of many professions needed not so long ago, as the automated equipment and robots substitute the human resources in different spheres of human life. Such professions as parking attendant, Shop Assistant, Courier, Shepherd, Postman, Translator and even Teacher are nowadays gradually substituted by the modernized systems which, as it was shown in practice, have higher efficiency than the human.

Besides, important issue of unemployment is the unstable world economy which has a negative impact on the capacity of the whole labor market, economic crisis and political non-stability which aggravate this issue. It would also be reasonable to take into account the strong migration processes caused by the military actions in Eastern Ukraine, which forces the young people to search for better life conditions which mainly concentrate in the European countries.

Complex assessment of the issue of the young people unemployment allows predicting the strategy of the legal policy improvement in Ukraine relying on the European experience.

The approach of the EU country to the employment level is constituted by a thorough analysis of the educational and qualification level of the young generation. Thus, the annual report "Employment and social developments in Europe 2018" states that «However, the results of the latest (2015) PISA tests in the key disciplines of mathematics, reading and science have once again sent alarm signals about the level of competence of 15-year-old Europeans. In all three disciplines, one in five pupils is a low achiever and the trend has strengthened recently. Moreover, there is strong evidence that low achievers at the age of 15 will remain low achievers as adults, because the lack of basic skills strongly reduces the likelihood of a person achieving a satisfactory labor market outcome» [1.p.14].

Thus, the world market and globalization processes demand more and more concentration on the educational processes for the young generation. For the national education the revolutionary changes also came, where the necessity appears to modernize the educational processes and the level of acquired knowledge. Besides, important element for the progressive changes is a close cooperation of educational institutions with the labor market aimed at the adaptation of educational programs for the modern requirements to the worker's professional competences. Besides, this cooperation shall be concentrated on the further employment of graduates. This experience demonstrated positive results in many developed countries.

According to S. Matiukh, «in the foreign states a clear cooperation may be observed between the higher education and science, production. Researching the process of this cooperation, two main directions may be outlined: First of all, due to the increased control over the educational process; secondly, due to the correction of the educational process itself. The foreign companies establish the control over the educational processes which is expressed in the common elaboration of the whole educational program for the students they select, despite that not all of them will work at these companies. This process provides for the possibility of mutual exchange by the teaching staff. Qualified workers of the American companies act as the supervisors of the junior students during the practice periods» [2, p.310]. As it is shown in practice, a young person who has just graduated from the higher educational institution is unable to apply the acquired knowledge in practice and sometimes the theoretical knowledge are even outdated as of the graduation period. Therefore, the cooperation of the higher educational institutions and labor market will be a positive solution of such problems.

It should also be mentioned that young people lack the computer skills which may have an essential negative impact on their competitiveness in future. This is because the fast development of the informational and telecommunication technologies and the information flow to be analyzed need certain skills. Here the necessity appears to focus more on this issue in the educational process which, in future, may improve the computer skills of the young generation, as analyzing the demands of the modern labor market is an integral part of the human progress nowadays, which is characteristic of each profession.

Conclusion

Thus, the unemployment of the young generation is the problem of most of developed countries. The main reasons are the absence of the work experience due to the age peculiarities of the researched subject, economic instability and political situation. To overcome this problem we consider it reasonable to focus on the cooperation between the labor market and educational institutions for the purpose of modernizing the education programs for the modern requirements. Besides, the attention is focused on the necessity of more detailed studying of computer at the higher educational institutions for the adaptation of a young person to the modern requirements.

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Cyberbullying: the latest type of violence against children

Nataliya Lesko¹, Solomiya Yurynets²

1. Department of Administrative and Informational Law, Lviv Polytechnic National University, UKRAINE, Lviv, S.Bandery street 12, E-mail: leskonataly@gmail.com

2. 2nd year student, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: Solomia020@gmail.com

Abstract – *The article is dedicated to the study of the problems of legal regulation of the protection of children from cyberbullying. The problems of legal regulation of the relations in social networks are examined.*

Keywords – violence, abusive treatment, children, minors, Internet, rights protection, information security, cyberbullying.

Introduction

When describing the phenomenon of harassment, abuse, violence in the information and communication space, domestic researchers use such concepts as "cyberbullying", "cyber harassment", "cyber hooliganism", "cyber aggression", "cyber stalking", and others.

Cyberbullying includes the following actions: sending messages, letters, videos, pictures of offensive, threatening nature; distribution of personal information (true or false) that discredits the victim; shooting of fights, mockery using modern gadgets with further demonstration of such photos, videos, etc. This is the so-called open or direct cyberbullying. It should be noted that such messages create a hostile, aggressive atmosphere, even when they are not directly targeted at a child.

In order to prove the fact of violence against children on the Internet, the victims provide evidence – the screenshots that display the information which became the ground for the conflict in the way it is presented on the Internet. However, according to paragraph 46 of the Resolution of the Plenum of the Supreme Economic Court of Ukraine "On Certain Issues of the Practice for the Settlement of Disputes Related to the Protection of Intellectual Property Rights" dated October 17, 2012, No. 12, the print-outs of Internet websites (web-pages) by themselves cannot be evidence in the case [1]. Judicial practice shows that such a print-out can be recognised as evidence provided that there are no objections from other persons involved in the case.

Thus, the Kyiv Appeal Administrative Court, in its ruling dated February 21, 2013, No. 2a-13438/12/2670, accepted screenshots of the pages on Facebook and Twitter as appropriate evidence. The main argument of the court in favour of such a decision was the fact that only a person who had the keys necessary to enter the administrative part of the website could make such screen-shots [2].

The most acceptable visual way of fixing a web page is to conduct expert research – the study of telecommunication systems (equipment) and means [3]. When carrying out an expert study in the field of telecommunications, the following actions are performed: verification of the domain name (the expert determines whether there is a web-site with the corresponding domain name on the Internet as of the date of the study and whether it is possible to properly connect to it); recording the data received with the help of WHOIS service (the expert finds out the data about the date of registration of the domain name, the date of making the latest changes, the administrator of the domain); determining of the IP address to which the domain name corresponds; recording the data about the hosting company for this domain name; checking the correctness of displaying the content of the website; displaying the main page; going to the pages that contain intellectual property objects or the information relevant to the study and their further

recording; fixation of the audio, video, or text files on the website that are relevant to the study (such studies are extremely useful in the event of copyright infringement on the Internet); fixation of the the entire website if necessary [4].

O. H. Radziyevska stresses that it is necessary to legislatively regulate the issue of treating informational violence as one of the types of negative informational influence on children. The scientist suggests including the protection from "all forms of informational violence committed directly or through the means and possibilities of information technology" to the list of forms of violence, the protection from which is guaranteed by Art. 10 of the Law of Ukraine "On the Protection of Childhood" [5, p. 14].

We shall note that cyberbullying is not just a "digitized" bullying. First of all, cyberbullying is a digital, mass resource. The point is that fakes, rumours, bad or edited photos do not only spread quickly, it is also difficult to delete them from the Internet. They can be duplicated on other resources or pages, stored on personal computers of users.

Conclusion

In view of the above, it is justified to introduce criminal liability for making public and distributing on the Internet, cell phones the information containing child pornography, violence scenes, commercial exploitation of children, as well as the facts of grooming and cyberbullying in relation to a child, as a result of which harm to the physical or mental health of the child could have been or was done.

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Manipulative advertising in Ukrainian media

Mariana Kitsa¹

1. Law and Psychology Department, Lviv Polytechnic National University, UKRAINE, Lviv, Kn.Romana street 12,

E-mail: imkitsa@gmail.com

In the article the expediency of determination of advertisement is reasonable as the pathogenic phenomenon. The basic signs of pathogenicity of text are analysed and an attempt to distinguish the basic criteria of pathogenicity of advertising text in the Ukrainian press is done.

Keywords – advertising, manipulations, audience, law, media

Introduction

Trends in increasing role of advertising in the life of society, are, apparently, visible to everyone. Advertising acts in different roles: as a subject of discussions, a way of earning money, or vice versa, as material or moral losses. It's a pity, but media are one of the most enduring hostages of advertising in our time. And this is natural, since advertising forms the most amount of the media profits. In each medium, promotional messages look different, but the purpose of commercial ads is to sell goods or services.

Unfortunately, advertising in the Ukrainian mass media can seldom be called qualitative or even correct, therefore we can increasingly notice advertising of poor quality, unfair or illegal advertisements.

The global public has paid attention to the negative aspects of advertising influence for a long time. Foreign researchers such as B. Stern, M.Jones, N. Postman and others are interested in this topic. In particular, B. Stern and M. Jones explore stereotypes that create TV commercials, and N. Postman considers advertising as a method of manipulating consciousness and propaganda.

Ukrainian scientists L.Myasnyankin and L.Pavlyuk focus on language mistakes in advertising, and O.Kuznetsova and O.Mayevsky are investigating prohibited types of advertising, such as hidden and unscrupulous advertising.

For the first time the text was named as pathogenic by Ukrainian scientists Boris Potiatynik and Marian Lozynsky, which have published a book with the corresponding title - "Pathogenic Text" [1]. The Ukrainian scholars K. Seragim, L. Masimov and S. Proskurin continued this topic. In their scientific works, scientists try to determine the criteria for pathogenicity of the text, taking into account, first of all, the influence of the text on the reader. We will consider the advertising text on the pathogenicity aspect and try to outline it's main criteria.

The purpose of the article is to substantiate the peculiarities of advertising, in particular its destabilizing influence in the media of Ukraine.

Before determining the criteria of manipulating in advertising in the Ukrainian press, it is necessary to find out what negative impact on the reader can have advertising, and whether it is appropriate to call such an act as particularly unfair?

Advertising in various media has its own peculiarities. If on television the main tool of the influence of an advertising message is visualization, which is manifested through the plot, the use of bright colors, musical accompaniment, then in print publications mainly text is a method of attracting the attention of the consumer.

The basis of the pathogenicity of the text explorer connects with a peculiar virus, which can affect the perception of the text by man. B. Potiatynyk notices that any text should be neutralized by the opposite in content with the words: "The preaching of violence can be neutralized by the preaching of non-violence, the preaching of atheism - the preaching of

religion, the propagation of a totalitarian ideology - the spread of democratic ideas and pluralism" [1, p.5].

According to the author, one of the few ways to neutralize or reduce the pathogenic impact of advertising on readers may be censorship. In Ukraine, restrictions on advertising concern mostly on such goods as alcohol, tobacco, weapons and drugs. However, the moral and ethical aspects of advertising in Ukrainian legislation are virtually ignored. So there is a problem of gender inequality, children's image in advertising, unmotivated comparisons in advertising messages, or illiteracy of the texts themselves remain on the conscience of advertisers, producers and distributors of advertising.

Another Ukrainian scientist K. Serazhym researches manipulative advertising texts which contain propaganda of class, racial hatred, pornography, hyperbolized advertising, totalitarian communication. She says that "it is not about individual cases, for example, involving inaccurate information, deception, which, of course, may have harmful or even fatal consequences for a common person. It is about the language of information in advertising (hypertrophied advertising), which, acting for a long time, have a significant impact on the way of life and worldview as an individual, and the human community, the nation, etc. "[2, p.157]. Returning to the peculiarities of the manipulative content in advertising, one must take into account the clarity of the illustration, its accessibility for perception and content. In accordance with the Law of Ukraine "On Advertising" [3], it is prohibited to portray children in dangerous situations and use them to advertise goods that do not directly affect the child's audience. Illustrations that contradict the norms of social morality are also prohibited, humiliates people's honor and dignity, or incite hostility. In this aspect, it is worth mentioning about the gender characteristics of advertising messages. The stereotyped image of women in the role of housewives, nannies or servants also does not advertise positive rice.

Conclusion

In order to eliminate the phenomenon of low-quality and manipulative advertising from the Ukrainian media space, it is necessary to provide clear control over advertising at all levels - from individual (at the level of self-control of a particular journalist) to editorial, regional and national. And this is possible only by creating an appropriate hierarchy of controlling bodies that would work for the interests of the state but not for their own.

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**5th INTERNATIONAL ACADEMIC CONFERENCE
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Facing Climate Changes: Forest Carbon Stock in Ukrainian Polissya and Disturbances Impact

Andrii Bilous, Viktor Myroniuk, Maksym Matsala, Petro Dyachuk

Department of Forest Mensuration and Forest Management, National University of Life and Environmental Sciences, UKRAINE, Kyiv, Heroiv Oborony 15, E-mail: bilous@nubip.edu.ua

Under increasing pressure of negative changes in climate and land use temperate forests continue to provide carbon sequestration. We examined impact of natural disturbances and harvest on forest carbon stocks in Ukrainian Polissya, using ground-based and remote sensing data. Those account for 21 % of total C emission from study area.

Keywords – ecosystem services, climate change mitigation, remote sensing, wind breakage, wildfires, insect outbreaks, timber harvest.

Introduction

Global warming, being actively discussed for the last decades, is likely to demand broader understanding of crucial role of global forest cover that can mitigate negative consequences of climate changes [2]. Temperate forests remain in special focus of international society: its possibility to being net carbon sink is hitherto uncertain. Moreover, carbon offsets, comparing to croplands, still can be overcome by differences in albedo and evapotranspiration parameters. Natural disturbances and timber harvest, including salvage, sanitary and illegal loggings, might substantially influence on forest ecosystem services, including carbon sequestration. Such alterations, as well as land use changes (including afforestation through natural successions), define carbon balance on local, regional and national spatial scales [4].

Forests of Ukrainian Polissya, being a part of Mid-Latitude ecotone, are definitely important, considering economical, social and ecological values for entire East European region [1]. Facing increasing pressure from emerging interactions between climate changes and natural disturbances, those need strict and reliable examination of all factors that cause substantial impact on forest carbon cycle if climate mitigation targets are wanted to become credible [2].

Method and Data

Estimation of forest biomass compartments for further examination of local carbon stocks was carried out on experimental polygon (area – 45 km²) established in Snovsk district of Chernihiv region. There are three main tree species in the study area: Scots pine (*Pinus sylvestris* L.), Silver birch (*Betula pendula* Roth.) and Black alder (*Alnus glutinosa* L.), admixtures of aspen, oak and others also were considered. Own research-based forest inventory was conducted within units of three local forest enterprises. Round ($r = 12.62$ m) and square sample plots were established, with aim to collect more precise estimation of biomass compartments.

Developed models were used for estimation of biomass in dry weight: for live components (stemwood over bark, foliage, branches and roots) and dead (snags, logs, litter of coarse branches and fine litter). Carbon stocks were examined, using guidelines of Intergovernmental Panel on Climate Change. For estimation of carbon fluxes and stocks due to method by Shvidenko et al. (2014) [1], data of Mukhortova et al. (2015) [3] was used (assessment of heterotrophic soil respiration, HSR), while Shvidenko et al. (2014) [1] models were taken for calculation of net primary production (NPP).

Ground-based forest inventory data (FID) was harmonized with remote-sensing (RS) data. With use of two high-resolution satellite imageries (Spot-6, acquired in 2010 and Sentinel-2, acquired in 2015), carbon stocks and fluxes were mapped for 5-year period. For land cover

classification and biomass modelling in RS data, RandomForest package and k -Nearest Neighbours (k -NN) method through yaImpute package in R system were used.

Data on harvest and natural disturbances (wildfires, wind breakage and insect outbreaks) were obtained from FID. Forest stands, damaged by storms and bark beetles, then were typically harvested with salvage loggings. Burned sites in young forests remained untouched. Data on afforestation on abandoned agricultural lands was obtained from RS evidence.

Results and Discussion

For the studied period (2010-2015), forest ecosystems within the experimental polygon were the net carbon sink. Flux-based method has shown well agreed results between FID and RS data: net C annual gain is 5.4 Gg C year⁻¹ and 5.6 Gg C year⁻¹, respectively. Difference between outputs, obtained via stock-based method, is significantly higher: increasing of C stock is 0.7 % (FID) and 16.2 % (RS data). Total C stock in 2015 is 567 Tg C (FID) and 592 Gg C (RS), where live biomass (27 %), coarse woody debris (1 %) and soil (72 %) carbon accounts for.

Natural disturbances and harvest cause 21 % of carbon emission for study period, with following composition by agents: 57 % – harvest, 34 % – storm, 6 % – bark beetles, 3 % – wildfires. Wind breakage of high severity in 2013 turned local forests into net carbon source for one year (Fig. 1). Substantial forest afforestation, observed by RS data, was not considered in the forest fund of local enterprises, thus on Fig. 1 only official reforestation is presented.

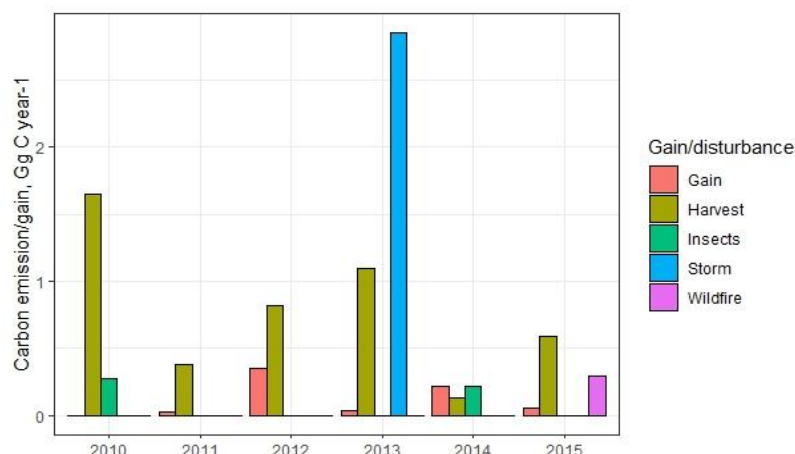


Fig.1. Composition of natural disturbances, harvest and reforestation within study area.

That is, understanding of processes that encompass and affect carbon sequestration capacity on such local scales, might help to broad knowledge for climate change mitigation efforts and sustainable development implementations in Ukrainian forests.

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Opportunity of wastes recycling for bio-production processes

Yelizaveta Chernysh, Olena Yakhnenko

Department of Applied Ecology, Sumy State University, UKRAINE, Sumy, 2, Rymskogo-Korsakova Str.,
E-mail: y.chernysh@ecolog.sumdu.edu.ua, o.yakhnenko@ecolog.sumdu.edu.ua

The mineral and organic wastes/by-products can be useful as nutritional needs of Lactic acid bacteria under bio-production of polymer composites. The present paper deals with the biochemical analysis of opportunity of lactic acid production and possibility of phosphogypsum and sewage sludge using as supplements under fermentation. The biochemical reactions were formed based on the KEGG database.

Keywords – phosphogypsum, sewage sludge, lactic acid production, supplements, biochemical analysis

Introduction

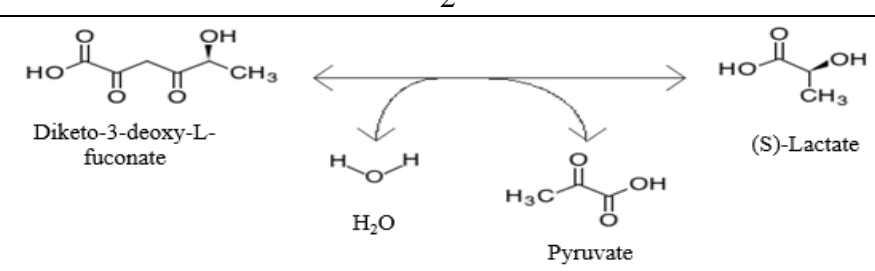
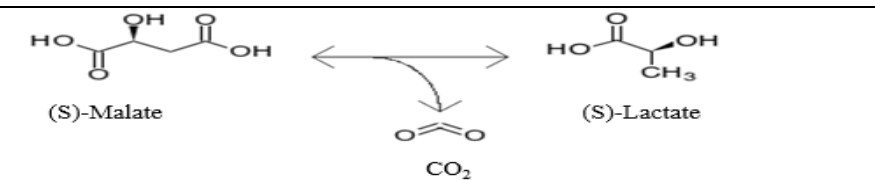
Today, biobased plastics have an established market that is growing rapidly both in Europe and worldwide. Europe is expected to remain the main consumer for biobased plastics through to 2030. Published market reviews on bioplastics have very different views on the expected future demand with projected annual growth rates of between 15% to 35% between 2010 and 2020 [1]. The chemical synthesis of bioplastic may be limited due to limiting source of naturally available raw materials in future and negative feature for environmental pollution. Whereas renewable sources including lingocellulose, starch, agricultural waste materials, sugars and others are abundant substrates for fermentative production [2].

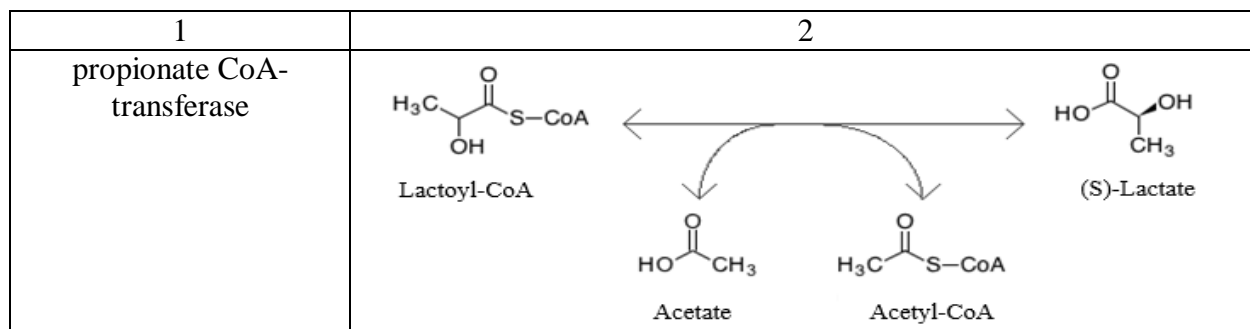
Main part

When lactic acid (LA) has been harvested, it can be polymerized into plastic LA using various methods, each of which requires varying concentrations of lactic acid and additives [3]. The present paper deals with the biochemical analysis of opportunity of LA production and possibility of phosphogypsum (PG) and sewage sludge using as supplements under LA fermentation.

The biochemical reactions under Lactate metabolism ((S)-Lactate; L-Lactate; L-Lactic acid) were formed based on the KEGG (Kyoto Encyclopedia of Genes and Genomes) database and present on the Table 1. These results are consistent with the studies described in the works [4-6].

Table 1

Enzyme properties and biochemical reaction under LA fermentation	
Enzymes	Bio-chemical reaction
1	2
2,4-diketo-3-deoxy-L-fuconate hydrolase	
malolactic enzyme : (S)-malate carboxylase	



Lactic acid bacteria (LAB) need sources of the carbon, nitrogen, phosphorus and other nutrients. PG and sewage sludge can be useful for the extending feedstock basis for the LA fermentation. They can be useful as cheap carbon sources for fermentation processes and the additional nutrients are important as well in view of an economic feasible entire process.

While the nutrient recycling strategy is expected to be a tool to tackle particularly diffuse sources, it is also important to look for opportunities in the present point sources and especially in cases where results can be achieved quickly and cost-effectively. While the PG waste sites contain vast amounts of phosphate phosphorus and potentially hazardous waste, it is important to keep on monitoring the sites and take measures to eliminate risks to the environment and human health. On the other hand PG contain useful elements (Ca, S, P, Mg, K, Na, microelements) and municipal sewage sludge contain organic carbon compounds for microorganisms growth. The primary sewage sludge is easily biodegradable since it consists of more easily digestible carbohydrates and fats, compared to activated sludge, which consists of complex carbohydrates, proteins and long chain hydrocarbons.

Conclusion

LA as a bio-product is healthier and more desirable for food, drink, and pharmaceutical industries because it is easier to metabolize by a living organism. The mineral and organic wastes/by-products (after pre-treatment) can be useful as nutritional needs of LAB. Further experimental investigation and computational modelling should be held for estimation on the effectiveness of the use of PG and sewage sludge as a nutrient supplement for bacteria growth.

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Investigation of the influence of the light spectrum on the growth efficiency of chlorophyll synthesizing Microalgae

Dyachok Vasy¹, Katysheva Viktoriia²

1. Department of Ecology and Sustainable Environmental Management, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: katyshevakt@gmail.com.

2. Department of Ecology and Sustainable Environmental Management, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: dyachokvasil@gmail.com

Abstract - the effect of light wave length on the rate of carbon dioxide absorption by microalgae has been studied. The coefficient of microalgae growth based on the mathematical model has been determined. The optimum length of light wave has been determined to design the flow chart for eliminating carbon dioxide from industrial gas emissions via the biological method.

Keywords: photosynthesis, light wave length, microalgae, diffusion, mathematical model, kinetics.

Introduction

A spike of greenhouse gases causing climate change around the world. “The rapid pace of climate change along with the demographic boom of the last century, loss of habitat, chemical and other pollution lead to ecological imbalances” – quoted by the UN news Centre UNEP expert Niklas of Hagelberg. British and Australian scientists have concluded that global warming threatens the loss of biodiversity and leads many natural disasters.

In the Paris agreement, the state promised to keep the global temperature rise at two degrees. But even if achieving this goal the risk of biodiversity loss is reduced only by half scientists [1].

The most important issue today is to prevent a rapid increase in air temperature. This can be achieved by reducing greenhouse gas emissions into the atmosphere and using alternative energy-efficient technologies. Such technologies include biological purification of air from carbon dioxide with the chlorophyll synthesizing microalgae such as Chlorella.

Description of the problem

The basis of the proposed method of solving the problem of global warming is the process of photosynthesis chlorophyll synthesizing microalgae, which, unlike terrestrial plants, can adapt to the edge of unfavorable living conditions and grow 7-10 times faster. The purpose of the study was to investigate the influence of the wavelengths of different range on the rate of absorption of carbon dioxide by microalgae.

The object of laboratory research was the process of absorption carbon dioxide by culture of green microalgae Chlorella vulgaris, which is cultivated with different colours of light during 14 days in four photobioreactors with a 1.5 L volume. In the first photobioreactor the colour of the light was blue, in the second – green, in the third – yellow and in the fourth one it was red. The algae received the same amount of the corresponding spectrum of light and bubbling carbon dioxide in all the four photobioreactors. In the further cultivation of algae, their number increased. The pH was 6.5. The temperature of cultivation was $35 \pm 1^\circ\text{C}$. The concentration of algae biomass was determined by a photocolorimetric method. The spectrum of absorption in the visible region of the aqueous solution of Chlorella microalgae presents in Fig. 1.

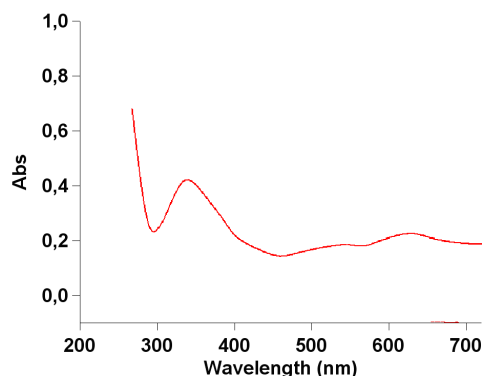


Fig. 1. The spectrum of absorption of the aqueous solution of the studied microalgae.

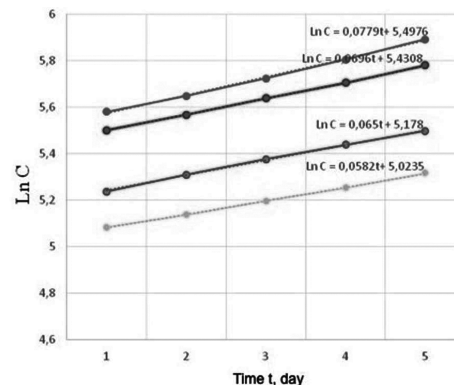


Fig. 2. Kinetic curve lines of increase of concentration of microalgae in logarithmic coordinates with the appropriate wavelength of light

As shown on figure 2 the dynamics of growth, and thus the intensity of the absorption of carbon dioxide by microalgae significantly depends on the wavelength of light. The experimental curve lines are well described by the famous equation:

$$C = C_0 e^{-k_M t}, \quad (1)$$

where N is the current cell concentration in the biomass of microalgae, N_0 is the cell concentration in the biomass of microalgae at the initial time $t=0$, k_M - the coefficient of increase of biomass of microalgae.

In logarithmic coordinates (1) describes a straight line of tangent of the inclination of which allows to determine the growth rate k_M . The results of the transformations are shown in Fig. 2.

The coefficient of growth for the corresponding spectrum of light was determined by the graphic method, as the tangent of the slope of the experimental straights (Fig 3).

$$k = 3,2 \cdot 10^{-3} \lambda + 0,0756, \quad (2)$$

where λ is the wavelength of light [2].

Conclusion

Based on experimental studies, the data that indicate the appropriateness of the use of blue and red light spectrums for the cultivation microalgae at night time were obtained. The value of the growth factor of microalgae from the wavelength was determined. The graphic dependence of the growth factor on the wavelength is obtained, the analysis of which allows us to say that the largest absorption region has (440 nm) and (590 nm).

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Investigation of the influence of nitrogen oxides to increase chlorophyll synthesizing microalgae in aquatic environment

Vasil Dyachok¹, Solomiia Mandryk²

1. Department of Ecology and Sustainable Environmental Management, Lviv Polytechnic National University, UKRAINE, Lviv, Stepan Bandera street, 12, E-mail: dyachokvasil@gmail.com

2. Department of Ecology and Sustainable Environmental Management, Lviv Polytechnic National University, UKRAINE, Lviv, Stepan Bandera street, 12, E-mail: solomiia.mandryk@ukr.net

Abstract - The purpose of this work is to study the influence of nitrogen oxides on the growth of chlorophyllsynthesizing microalgae in aquatic environment. In this work studied the process of microalgae of the Chlorella type cultivation provided the presence of nitrogen oxides. The method of determining the influence of nitrogen oxides on the growth of biomass of microalgae is described. The method of calculating the value of the optimal concentration of nitrogen oxides for chlorophyllsynthetic microalgae is established.

Keywords: chlorella, nitrogen oxides, carbon dioxide, cultivation, chlorophyllsinting microalgae, biological treatment, biomass growth.

Introduction

To date, the concern of irreversible changes and the consequences of an increase in carbon dioxide in anthropoecosystems is gaining catastrophic proportions. The main source of CO₂ is industrial emissions from the combustion of solid, liquid and gaseous fuels. Everyone knows that carbon dioxide is one of the main greenhouse gases. The accompanying gases are sulfur oxides, since sulfur is always present in the fuel, as well as nitrogen oxides, phosphorus and other related greenhouse gases. Work on the influence of SO₂ on the absorption of carbon dioxide by chlorophyllsynthesizing microalgae is contained in previously published works [1]. Our task is to investigate the effect of nitrogen oxides on the rate of absorption of carbon dioxide chlorophyllsynthesizing microalgae of the Chlorella type.

Description of the problem

Unlike other green plants, algae have a number of significant benefits. They grow 7-8 times faster, and, accordingly, absorb larger concentrations of nitrogen oxide, which can adapt to the edge of adverse conditions. Such advantages make it expedient to introduce gas purification processes with the use of single-celled chlorophyllsynthesizing microloans of the Chlorella type in industry. The literature contains little data on the influence of nitric oxide on the rate of growth of biomass of algae. Therefore, it is important to investigate the effect of nitrogen oxide on the activity of microalgae. From literary sources, the concentration of nitrogen oxides is known to have a detrimental effect on the flora. The impetus for our work was the concentration of NO_3^- 0,17 – 0,18 mg / m³ [2].

The object of laboratory research is the process of absorption of carbon dioxide in the presence of nitrogen oxides, which in the aqueous medium, as a rule, is in the form of anion NO₂ - a culture of green algae of the type Chlorella. During the research it is obvious that intensive growth of microalgae should be expected, due to the fact that nitrogen oxides are a source of nitrogen for microalgae (nutrient medium).

The growth of biomass chlorophyllsynthesizing microalgae under these conditions was determined by photocolometric method using a blue light filter according to Bouguer-Lambert-Ber. Since the concentration is proportional to the optical density, the experimental data on the accumulation of biomass of algae, depending on the time within the studied nitrogen oxide concentration (NxOy), correspond to the values of optical densities(Fig. 1,2).

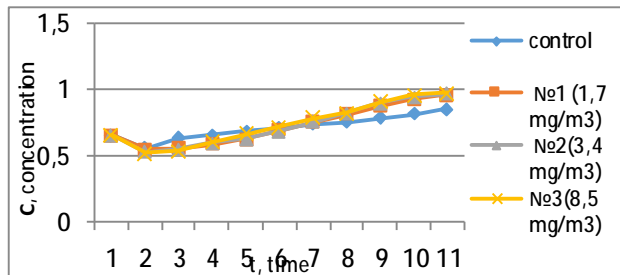


Fig. 1.– Dependence of changes in the concentration of microalgae cells in time at appropriate concentrations NO_3^-

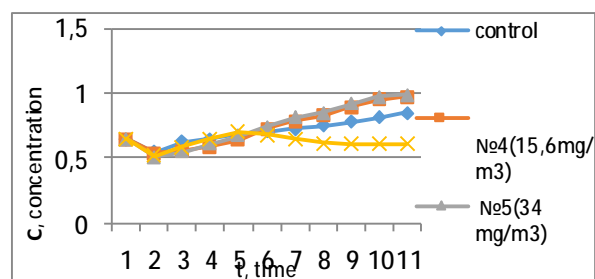


Fig. 2.– Dependence of changes in the concentration of microalgae cells in time at appropriate concentrations NO_3^-

The main goal of the work should be to find the critical concentration of NO_3^- at which a harmful effect on microalgae will come.

The mathematical formulation of the model for the growth of microalgal biomass under the condition of the presence of nitrogen oxides is to achieve a maximum of their growth, with a further reduction is the system of equations(1):

$$\begin{cases} \frac{dC}{dx} = k_1 C - k_2 C \\ \frac{dC}{dx} = k_1 C; \\ x = 0, C = C_0 \end{cases}; (1)$$

where, x – concentration of nitrogen oxides; C - concentration of algae in a suspension; k_1, k_2 - coefficient of growth of biomass of algae.

The decision of the mathematical model has the form (Eq.2):

$$x_{\max} = \frac{\ln k_2 - \ln k_1}{(k_1 + k_2)}; (2)$$

Under these circumstances, calculating the growth factors for algae - k , according to experimental data of studies, it is always possible to calculate and predict the values of nitrogen oxide concentrations, which maximize the growth of microalgae in the absorption of carbon dioxide and to forecast equipment for the implementation of the technological process in practice.

Conclusion

A mathematical model of the growth of microalgae colonies in the absorption of carbon dioxide has been constructed under the presence of nitrogen oxides. Based on the decision of the mathematical model and the experimental results obtained, the calculated value of the optimum concentration of NxOy for the growth of microalgae of the *Chlorella* type is established. In addition, the solutions made will allow in the future to predict equipment for the implementation of the technology of absorption of greenhouse gases, provided NxOy is present.

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Adsorption treatment wastewater from the production oils

Dyachok Vasil¹, Marakhovska Anastasiia²

1. Department of Ecology and Sustainable Environmental Management, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: dyachokvasil@gmail.com

2. Department of Ecology and Sustainable Environmental Management, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: anastasia.marakhovska@gmail.com

Abstract – The adsorption method of after-treatment of wastewater from the production of edible oils was investigated. The reasons of choice the activated carbon as adsorbent was justified. The statics of the absorption process by activated carbon the organic component from the wastewater of oil production after extraction cleaning was investigated. The experimental data based on the theory of Freundlich and Langmuir were processed and the main constants of the process were defined.

Keywords – wastewater, adsorption, activated carbon, isotherm, statics, kinetics.

Introduction

The production of edible oil's increases year by year in proportion to the demand, more and more enterprises of this profile emerge, thus the total amount of emissions including wastewater increasing. For Ukraine, the topic of wastewater from the production of oils is relevant because our country occupies the first place in the world ranking of growing sunflowers, consequently, the production of oil. As Ukraine is one of the major sunflower producers and their processors, the issue of wastewater treatment of the oil's production is very relevant today.

In the process of vegetable oil's production, a large amount of wastewater arises in the form of emulsions. Such systems are stable over a long period of time. They are not destroyed by the mechanical method [5, 6]. They are poorly biodegradable due to large volumes of wastewater and a significant amount of organic components in them [2-4]. In such circumstances, it is appropriate to use liquid extraction to clean such wastewater [1,7]. The feasibility of using extraction for wastewater treatment is determined by the concentration of organic impurities in them.

The absolutely insoluble liquids are absent in water, that's why in the process of extraction, the part of the extractant dissolves in wastewater and becomes a new pollutant. Therefore, it is necessary to remove the extractant from the conditionally purified water. This also needs to be done to reduce the consumption of the extractant. In addition, extraction cleaning is not always appropriate to achieve high purification efficiency. In these cases, the adsorption method of purification is used. The advantage of the method is the high efficiency, - and the possibility of purification of wastewater, which contains several substances and recovery from these substances.

Description of the problem

The adsorption method of extraction residual amount of the pollutant and the extractant was chosen for research. This method allows to removing of residual concentrations of pollutions. The activated carbon was selected as a sorbent. It has the ability to absorb pollutants of organic origin. In mixing the adsorbent with wastewater, activated carbon was used in the form of particles of 0.1 mm and less.

The adsorption of activated carbon in the form of the isotherm is shown on the graphic (Fig. 1). The isotherm describes the equilibrium between the pollutant in wastewater which must be treated and the amount of pollutant in the activated carbon.

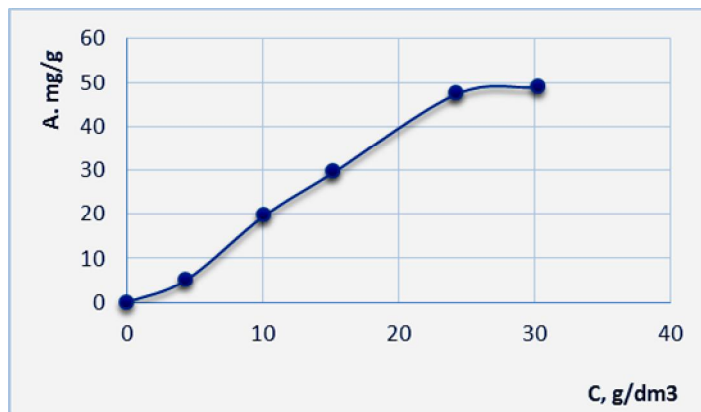


Fig. 1. The isotherm of adsorption wastewater pollutants in sunflower oil's production by activated carbon

The adsorption equilibrium in the solid adsorbent-solution system describes the equations that are given in the literature [1, 8]. We used two models that describe adsorption isotherms. One of the models is represented by the Freundlich equation.

To determine the constants of the Freundlich equation (k , n), the equation was given to the linear form by taking their logarithm:

$$\ln A = \ln k + 1/n \ln c \quad (1)$$

From the graph built in the coordinates $\ln A = f(\ln c)$, we find $\text{tg} \alpha = 1/n$ and $\ln k$ as the distance which cuts the experimental straight line on the Y-axis. Experimental data in linear coordinates $\ln A = f(\ln c)$ according to Freundlich equation are presented in Fig. 2.

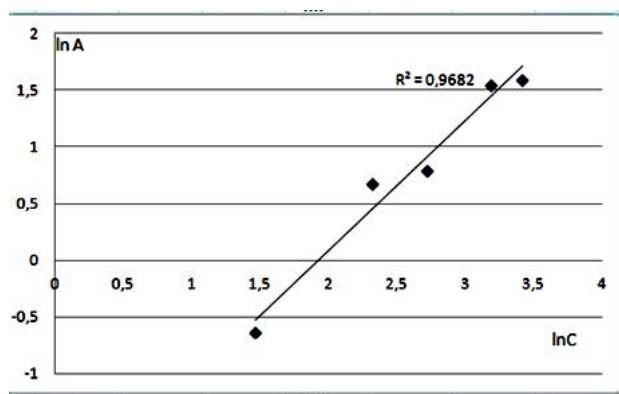


Fig 2. The isotherm of adsorption in linear coordinates

The experimental data on Fig. 2 represent a straight-line correlation and this indicates a satisfactory description of the isotherm of adsorption by the Freundlich equation. The correlation coefficient of experimental and theoretical data is 0.96, which indicating the reliability of experimental data.

The final form of the Freundlich equation for the adsorption process with using activated carbon:

$$A = 1.045C^{1.1836}$$

However, we believe that there is sorption in the form of a monomolecular layer of adsorbate and this process is better described by the Langmuir equation. Therefore, we have analyzed the obtained isotherms of adsorption according to this theory.

To calculate the limiting adsorption of the organic pollutant (A_∞) we use the linearity Langmuir equation [2, 3].

$$\frac{C}{A} = \frac{1}{A_{\infty}k} + \frac{1}{A_{\infty}C} \quad (2)$$

where A_{∞} - the static activity of the adsorbent, which determined:

$$A_{\infty} = \frac{C_{\text{init}} - C_p}{m} V \quad (3)$$

The graph in the coordinates $C/A = f(1/C)$ was constructed and the angular coefficient of the slope of the line $k = \Delta C / \Delta(C/a^*)$, which is equal to the limit of the adsorption of was find.

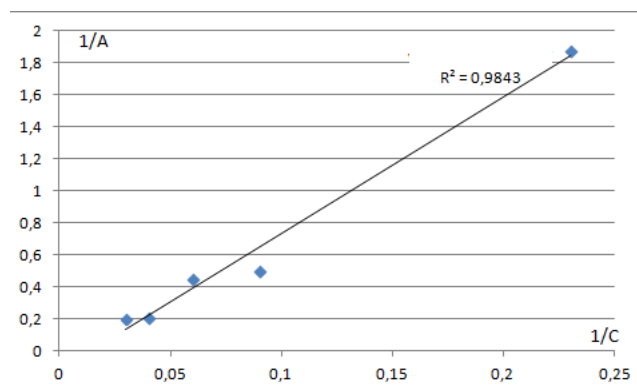


Fig 3. The Langmuir isotherm of adsorption in linear coordinates

The isotherm of adsorption pollutants from wastewater of sunflower oil's production after chemical treatment (the destruction by chemical substances of a stable emulsion "oil-water"), by activated carbon is described by the Langmuir equation:

$$A = 49.1 \frac{0.97C}{1 + 0.97C} \quad (4)$$

The correlation coefficient of the experimental and theoretical data R^2 is 0,96 ...0,98, which indicates a more reliable description of the experimental data by Langmuir isotherm. The selection criterion of the theoretical model was the maximum value of Fisher's criterion (F) and the maximum value of the determination coefficient.

Conclusion

The statics and kinetics of adsorption method of after-treatment of wastewater from the production of vegetable oil was studied. The study established that the experimental isotherm of adsorption is the best described by the Langmuir equation, and the process of adsorption proceeds by the external diffusion mechanism. In such circumstances, the degree of wastewater treatment corresponds to safe hygiene practices.

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The Ecological Monitoring System of the Territory of the Mining and Chemical Enterprise at the Stage of Liquidation

Elvira Dzhumelia¹, Volodymyr Pohrebennyk²

1. Department of Ecological Safety and Nature Protection Activity, Lviv Polytechnic National University, UKRAINE, Lviv, 130, Hen. Chuprynka St., E-mail: elviradzhumelia@gmail.com

2. Department of Ecological Safety and Nature Protection Activity, Lviv Polytechnic National University, UKRAINE, Lviv, 130, Hen. Chuprynka St., E-mail: vpohreb@gmail.com

Abstract – On the example of Rozdil State Mining and Chemical Enterprise (SMCE) "Sirka" the main problems of the system of ecological monitoring of the territory of the mining and chemical enterprise at the stage of liquidation are highlighted. It was established that monitoring of the territory of the enterprise at the stage after the exploitation will increase its environmental safety and surrounding settlements.

Keywords – sulphur mine, reclamation, environmental monitoring, soil pollution, water pollution, mining and chemical enterprise.

Introduction

The activity of mining enterprises or complexes is temporary. When an enterprise ceases its work and goes into the stage of liquidation, it is necessary to protect and restore the environment, the territory must be restored back to its original state. Ensuring ecological safety during the liquidation of the mining and chemical enterprise is carried out on the basis of monitoring and includes: control over the release of gas in areas dangerous and threatening to penetrate methane to the surface, and measures to prevent its uncontrolled exit and accumulation under built-up areas and in underground structures (organized outlet through degassing pipelines, laid in trunks, through specially drilled wells from the surface in underground workings, etc.); control over the level of underground mine waters with the implementation of the need to reduce them to the set level of pumping, drainage, engineering training of the territory to drainage; control over deformations of the earth's surface with the implementation of technological measures for the protection of buildings and structures, the elimination of the consequences of failures. Environmental monitoring is also necessary for the dynamics of soil contamination and the quality of atmospheric air near dumps; radiometric control of waste heaps, sediment ponds, accumulation ponds, underground waters, buildings in hazardous areas [1].

Monitoring Problems

At present, the theoretical and methodological approaches to environmental monitoring of a mining enterprise in the liquidation stage, as well as its material and technical and financial support have not been solved. . This problem is only at the initial stage of the solution. The need for a scientific substantiation of the monitoring system in the area of former mining activity, where the mosaic of technogenesis is very complex, requires the use of various theoretical positions, concepts and methodological tools, and interdisciplinary studies of various sciences.

Rozdil State Mining and Chemical Enterprise "Sirka" left after its activities tailing pits, dumps of phosphogypsum, flooded quarries. Also, there are tars, that imported from Hungary in 2004, on the territory of the enterprise and a household waste landfill.

Soils are of great importance to the environment, including a protective role for ecosystems. In industrial areas, especially in areas of mining and chemical works, there is a negative anthropogenic impact on the natural environment and its individual components. The activity of the mining and chemical enterprise pollutes the environment with heavy metals,

harmful substances. Particularly widespread pollution of soils and the water environment (underground and surface waters) with the following pollutants: zinc, lead, strontium, chromium, manganese, etc. In addition, as a result of chemical activity, soil acidity may be altered.

The water environment is contaminated by components of the salt composition, ecological and sanitary indicators, indicators of toxic and radiation action. Heavy metals pollute the soil and water environment. It is necessary to create the monitoring system since the enterprise is in the liquidation, but still poses a threat to the environment. It is necessary to consider the organization of the monitoring system of mining objects depending on the types of influence on the sources of environmental impact, since each source may have several types of influence on the elements of the environment [2], [3].

The informational and analytical monitoring system of the Rozdil state mining and chemical enterprise "Sirka" is intended for analysis of the state of:

- soils;
- industrial waste;
- geophysical processes;
- water objects.

The current state of the environment of the enterprise and its impact on the adjacent territories will be determined using the system of environmental monitoring of soil of Rozdil SMCE "Sirka", that will allow to react in a timely manner to adverse changes in the composition of the soils of the territory, to predict and simulate the process of migration of heavy metals in soils, and to reduce the area of pollution. The system of ecological monitoring of the environment of mining and mining-chemical enterprises and complexes at the stage of liquidation should be the part of the system of state environmental monitoring [4].

Conclusion

The system of ecological monitoring of the environment of mining and mining and chemical enterprises and complexes at the stage of liquidation should become an effective information and analytical base for the regulation of the ecological situation in the areas of extraction of minerals. Creation of such a system is an important step to increase the ecological safety of the territory, because timely information about the ecological state provides a operative solution to the problem with minimal risks and consequences.

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Researching of alternative water cleaning and restoration technology

Anna Hlukhaniuk, Oleksandr Ivashchuk, Kateryna Marushchak, Andriy Sharanevych

Department of Chemical Engineering, Lviv Polytechnic National University,
UKRAINE, Lviv, S. Bandery street 12, E-mail: roma.shkovna.hanna@gmail.com

Abstract – This article presents new alternative way of cleaning and restoration of water, based on Viktor Schaubberger's scientific theories about its naturally correct handling, storage, and conduction by means that promote its self-purification, the retention and enhancement of its natural energies and health.

Keywords – alternative water cleaning ways, water purification and restoration, implosion, engineering analysis, simulation.

I. Introduction

In order to fight with water pollution catastrophe, alternative cleaning and recovering methods should be investigated.

Modern ways, like Chlorination and Fluoridation, using settling tanks and other machines based on mechanical cleaning are very common for our 21st century industry. All ways, mentioned above, are popular because of their low cost, simplicity and relative efficiency, but every has its pros, that don't allow us to use them like universal and ideal. For example, chlorine, like powerful disinfectant kills great amount of bacteria, both beneficial and harmful. And of course, it has a bad effect on health, caused by ability to accumulate in the body [1].

II. Schaubberger's alternative insights on water

The idea of alternative water cleaning way is well presented in works of the Austrian inventor Viktor Schaubberger. Water, live natural alive substance, needs correct handling, storage, and conduction by means that promote its self-purification, the retention and enhancement of its natural energies and health. The researcher suggested using natural way of 'growing' groundwater throughout the ground, depending on soil temperature, radiance of the sun and soil salinity. The most important factor of this process is the nature and structure of the path that passes water from the depths to the surface, and the very connection between it and the qualities of the fluid that we receive as a result is the most complicated for the scientific substantiation.

Analyzing nature processes of foundation of water, Viktor Schaubberger discovered, that reflecting nature's principal constant, namely that of continuous change and transformation, the vortex epitomizes its form of open and flexible motion. Based on his study of the vortices occurring naturally in flowing water and in the air in the form of cyclones and tornadoes, researcher developed his theories of implosion.

The water restructuring produced by the better vortex treatment systems, such as the Living Water Jug, which employs Viktor Schaubberger's technology should allow superimposed natural vibrations to erase the memory of water's previous abuse. The vortex, being the transmuting agent or the enabling gateway between different qualities or levels of energy, encourages the water to absorb the etheric or cosmic level of energy that surrounds us all.

We would recommend a combination of an efficient plumbed-in double-carbon filter with a vortex-type re-energizing system [2].

An example of the vortex technique is shown in Fig. 1: (1) the Aquagyro type, (2) the Stuttgart experimental type. The goal is to lead water into a big vortex inside a tube.

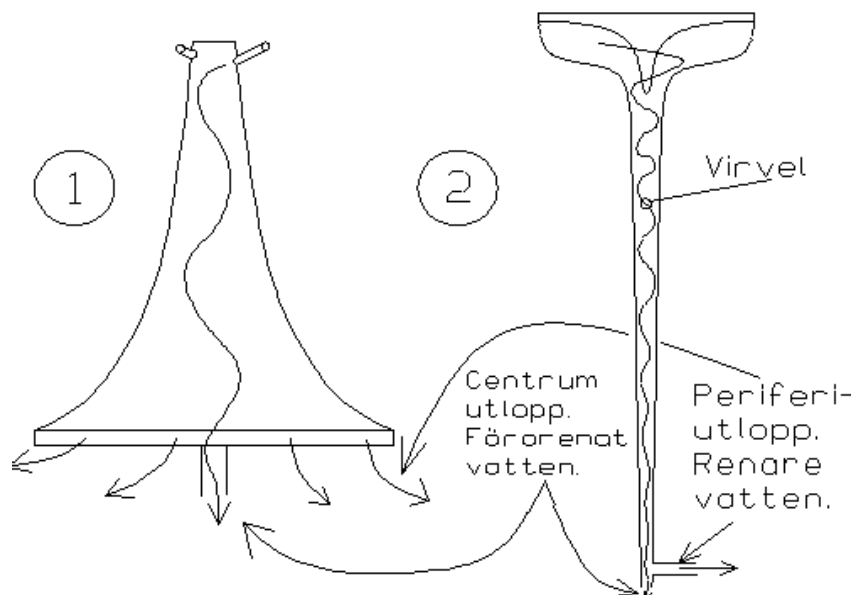


Fig.1. Vortex technique (Translation from German: centrum - center, utlopp - outlet, förorenat - polluted, periferi - peripheral, renare - purified, vatten – water).

A large amount of the polluting particles is then gathered in the center axis of the vortex. Changes of the chemical properties in the water have been reported, i.e. changes of the content of oxygen, precipitation and bonding of metal ions. Preliminary tests indicate that a multiplied centripetal movement is applied on the media, i.e. spirals within spirals. This movement creates centripetal forces that concentrate the particles in downward space spiral around the central axis [3].

III. Defining process parameters

Apart from other factors (some cannot be defined quantitatively), encompassing such aspects as turbidity (opaqueness), impurity, and quality, the most crucial factor affecting the health and energy of water is temperature. As a liquid, the behavior of water differs from all other fluids. The latter become consistently and steadily denser with cooling, while water reaches its densest state at a temperature of +4° Celsius (+39.2°F), below which it grows less dense. This is the so-called "anomaly point", or the point of water's anomalous expansion, which is decisive in this regard and has a major influence on its quality. Below this temperature it once more expands. This highest state of density is synonymous with its highest energy content, a factor to be taken carefully into account, since energy can also be equated with life or life-force. Therefore if water's health, energy and life-force are to be maintained at the highest possible level, then certain precautions must be taken, which will be addressed later [1].

In its natural, self-cooling, spiraling, convoluting motion, water is able to maintain its vital inner energies, health and purity. In this way it acts as the conveyor of all the necessary minerals, trace elements and other subtle energies to the surrounding environment. Naturally flowing water seeks to flow in darkness or in the diffused light of the forest, thus avoiding the damaging direct light of the sun [1].

IV. Conclusion

Nowadays, the searching of the alternative water cleaning and restoration technology is an important scientific issue. In order to that we are going to provide laboratory experiments and simulation of the process with the modern software, for example Solidworks. The results will published.

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Fluorescent monitoring of phytomelirants of man-made landscapes of the Yavoriv mining industry district

Ruslan Hrechanyk¹, Volodymyr Mokryy², Oleksandr Moroz²,
Ihor Petrushka², Rostyslav Kravtsiv²

1. Department of Ecology and Natural Resources of Lviv Regional State Administration, UKRAINE, Lviv, street, Stryiska, 98, envir@mail.lviv.ua

2. National University "Lviv Polytechnic", UKRAINE, Lviv,; street, S. Bandery, 12, istr.dept@lpnu.ua

Abstract – Actuality of fluorescence monitoring of regionalization and degradation transformations of ecosystems of Yavoriv mining industry is considered. Identification of forest conditions and express diagnostics of photosynthetic apparatus of plants was performed. The methodological principles of using integral information on the basis of morphophysiological and fluorescence characteristics of plants for phytomelioration of technogenic landscapes are given.

Keywords – monitoring, fluorescence, photosynthesis, technogenic landscape, mining industrial area, phytomelioration.

Introduction

Problem solving in general and its connection with important scientific and practical tasks. Modern concepts of management of man-made ecosystems of the Yavoriv mining industry district (GPR) are based on the widespread use of comprehensive monitoring data. The use of modern information-analytical methods and technologies in the selection, accumulation and analysis of the parameters of the functioning of the components of biogeocoenoses, is relevant for: assessment of the dynamics of spatial and temporal changes in technogenic landscapes; determination of the specificity of the manifestation of degradation and renaturalization processes in morphophysiological indices of plants and spatial-species structure of plant groups, analysis of the effectiveness of phytomelioration; formation of scientific principles of technologies of protection and restoration of natural technogenic ecosystems.

An analysis of recent research and publications, which initiated the solution of this problem, which is based on the author. The analysis of research on the environmental problems of mining of sulfur deposits indicates the existence of a fundamental basis of the phenomenology of environmental safety of mining regions of Ukraine [1]. The authors [2-4] summarize numerous, in-depth, and detailed, but fragmentary and disparate results of geoecological researches of the mining complexes of Precarpathians. Landscaping, geological, geographic studies of the influence of mining industry on the environment are devoted to the work Grodzinsky MD, Ivanova Ye.A., Kovalchuk I.P. etc. Problems of environmental safety at the stage of liquidation of sulfur mines are devoted to works by Y.M. Semchuk, Y.I. Kryzhanivsky Korina S.C. etc. The questions of engineering protection of sulfur deposits of the Carpathian region are devoted to the work of Rudko GI, Gaydin AM, Zozulii I.I., Dyakiv VO. etc. Information, software and mathematical support for evaluating the karstic and shift processes induced by mining workings are covered in the works of Adamenko Ya.O., Chepurnogo IV, Kuzmenka E.D., Ivanik A.M. etc.

The considered works indicate the need for an integrated approach to environmental protection in mining complexes, the use of elements of unification and adaptation of technologies for the protection of the natural and man-made environment, to real objects. The logical continuation in the scientific works of technological schemes and technical decisions of monitoring, stabilization of technogenesis and ensuring environmental safety is the development of conceptual foundations of phytomelioration of man-made landscapes.

V. Selection of previously unsettled parts of the general problem, to which this article is devoted. The analysis of the natural and climatic conditions of Yavorivsky GPR proves the expediency and necessity of forest-meliorative transformation of man-made, degraded and unproductive lands. Taking into account that forest cenoses use up to 90% of solar energy (agrocenoses - only 40%), and also taking into account that the harmonious development of a society with nature requires a ratio of forest vegetation to agro-landscapes within 50% [5], on lands that have undergone man-made impacts, it is advisable to create forest cultures of phytocoenoses, which would fulfill various vital protective functions. Therefore, monitoring of the processes of afforestation of man-made landscapes of the Yavorivsky GPA will contribute to improving the quality of the environment, increasing forestry in the mining regions, and attracting land with disturbed soil to the economic flow of land.

Formulation of the purpose of gender (statement of task). The purpose of the research is to express the diagnosis of morphophysiological indices of plants, to obtain information on the signs and properties of the objects of natural and technogenic biogeocoenoses, necessary for a qualitative interpretation of the biodegradability of phytomelirants of technogenic landscapes.

Object of research. As the object of comparative research, the main forests of the crop species of forests - oak are commonly used to determine and compare the vitality index in different types of forest vegetation. The test material is selected from underground sulfur (PVS), control samples - from adjacent undisturbed terrain.

Subject of study. The subject of research is the processes of stress adaptation of the plant, general functional changes in the assimilation apparatus of oak ordinary in different environmental conditions determined by the complex of fluorescence parameters.

Research methods. The research methodology includes field surveys of technogenic and natural landscapes, sampling, laboratory measurements of plant morphophysiological parameters, and the formation of a database of fluorescence monitoring results. The activity of photosynthetic apparatus isolated from leaves of plants was investigated by the method of photoinduced fluorescence of chlorophyll (FH) [6]. Before the measurements, the sheets adapt to the conditions under which the FX measurements will be made. The sheet must be adapted to the darkness for 3 minutes before installing into the sample compartment. Inductive curves of FS are measured by a dynamic fluorimeter. The spectral selection of the excitatory ($\lambda = 450-550$ nm) and the registered radiation ($\lambda = 680-760$ nm) is carried out with the help of glass filters. Registration time is 3 minutes. The time dependence of FH is recorded by the recorder. The ratio of the maximum and background amplitude of inductive transitions is recorded by an oscilloscope. The mathematical models of FK kinetics graphs are executed in Excel, using the "Graph2Digit" program. To test the results of the research, the Styudents criterion was used.

Presentation of the main research material with full justification of the received scientific results. The phytomelioration of the Yavoriv GPR territory is necessary to stop the man-caused degradation of land and the return of devastated territories to recreational and economic use. Optimization of the ecological situation provides a wide range of ecological and economic measures based on the data of testing the morphophysiological parameters of floristic elements at the initial stage of the recultivation succession of the formation of vegetation on the technogenic soil substrates of Yavorivsky GPR.

The results of investigations of the kinetics of induction transitions of FX showed a significant difference in the fluorescence intensity of the investigated objects. Figure 1 shows the kinetic changes of FH oak in the natural and man-made landscapes of Yavorivsky GPR in two consecutive sampling samples. The insert of Fig. 1 shows the value of the vitality index (Rfd),

which reflects the deactivation of the photosynthetic apparatus due to the deterioration of the conditions of location.

The largest induction maximum is observed in the control plants of the forest from the adjacent area. The smallest - from the territory underground smelting sulfur, characterized by the largest man-made degradation of land. Reducing the maximum induction of FH indicates changes in the activity of the donor part of the photosystem 2. The obtained data indicate the inhibition of the transport of electrons along the transport chain from absorbing light quanta of pigments and their centers to acceptors. The deterioration of the conditions of location, in addition to the change in the amplitude of FH, is accompanied by characteristic changes in the kinetics of photoinduced transitions FH.

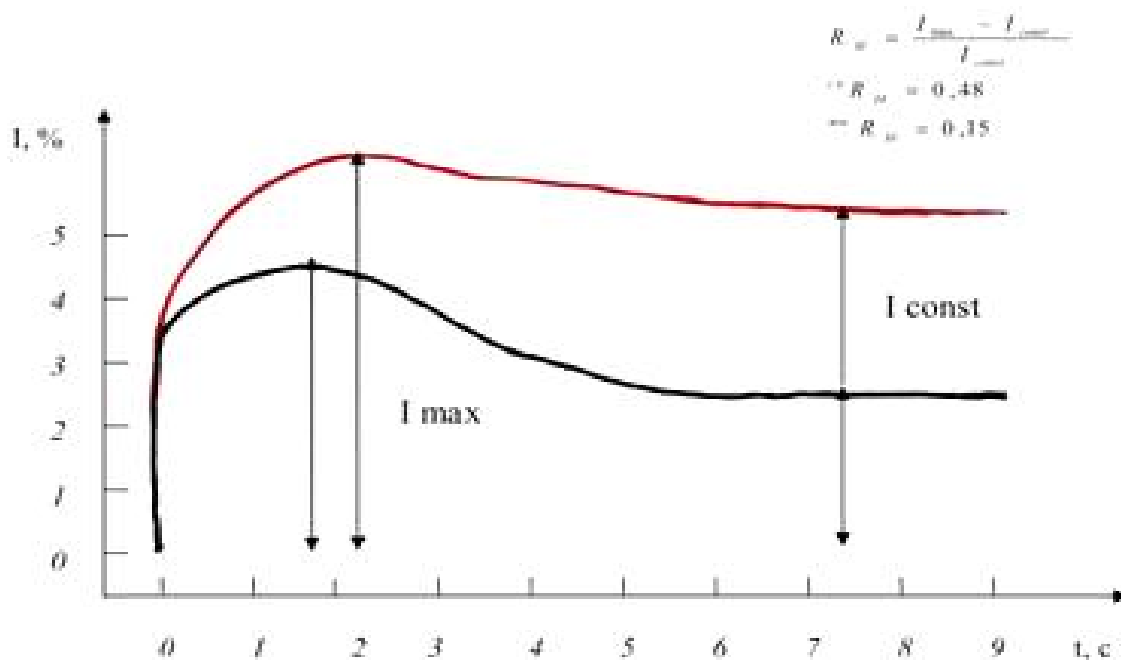


Figure 1. The kinetics of the photoinduced fluorescence of oak in the natural and technogenic landscapes of the Yavoriv GPR. On the insert - the value of the index of vitality.

In the fluorescence induction of photosynthetic objects, two components are distinguished: fluorescence variable, which carries information about the functioning of the photosynthetic apparatus (parameter) and background fluorescence, which reflects the state of "antenna" chlorophyll (parameter). By the nature of the decline of the quantum yield of FS, one can estimate the functioning of the photosynthetic apparatus by determining the vitality index. This parameter of photosynthetic activity is determined by the ratio:

$$R_{fd} = \frac{F_d}{I_{\cos t}} \quad (1)$$

where $F_d = I_{\max} - I_{\text{const}}$ - reduction of fluorescence of chlorophyll from the maximum value to the stationary level, due to the activation of the carbonase photosynthesis enzymes.

Based on the comparative measurements of the kinetics of FH in vivo, the index of vitality of plants is determined (R_{fd}), the meaning of which is given in Table 2. Maximum value R_{fd} testifies to optimal conditions of location. With the increase in the intensity of the environmental factor, a decrease in value is recorded R_{fd} , which reflects a decrease in the potential activity of the photosynthetic apparatus of plants.

The correlation of the measurement of the content of pigments [7] and fluorescence testing shows that the adaptation of the pigment apparatus to the corresponding environmental conditions is an integral part of the species survival strategy in a particular environment.

Conclusions from this study and prospects. The work confirms the efficiency of the diagnostics by the method of photoinduced fluorescence of chlorophyll of the vitality of plants, since the potential activity of the photosynthetic apparatus is tested without disturbing the integrity of the object. Fixed values of the vitality index of plants indicate the sufficiency of degraded conditions for the existence and development of pioneer vegetation.

Due to its high efficiency, fluorescence monitoring of forest technoligy of technogenic landscapes occupies a prominent place in the complex of measures on ecological safety, localization of degradation processes, improvement of the structure of the land fund and sustainable development of mining regions.

The process of phytomelioration of the Yavoriv GPR takes place extensively (self-growing) and intensively (artificial breeding), ensuring the cessation of man-made degradation of land and the return of territories to recreational and economic use.

The obtained results and the literature data on forest crops growing on broken soils indicate the success of reclamation of modern dumps of mining quarries with the help of mixed crops with the use of *Quercus robur* oak and an admixture of alder (*Alnus glutinosa*), common aspen (*Ropulus tremula*), pine usual (*Rennus sylvestris*). Despite the low productivity, these plantations are characterized by sufficient biological resistance. The implementation of phytomelioration measures should ensure the consistent formation of stable plant communities. The success of phytomelioration depends on the correct selection of a complex of agro-technical and forest-cultural measures in accordance with the ecological specificity of man-made landscapes.

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Kinetics of albumin adsorption by natural zeolite

Anna Hyvlyud¹, Mariya Ruda², Nazariy Ripak³

1. Department of Ecological Safety and Nature Protection Activity Lviv Polytechnic National University, UKRAINE, Lviv, 12, S.Bandery St., E-mail: anna.hyvlyud@gmail.com
2. Department of Ecological Safety and Nature Protection Activity Lviv Polytechnic National University, UKRAINE, Lviv, 12, S.Bandery St., E-mail: marichkarmv@gmail.com
3. Department of Ecological Safety and Nature Protection Activity ,Lviv Polytechnic National University, UKRAINE, Lviv, 12, S.Bandery St., E-mail: nazariy.s.ripak@lpnu.ua

Abstract - The kinetics of albumin adsorption on natural zeolite of clinoptilolite structure have been investigated. The basic characteristics of zeolite have been determined. The method of albumin in a solution analysis was given. An isotherm of albumin adsorption was plotted and the Langmuir equation describing this isotherm was given. The presence of an external and pore diffusion adsorption mechanism has been experimentally established during the study of kinetics in a machine with mechanical stirring. The mass-transfer coefficient for.

Keywords – adsorption, zeolite, albumin, adsorption isotherm, kinetics, kinetic coefficient.

Introduction (use Times New Roman, 12, bold, center)

Adsorption processes are widely used in chemical, food, pharmaceutical and especially in environmental technologies. These processes are among the most effective methods of water purification from contaminants. An important advantage of these methods is the possibility of sorbents regeneration and their reuse [1]. Solid sorbents are applicable for various processes that differ by certain regularities. Such processes include physical adsorption, chemisorption, ion exchange, chromatography, *etc.* Various synthetic and natural solid sorbents are used for the adsorption processes. The choice of sorbent is determined by its sorption ability, selectivity, and cost. Recently, natural aluminosilicates – zeolites are widely used [2].

The industrial application of sorbents requires the study of their properties, namely sorption ability, kinetic and dynamic regularities, the possibility of regeneration or the zeolites use with adsorbed component.

The structure of natural zeolite is investigated by different physical and chemical methods (electron microscopic, X-ray, IR-spectroscopy), by means of which physical characteristics, porosity, specific surface, pore sizes and other properties are determined [3, 4]. The most of the investigations is devoted to the sorption of inorganic substances, mainly metals [5-8]. The researchers show that there is an ion exchange between metal cations and alkaline/alkaline earth metals. The adsorption of phosphates was investigated and satisfactory adsorption of the anionic phosphate group P_2O_5 was found, which is adsorbed only by physical adsorption and chemisorption [9].

Natural zeolites are capable of absorbing the substances of organic origin [10, 11].

Page Setup

For investigation of the zeolite surface morphology and X-ray spectral analysis the scanning electron microscope Nova 200 NanoSEM was used. The chemical and oxide composition of the material was determined by X-ray spectrometer ARL 9800 XP. Spectrometric studies were performed using the spectrophotometer SPECORD-75 IR. The material porosity was determined using the Autopore 9500 IV (mercury porometer) in the range of mercury pressure 0.036–413 MPa, which allows to determine the pore radius within 0.0015–47 μm . Before the test, the zeolite was dried in a drying oven at 373 K and degassed in vacuo under a

residual pressure of 6.67 Pa at 293 K. The Washburn equation was used to determine the pore radius.

The zeolite adsorption capacity was investigated using a natural zeolite of the clinoptilolite structure, and its characteristics were determined. X-ray spectral analysis of the chemical composition of zeolite is presented in Fig. 1.

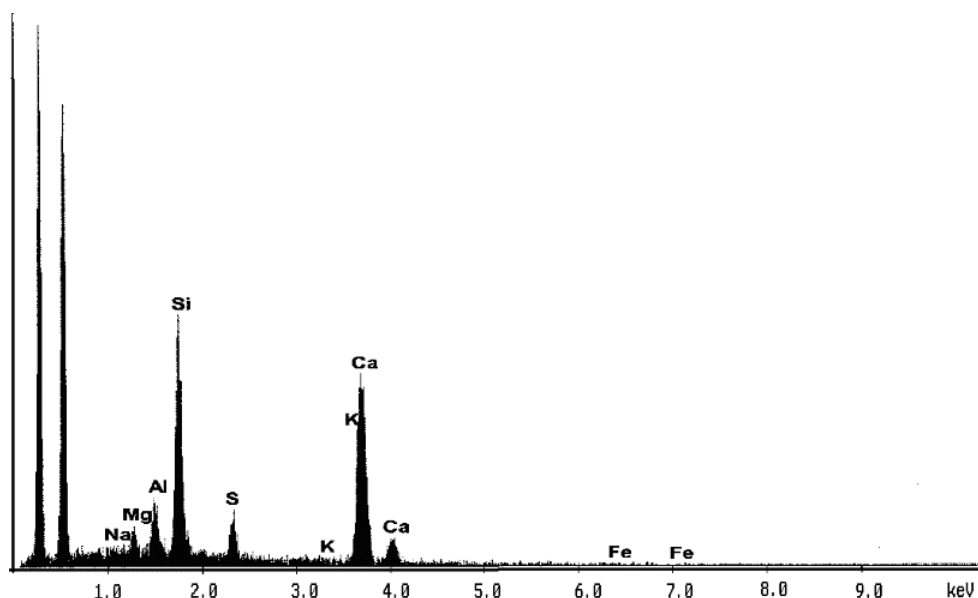


Fig. 1. X-ray spectrum of the zeolite

From the crystallochemical point of view the zeolite is a silicon- and aluminum-containing spatial structure with a certain porosity which is characterized by corresponding size. Since the clinoptilolite lattice has a negative charge, the hydrated Na^+ , K^+ , Ca^{2+} , and Mg^{2+} ions in the pores can participate in ion exchange processes, that is very important for adsorption processes. In this case, these hydrated ions occupy certain positions in the structure which creates micropores of corresponding size and spatial orientation, namely: I – Na- and Ca-ions localized in 10-fold ring by size of 0.44×0.72 nm; II – Na- and Ca-ions in 8-fold structural ring by size of 0.41×0.47 nm; III – K-ions in 8-fold vertical structural ring by size of 0.40×0.55 nm; IV – Mg-ions in 10-fold structural ring which are located in the center of the channel.

Parameters of the studied samples, obtained by the method of mercury porometry are presented in Table 1.

Table 1

Adsorbent characteristics

Zeolite	Total area of pores, m^2/g	Average radius of pores, μm	Density, g/cm^3	Porosity, %
Clinoptilolite	14.077	0.027	1.534	28.2

To investigate the kinetics of the albumin sorption process under mechanical stirring, the experiment was carried out in a vessel 3 with a blade-type stirrer 4 with a speed of 200–500 rpm.

Experimental data on the kinetics of albumin adsorption on natural zeolite during mechanical stirring are shown in Fig. 2. The sharp change in the nature of the curves indicates two mechanisms of adsorption: external diffusion and pore diffusion. Exit to the plateau at $\tau > 200$ s and a sharp change in the sorption rate indicate the transition of the adsorption process from the external diffusion region to the pore diffusion one.

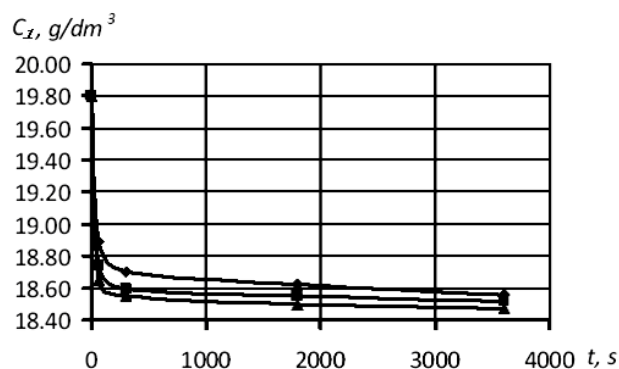


Fig. 2. Change in the albumin concentration during the study of the kinetics of its sorption by natural zeolite in the apparatus with mechanical stirring for different numbers of revolutions (rpm): 500 (◆); 300 (■) and 200 (▲)

The process in its pure form takes place only at initial intervals of time, when albumin concentration is equal to 0 on the adsorbent surface, and to the initial concentration – in solution. For these conditions, we determine the coefficient of mass transfer according to Eq. (1) [1]:

$$b = \frac{\Delta M}{\sum F(C_0 - C_n)\Delta t} \quad (1)$$

where C_0 – albumin concentration in solution, kg/m³; C_n – albumin concentration on the zeolite surface, kg/m³; $\sum F$ – total area of the external surface of zeolite particles, m²; Δt – time, s.

The mass of the absorbed albumin was determined according to the equation of the material balance:

$$\Delta M = V \cdot (C_0 - C_1) \quad (2)$$

where V – volume of solution, m³; C_1 – current concentration of albumin in solution, kg/m³.

The total external surface of the particles was determined by their average diameter and the number of particles N :

$$\sum F = N \cdot \pi \cdot d^2 \quad (3)$$

For the given granulometric composition, the average diameter of the zeolite particles is $d = 1.8 \cdot 10^{-3}$ m.

The defined mass transfer coefficient β have the following values, depending on the number of revolutions of the stirrer n :

Table 2

The number of revolutions of the stirrer n			
n , rpm	200	300	500
b , m/s	$9.26 \cdot 10^{-5}$	$9.24 \cdot 10^{-4}$	$9.25 \cdot 10^{-4}$

Thus, the stirring significantly influences the mass transfer coefficient, increasing it by an order of magnitude. At $n = 300$ rpm and higher values the mass transfer coefficient is maximum, which indicates the transition to the pore diffusion region.

Pore diffusion kinetics investigates the processes of mass transfer in pores and channels of the zeolite grains. The transport of components is due to molecular diffusion, because there is no effect of the hydrodynamic parameters inside the particles. Mathematically, the problem of pore diffusion is described by the differential equation of molecular diffusion with initial and boundary conditions [1, 9]. The analytical solution of this equation allows us to determine the change in albumin concentrations within the zeolite grains. The equation of material balance of

the system allows to establish a connection between the concentration in solution C and the volume average concentration in grain \bar{C}_A .

Having determined \bar{C}_A , the analytical equation will be written in a form that allows the use of experimentally determined data (Fig. 4).

$$\frac{C_n - C}{C_n - C_p} = 1 - \sum_{n=1}^{\infty} \frac{6}{p^2 n^2} \exp\left(-p^2 n^2 \frac{D^* t}{R^2}\right) \quad (4)$$

where R – the radius of zeolite grain; D^* – pore diffusion coefficient; C_p – equilibrium concentration.

Introducing Eq. (7) in the logarithmic form for the first term of the sum, this dependence in the coordinate system $\ln\left(1 - \frac{C_n - C}{C_n - C_p}\right) = f(t)$ gives a straight line, the slope angle of which determines the effective coefficient of pore diffusion D^* . For different numbers of mechanical stirring $D^*_{200} = 3.95 \cdot 10^{-9} \text{ m}^2/\text{s}$, $D^*_{300} = 5.36 \cdot 10^{-9} \text{ m}^2/\text{s}$ and $D^*_{500} = 6.55 \cdot 10^{-9} \text{ m}^2/\text{s}$. So, the D^* value depends on the number of revolutions. For the substances, *e.g.* metals, the structure of which does not change under the influence of external factors, this dependence should not be observed.

Conclusion

Albumins under the influence of physical, chemical and biological factors undergo profound changes related to the imperfection of quaternary, tertiary and secondary structure, which leads to changes in the physical, chemical and biological properties of albumin. During the albumin denaturation there is a rupture of secondary bonds, which “cement” albumin molecule. In many cases, this leads to the change in spatial structure, the decrease in the molecular weight of the dissolved albumin and deterioration of its hydrophilic properties. The mechanical stirring is also accompanied by the decrease in the viscosity of the studied non-Newtonian solution. Thus, the increase in the number of stirrer revolutions will increase the pore diffusion coefficient, and thus the intensification of albumin adsorption by natural zeolite.

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Poultry Waste Disposal

Malovanyy Myroslav¹, Odnorih Zoriana², Kanda Marija³

1. Department of Ecology and Sustainable Environmental Management, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: mmal@lp.edu.ua.

2. Department of Ecology and Sustainable Environmental Management, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: odnorigzor@gmail.com

3. Department of Ecology and Sustainable Environmental Management, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: 27kandam@gmail.com

Abstract – This research addresses methods of poultry manure utilisation to produce organic mineral fertiliser. We studied the prospects of use of clinoptilolite mixed with palygorskite as adsorbents of ammonia emissions from bedding used on a poultry farm.

Keywords – adsorbent, poultry droppings, ammonia, utilisation, organic mineral fertiliser.

Introduction

Application of intensive production processes in the field of poultry farming results in the huge accumulation of poultry droppings. Research data shows that part of animal excrements, urea and manure in over 13.5 mln ton of agricultural wastes generated in recent years make 37% (or 4.938 mln tons).

Description of the problem

Generated droppings amount is determined either by a calculation method based on average annual litter output per middle-aged bird, or by weighing, as referred to in [1]. The chemical composition of droppings, which content and properties depend on bird species, keeping and feeding as well as accumulation conditions, defines its processability. It is found [2], that moisture content of laying-chicken droppings is 68-78%, pH = 6.8÷7.4, and density is 1.04-1.15 g/cm³. Dry droppings content is presented in [3].

An initial stage of manure production is accumulation of droppings in a dung yard. During storage of poultry manure its losses can be as follows: by organic matter – up to 30-60%, by nitrogen – up to 36%, by phosphorus – 12%, by potassium – 10%. [2, 4, 5, 6]. Poultry droppings utilisation methods are studied by scientists and technologists for a long time. These studies are related to the development of efficient ways of manure storage in a dung yard, composting in pits and worm composting [7-10], thermal drying at different temperatures (65 to 1000 °C) in order to receive powderette [2, 11, 13], anaerobic and biologic fermentation using aerobic meso- and thermophilic bacteria to produce biogas, and pyrolysis for production of heat and energy [12, 15]. Also, studies are carried out in formation of a balanced organic and mineral fertiliser composition, which would combine favourable properties of both organic and mineral fertilisers as a result of change of phosphorus and nitrogen content as well as adding admixtures [14-17].

We consider adding sorbents like clinoptilolite and palygorskite to litter followed by granulation and drying one of the most efficient methods of poultry droppings utilisation. The benefits of this method include relative moisture indicator (12-15%), odour-free product, convenient packaging and application to soil, nearly complete sterility from pathogenic organisms and weeds, and reduction of droppings weight in 3-4 times.

Conclusion

The studied composition of organic fertiliser of prolonged action based on poultry manure and a mixture of palygorskite and clinoptilolite will serve as means for improvement of the soil structure.

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Integral assessment of ecological safety of the Eastern Carpathians using sanitary-microbiological indicators

Andrew Masikevych¹, Myroslav Malovanyy², Ludmyla Belikova¹, Yuriy Masikevych¹

1. Department of Hygiene and Ecology Bucovinian State Medical University, Ukraine, Chernivtsi, Teatralna sq. 2,
E-mail: masikevich.a@gmail.com, L.belikova1999@i.ua, yumasik@meta.ua

2. Department of Ecology and Nature Management, Institute for Sustainable Development named after
V. Chornovil, National University "Lviv Polytechnic",
Ukraine, Lviv 79013, 3/4 St. Yura square, Building 8, E-mail: myroslav.mal@gmail.com

Abstract – The sanitary-microbiological indices of the main components of the mountain ecosystem habitat of the Eastern Carpathians are investigated. As the benchmark for comparing anthropogenic impact on natural ecosystems, the territory of the nature reserve fund of the research area has been selected. The efficiency of using sanitary-microbiological indicators for monitoring observations and drawing up of long-term forecasts of ecological safety of mountain territories is shown.

Keywords – ecological safety, mountain ecosystems, nature reserve fund, anthropogenic activity, sanitary-microbiological indicators, sustainable development..

Introduction

As a result of anthropogenic influence in the mountainous part of the Eastern (Ukrainian) Carpathians in recent years, the threat of violation of the ecological safety of the region has become acute. Our analysis of the literature shows that due to human economic activity, mountain ecosystems became quite vulnerable and require more careful attitude and balanced use. Endowed with appropriate environmental status and zoning, the land of protected areas is a kind of benchmark for monitoring research of ecosystem changes under the influence of anthropogenic activities. Studying their status enables to predict changes in the environment for a long-term perspective. However, it should also be noted that the use of sanitary and microbiological indicators of soil for assessing the status of protected objects, to date, is episodic and does not apply to specific functional areas of these territories [1, 2].

Main part

We conducted the study of the sanitary-microbiological state of the main components of the physical environment of the mountain ecosystem: the hydrosphere, the lithosphere and the atmosphere of protected areas and economic landscapes with a high level of anthropogenic loading.

In the study of soils it was established that the number of microorganisms studied and the biological activity of soils of various functional zones of the protected areas of the nature reserve are directly dependent on the level of anthropogenic loading. Representatives of the pathogenic microflora appear among the microbioty of the soil environment of territories of active economic activity, as evidenced by a change in the index of perfringens titres, titres of enterococci and the number of thermophilic bacteria (indicators of fresh faecal contamination). In this case, there is a violation of the metabolism and energy in the trophic chains, the intravivoid and inter-species competition for nutrients increases. The activity of soil microorganisms acts as highly sensitive indicators of biological activity of soils, which becomes of particular importance for monitoring the status (protected) territories - centers (nuclei) of the ecological network, centers of conservation, restoration of landscape and biological diversity and maintenance of ecological safety of these territories.

Anthropogenic activity has also spawned a number of risks and challenges for the water ecosystems of the Eastern Carpathians, which exceed the economic capacity of the biosphere to date. The main pollutant of the river network of the studied region is forestry activity. The accumulation in the watercourses of wood wastes leads to a sharp deterioration of the hydrochemical regime and the basic hygienic parameters of the mountain hydroelectric system, which is the result of the indicators we received (BOC, ChOC, nitrate content, the coli-index, the coli-titre, the total microbial number, etc.).

Violation of the integrity of mountain forest ecosystems, accompanied by significant economic losses, degradation of landscape and biological diversity. So, in particular, in the water of the economic zone, with the growth of organic detritus, the species composition of the periphyton is replenished at the expense of detritophagous incl. nematodes, oligochaetes, dreisen and others. The increase in the species composition of hydrobionts in the "biofilters" of the watercourses of the economic zone indicates the complications of the nutrient chains due to the increase in the level of organic pollution of the hydrosphere.

At the population level there is a violation of the dynamics of the number of microorganisms, invertebrates and algae, the change in age structure of the population. In the periphyton, used by us fibrous carriers "Vija", a specific micro-ecosystem is created. In this microsystem, the fibrous carrier serves as a "home" for microorganisms, plant and invertebrates, and serves as a kind of model of artificially created nutritional chain. By the species composition, the quantitative correlation of organisms, the peculiarity of the accumulation of biogenic elements in this model system, one can judge the specificity of the course of the biogeochemical colloid of substances and energy in a holistic mountain ecosystem. It is found that the transition from reserve to the economic zone of the nature conservation, characterized by different levels of anthropogenic activity, there is a descending gradient of concentration of light ions that clearly indicates the value of coefficient unipolarity. Significant influence on the quality of the atmospheric air of the mountainous territories is due to the species composition and completeness of green plantations.

Conclusion

The long-term systematic studies conducted by us made it possible to substantiate the structure of sustainable development of the region taking into account the ecosystem approach. The basis of the proposed concept is the combination of components that determine the level of environmental safety at different levels of organization of matter: from atomic-molecular to ecosystem. The long-lasting stable links between the individual blocks of the biotic and physical (abiotic) environment determine, ultimately, the sustainable development of the mountain ecosystem and the level of environmental safety (in fact, the "integrity ecosystem health").

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Reducing of gas emissions from the production of calcinated soda ash

Moiseev V.¹, Manoilo E.², Hrubnic A.³, Liaposhchenko A.⁴, Khukhryanskiy O.⁵,

1-3. KhTPE, NTU "KhPI", Ukraine, Kharkiv, 2 Kyrpychova str., 61002, E-mail: bublikova1@gmail.com

4-5. Sumy State University, Ukraine, Sumy, 2 Rymyskogo-Korsakova St., 40007, lyaposchenko@ukr.net

Abstract – Reducing the negative impact on the environment of the production of soda ash is achieved by reducing the formation of gas and dust emissions, as well as their deeper cleaning. The problem of cleaning gas emissions from the production of soda ash is solved by using hollow vortex devices. The advantages of multi-stage vortex-type apparatuses for cleaning large volumes of industrial gas emissions are noted.

Keywords – industrial gas emissions, vortex apparatus, cleaning processes, ammonia, soda ash dust.

Introduction

Wasteless and low-waste technologies are used in all industries, developing in the direction of developing and implementing fundamentally new technological processes that reduce the amount of waste; development and introduction of methods and equipment for waste processing into commercial products; creation of drainless water recycling systems in which water purification is carried out and the efficiency of gas phase cleaning is improved.

Description of the problem

Progress of soda production until recent years has been aimed at improving technology and upgrading the equipment of the main production cycle. The creation of equipment for the protection of the environment was not given much attention. Gases and liquids were cleared only of ammonia to the limits substantiated economically, and not sanitary norms. This, in turn, requires the development of scientific principles for the design of devices for cleaning gas emissions of soda production. In addition, the introduction of traditional systems and installations for cleaning industrial emissions require large capital and operating costs.

In comparison with other chemical and petrochemical enterprises soda plants discharge large amounts of harmful emissions into the atmosphere, mainly not related to particularly toxic (dust soda, carbon dioxide, ammonia). Carbon monoxide and a small amount of hydrogen sulphide are also present in the emissions. The emissions from the boiler unit of the soda plant usually contain oxides of nitrogen and sulfur.

The task of cleaning industrial gas emissions is significantly complicated by the fact that their volumes are dozens, and sometimes hundreds, thousands of m³/h, which makes it difficult to use traditional cleaning equipment. Most of the devices currently used to purify gases from gaseous, liquid and solid impurities are characterized by low capacity, due to the small maximum allowable gas velocities in the apparatus.

Multi-stage vortex devices are perspective equipment for cleaning large volumes of industrial gas emissions, including ammonia [1]. A comparative analysis of the parameters of the operation of devices for gas cleaning testifies to the use of hollow vortex devices with low hydraulic resistance, fairly low energy and metal capacity. Multistage vortex devices are a heat and mass exchange column with contact vortex stages. The contact stage of multi-stage devices is executed in the form of a single vortex stage inside which counter-current motion of phases is realized. In general, in the apparatus phases move the in countercurrent mode.

Features of the technology for cleaning gas emissions from ammonia, as well as the operating principle and design of a multi-stage vortex device are described in detail in the following works [1].

A feature of the vortex apparatus is the presence in the working space of a highly developed surface of mass exchange, which includes a drop, film, and foam interface [1]. High relative phase velocities and constant renewal of the phase interface ensure high efficiency of the devices of this design. The coefficient of heat and mass transfer of the apparatus is an order of magnitude higher than in known industrial apparatuses used for the same purposes. This allows you to get the desired result with minimal overall dimensions and metal capacity.

Also, among the most important problems of soda production, the process of which is related to storage, processing, packaging, etc., first of all, pollution of air, industrial premises and territories with soda dust. Such technological processes as loading, unloading, overfilling, sorting are accompanied by the release of dust. Technology dust is very diverse in chemical composition, size, shape and density of particles. The density of the particles of soda ash varies, generally, from 1000 to 3000 kg/m³. It contains particles of 3-50 mkm in size. The formation of fine soda dust is facilitated by the processes of its mechanical processing, as well as various loading and unloading operations, transportation and storage.

To intensify the trapping of dust, it is necessary to use an intensive mode of interaction of phases with a high turbulence of the streams. Fine dust particles have low inertia, so the cleaning process is possible only in devices with an intensive hydrodynamic mode of operation, for example, such as hollow vortex devices. In a vortex dust collector, as in a cyclone, dust separation is based on the use of centrifugal forces. In vortex dust collectors, a very high purification efficiency is achieved - 99 ... 99.5% and higher. The device can be used for cleaning gases with a temperature up to 700°C.

The main advantages of this device are high throughput in the gas phase and low hydraulic resistance. These factors necessitate the joint use of already installed cyclones at the enterprises simultaneously with vortex devices for gas purification from cleaning matter in soda plants. In order to pre-clean the large particles of soda, the gas is supplied to the apparatus for trapping large particles, for example, a cyclone. After that, the gas enters the vortex apparatus for wet cleaning from small dust particles. The liquid in the vortex device comes from the condenser. The spent liquid from the dust trap is taken to the evaporation apparatus, where the concentration of the solution is taken, which is then taken to the crystallizer to separate the soda crystals. Water vapor is then fed to the condenser, and then returns to the hollow vortex device.

Conclusion

The proposed gas purification method can also be used in other industries to purge from soluble dust crystals. The efficiency of deposition of submicron particles in a device with intensive phase interaction can exceed 95%. The main result of the work is updating of the technology of ammonia and dust emissions, development a new construction of equipment, which contributes significantly to the improvement of soda production as an important sub-sector of the chemical industry.

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Analysis of the impact on the environment of cars with gasoline and electric motors

Odnorih Zoriana¹, Tymchuk Ivan², Zhydun VasyI³

1. Department of Ecology and Sustainable Environmental Management, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: odnorigzor@gmail.com.
2. Department of Ecology and Sustainable Environmental Management, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: i.s.tymchuk@gmail.com
3. Department of Ecology and Sustainable Environmental Management, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12, E-mail: vasil.zhidun@gmail.com

Abstract - In this work, the analysis of the environmental impact of cars with gasoline and electric engines was carried out using computer software for the analysis and modeling of the SimaPro Life Cycle Assessment, as well as PRé Sustainability databases. For the comparative characteristics were selected 3 examples of modulated vehicles with identical tonnage and traveling distance.

Keywords – Life-Cycle Assessment, SimaPro, cars, environmental impact, modeling, forecasting.

Introduction

The development and distribution of vehicles using alternative energy sources is one of the most promising ways to ensure the concept of sustainable development, which contributes to the harmonious combination the needs of the three components - society, economic development and the environment. The leading standards for LCA are: DSTU ISO 14040: 2006 and ISO 14044: 2006.

Description of the problem

The purpose of the research is to conduct their own experimental studies on the environmental impact of cars with gasoline and electric motors through the modeling of the Life Cycle Assessment. The result of the research will be the confirmation of the effectiveness of one or another variant of cars. Methods of research: analytical and laboratorial.

Various computer programs have been developed to characterize the environmental impacts of the product, in particular: "Umberto-LCA +", "GaBi Software LCA" and "SimaPro". We have chosen the SimaPro 8 program, which is a tool for quantifying the environmental performance of products, taking in meaning of the full life cycle, from raw material production to final disposal of products, including recycling of materials, if necessary [1]. Regarding to this, it is possible to design different scenarios of influence on all components of the environment, as using a direct method (for ordinary cars), or indirectly (for electric cars).

The research consists of four main steps:

Step 1. Determine the purpose and scale of the research.

Step 2: Create a product lifecycle model with all the resources and products in the environment. This collection of data is usually referred as a lifecycle inventory.

Step 3: Understanding the environmental responsibility of all inputs and outputs. This is called the impact assessment life cycle.

Step 4: Interpretation of the research.

For the program calculation of the LCA, the SimaPro (computer program) was used in the "Inventory" mode.

For the comparative characteristics were selected 3 exemples of modulated vehicles with identical tonnage and traveling distance. Specific models of EURO-3 and EURO-5 tracks are not

necessary, because of the algorithms written in the scenarios of the LCA program give universal results, based only on the specific indicators of the components sought.

In the case of gasoline units, the unit of measurement of specific energy consumption is "ton-kilometer" (tkm). Under this unit of measurement is the number of tons transported per unit distance in kilometers. For two gasoline representatives, we will take this value for 1000 tkm, which in practice will be described as 10 tonnes of transported weight per 100 kilometers of the way. When choosing the Processes category, the choice comes from the most common transportation class - "Transport, truck 10-20t". Under the "Low Fluence" category, the category "80% LF" is chosen as the most commonly used group of vehicles of this class.

The third vehicle for which the calculation was made is Tesla Semi. The necessary output data is the specific capacity of the batteries and the supply range. They are 1,320 kilowatt hours and 800 kilometers respectively.

For carrying out analytical calculations the standard of calculation of ISO 14044 is used - Overall transport of EURO-3 and EURO-5 standards (Transport, truck 10-20t, EURO3 or EURO5, 80% LF, default / GLO Energy), both with the Standard of calculation of ISO 14044 - Electricity Low Voltage (Electricity, low voltage {ASCC} | market for | Alloc Def, S). The method "IMPACT 2002+ V2.14 / IMPACT 2002+" was used, which currently contains the most effective and extensive database on transport and energy. The calculation was made using the LCA Wizard, which is developed by PRé Sustainability. Because it is written specifically for this software, it simplifies the work and does not require the use of third-party software and its plug-in to the program.

The results of the simulation of the LCA are called "Network". In this calculation mode, a network of contaminants has been created that are directed to one common mark in the - Impact Points. They are a non-system unit of measurement created and described by "IMPACT 2002+ V2.14 / IMPACT 2002+". Outside the limits, they have no practical application, but are ideal units for comparing the effects on the environment, processes, products and materials, reducing the factors underlying one single denominator.

Also, using the "Network" results there is an opportunity to look at a simplified scheme for the creation and distribution of fossil and energy resources. This scheme has practical application in describing complex and detailed technological, industrial or waste processes and shows the dependence of factors as a closed network of matter and energy.

The results of simulations of the LCA have become estimates in Impact Points, which are: for EURO-3 0,0735 Pt; for EURO-5 0,0649 Pt; and 0,0424 Pt for the low-voltage electrosupply standard. This means that even with using fossil fuels for transport, including all stages of its transformation, and taking into account the method of conversion of fossil fuels into electric energy, the use of electric aggregates is more efficient - 1.73 compared to standard fuel EURO-3 and 1.53 in compared to the Euro 5 fuel standard, even if the same type of fossil fuel is used.

Conclusion

Usege of the program gives opportunity the auto-producers to prioritize the expansion of the list of alternative energy sources, to control the impact on the environment and public health, thus increasing the level of environmental safety and resource efficiency.

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The analysis of dynamics of emissions of some pollutants of atmospheric air from PJSC "Ivano-Frankivsk Cement"

Ihor Petrushka¹, Nataliia Latsyk²

1. Department of Ecological Safety and Nature Protection Activity, Lviv Polytechnic National University, UKRAINE, Lviv, Stepan Bandera street, 12, petim@ukr.net

2. Department of Ecological Safety and Nature Protection Activity, Lviv Polytechnic National University, UKRAINE, Lviv, Stepan Bandera street, 12, antoniuknataliia@gmail.com

Abstract – The purpose of work is the analysis of emissions of pollutants in atmospheric air from PJSC “Ivano-Frankivsk Cement”. The scientific novelty of the received results consists in the analysis of emissions of pollutants in atmospheric air from a new way of production of cement at the plant. The carried-out analysis of dynamics of emissions of some pollutants of atmospheric air from PJSC “Ivano-Frankivsk Cement” shows increase in volume of emissions of pollutants but not excess of the resolved values of maximum permissible emissions.

Keywords – emissions of pollutants, atmospheric air, emission sources, maximum permissible emissions, pollutants

Introduction

The cement industry plays an important role in increase in the standard of living worldwide, creating immediate employment. Despite the popularity and profitability, emissions from the cement industry not only worsen quality of air, but also have negative effect on health of the person. Since 2014 the PJSC “Ivano-Frankivsk Cement” uses a dry cement production method, as well as in 2017, opened the third line of cement production.

So today is an actual analysis of emissions of pollutants in the atmosphere from the plant.

Sources of atmospheric air pollution at the PJSC “Ivano-Frankivsk Cement”

Formation of pollutants at the plant, which are emitted into the atmosphere, occurs during:

- moving and storing raw materials;
- sorting, drying, crushing of raw materials;
- fell out of clinker;
- grind clinker;
- moving and storing cement;
- combustion of coal dust and stove fuel in furnaces;
- combustion of alternative fuel;
- unloading, loading, crushing, moving of gypsum stone;
- grinding and drying of gypsum crushed stone;
- during mixing of sand, rubble and cement;
- reception, storage, delivery of petroleum products;
- mechanical processing of wood;
- during conduction of electric welding and gas-cutting works;
- during metal processing;
- storing and storing petroleum products;
- storage, drainage and release of oils and lubricants;
- repair of rolling stock;
- replacement of oils;
- storage of propane and butane cylinders;
- work of compressors.

Characteristics of emission sources of PJSC "Ivano-Frankivsk Cement" are presented in Table 1.

Table 1

Characteristics of emission sources of harmful substances of cement production at PJSC "Ivano-Frankivsk Cement"

№	Emission source	quantity, pc.	Work number of hours in a year	Parameters of air-gas mix at the exit from a source				
				height, m	diameter, m	velocity, m/s	volume in an hour, m ³	temperature °C
1	Hammer breaker CM 170 A	1	1842	20	0,5	7,51	1,502	20
2.	Rotary furnace №1	1	8139,3	82	2,3	22,72	95,95	160
3.	Rotary furnace №2	1	8138,6	82	2,3	22,72	95,95	160
4.	Cement mill №1	1	6472,8	19	0,3	11,9	2,833	70
5.	Cement mill №2	1	6523,2	19	0,3	11,8	2,812	70
6.	Cement mill №3	1	6400	19,7	1,4	5,7	8,75	125
7.	Cement mill №4	1	6400	19,7	1,4	5,7	8,75	121
8.	Cement silos 1,2	2	6523,2	30	0,21	7,82	1,626	32
9.	Cement silos 3,4, 5	3	64129,2	30	0,21	7,8	1,617	32
10	Cement silos 6, 7, 8	3	6419,7	30	0,21	7,81	1,624	32
11	Clinker conveyor	2	8139,3	25	0,3	5,08	0,580	100
12	Cement bunker	2	1820	30	0,21	8,1	1,62	32
13	Bunker of cement pumps	2	5895	14	0,3	7,8	1,553	32
14	Rotary furnace № 3	1	7813	90	3,6	3,3	33,3	160
15	Clinker conveyor	1	7813	25	0,3	7,2	0,51	115
16	Cement bunker	1	2027	20	0,5	4	1,11	37
17	Composition of clinker	1	8760	10	0,5	-	0,59	30

Production dust is formed at the enterprise during the operation of cement. It is very dangerous for the environment and people who work in this production.

The analysis of data on observation of atmospheric air at the plant

On the basis of the data from the "Report on the protection of atmospheric air" for 2014-2016 and the "Permit for emissions of pollutants into the air" made a comparative analysis of emissions of certain pollutants into the air from PJSC "Ivano-Frankivsk Cement" (Table 2).

Table 2

Emission of certain pollutants into the air

№	Substance	Maximum permissible emissions	Substances emissions, ton per year		
			2014	2015	2016
1	2	3	4	5	6
1	Metals and their compounds	0.667	0.623	0.336	0.573
2	Iron and its compounds	0.606	0.572	0.308	0.495
3	Manganese and its compounds	0.054	0.051	0.028	0.041
4	Substances in the form of suspended solid particles	255.826	101.236	161.424	239.09

1	2	3	4	5	6
5	Substances in the form of suspended solid particles ($> 2.5 \cdot 10^{-6}$, $< 10 \cdot 10^{-6}$)	255.645	100.547	161.086	238.921
6	Asbestos	0.7	0.689	0.338	0.169
7	Nitrogen compounds	486.124	328.187	407.965	450.115
8	Nitrogen oxides	440.602	328.187	407.965	334.766
9	Sulfur dioxide	111.315	45.853	94.016	101.096
10	Carbon monoxide	122.176	75.208	102.198	113.126
11	Carbon dioxide	1454312.9	724000.6	1092777.4	1310191.8
12	Σ	-	724981.7	1094113.1	1311670.2

From Table 2 data, we see an increase in emissions from the plant in the atmosphere.

Reducing emissions into the atmosphere

For today there are 39 units of highly effective cleaning equipment at the plant. This allows to reduce the specific emissions to the atmosphere of solid particles of waste gases up to 20-25 mg/m³ (it should be noted that according to the European Union standards, emissions that do not exceed 30 mg / m³ are considered safe).

At the PJSC "Ivano-Frankivsk Cement", the following measures are used to reduce emissions: hiding places with intensive dust removal, installation of hose filters, electrofilters, cyclones, exhaust ventilyzation systems.

Various measures are being implemented, including: complex automation of technological processes and remote control; improvement of equipment design (sealing equipment); improvement of technological processes (application of closed and continuous technological processes); replacement of worn-out and obsolete equipment to a new high-performance and environmentally safe; timely and qualitative repair of technological equipment; installation of local ventilation with filtering of the airborne mixture [5].

In places where the drainage in the working zone is insignificant, individual protection measures for respiratory organs are used. Individual protection means belong overalls, antiseptic pastes, glasses, helmets, masks and respirators. Hermetic cabs for personnel are installed in places with high dust concentrations.

Dry apertures for dust extraction at PJSC "Ivano-Frankivsk Cement" use chemical dust collectors. They are designed to extract coarse dust (more than $100 \cdot 10^{-6}$ m) from the streams of spray gases and are used as the first degree of purge of gas for reducing the supply to the next stages of purification. The efficiency of dusting of these devices is 40-60%. They are very cumbersome and therefore limited [4].

Also, the plant used micrometry pistols with dust-forming, which connect the rolling of material before cargo work. They combine material to be loaded with cargo. The fine methods of pouring with dust formation are based on the properties of water to rinse and bind dust particles. They are also recommended so also for materials that nourish dirty or explosive dust [3].

Conclusion

The analysis of dynamics of emissions of some pollutants of atmospheric air from PJSC "Ivano-Frankivsk Cement" shows increase in volume of emissions of pollutants. Emissions do not exceed the maximum permissible emissions for the plant. With the construction in 2017 of the third line of cement production associated with an increase in emissions every year.

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Approaches to Integrated Waste Management System Modeling

Volodymyr Pohrebennyk¹, Iryna Koval², Elvira Dzhumelia³

1. Department of Ecological Safety and Nature Protection Activity, Lviv Polytechnic National University, UKRAINE, Lviv, 130, Hen. Chuprynka St., E-mail: vpohreb@gmail.com
2. Department of Ecological Safety and Nature Protection Activity, Lviv Polytechnic National University, UKRAINE, Lviv, 130, Hen. Chuprynka St., E-mail: iralito@i.ua
3. Department of Ecological Safety and Nature Protection Activity, Lviv Polytechnic National University, UKRAINE, Lviv, 130, Hen. Chuprynka St., E-mail: elviradzhumelia@gmail.com

Abstract – *The approaches to the integrated waste management system modeling, based on the Gaussian model, are presented. A mathematical model of the quality indicator of the environment and a hierarchical block diagram of the waste management system, which enables to obtain the matrix dependences of the environmental quality index are developed.*

Keywords – mathematical modeling, integrated system, waste management, environmental quality indicator, Gaussian model.

Introduction

Currently, one of the most important and most urgent environmental pollution problems in Ukraine is the uncontrolled accumulation of industrial and domestic wastes, their burial at landfills.

Waste management is the collection, transportation, processing (including recovery and disposal), supervision of such operations and further control, care of waste facilities after their closure. Integration of waste management systems in developed countries has long been established. Integrated waste management systems need to be implemented for sustainable development of Ukraine [1].

The aim of the work is to formulate approaches to the integrated waste management system modeling.

Modeling of Integrated Waste Management Systems

Modeling of integrated waste management system covers the following issues:

- planning of options for implementation of the waste management system;
- analysis of processes of systems components;
- optimization of elementary processes of the waste management system (process management, task management);
- definition of correlation between the main elements and processes of the system;
- identification of data structures that describe system elements or processes;
- classification of data, processes, threats to the environment caused by the emission of chemical and biological substances;
- forecasting changes: process flow, process parameters, caused by waste stream;
- analysis of the migration of pollution from the technological processes of transformation and disposal of waste;
- modeling of elementary objects and processes;
- modeling of geo-natural data.

Based on the analysis of literary sources, the waste management model can be divided into [2]:

- models, which are based on the definition of economic efficiency CBA (Cost Benefit Analysis);
- models based on the ecological assessment of the life cycle LCA (Life Cycle Assessment);

–models based on multicriterial analysis of the decision cycle MCDA (Multicriteria Decision Analysis).

Taking into account the complexity of the processes of the components, waste management systems, these models consider the environmental, economic and social aspects in accordance with the idea of balanced development, where the proportions of components of dependence are $E : S : P$ (E – economic factor, S – social factor, P – a natural, environmental factor).

Mathematical model of environmental quality index

This model is a discrete, deterministic model that is based on the analysis of the distribution of concentrations of the pollutant $c(x,y,z)$ in the components of the environment. The methodology for determining the values of pollutants is based on the Gaussian model, which has the form

$$c(x, y, z) = \frac{E}{2pd_y d_z \bar{u}} \exp\left[-\frac{y^2}{2d_y^2}\right] \left\{ \exp\left[-\frac{(z - H_e)^2}{2d_z^2}\right] + \exp\left[-\frac{(z + H_e)^2}{2d_z^2}\right] \right\}, \quad (1)$$

where, E – intensity of pollution; δ_y, δ_z – RMS standard deviations of the distribution of the concentrations of contaminants, respectively, in the directions of the Y and Z axes; \bar{u} – average wind speed; emission height H_e .

The structure of the data of the model of the quality index of the environment is based on the parameters describing the process of dispersion of pollution in the natural environment. The structure of data can be divided into the following block parameters: the range of modeling process; characteristics of sources of pollution; description of the topography of the territory; description of the components of the environment (landfills, surface and groundwater); description of roads, tracks, built-up areas; weather data; structure of chemical changes; parameters of time sampling and spatial model.

The model of distribution of pollution includes models of the atmosphere, transport of contaminated substances and the exchange of computational results, their visualization and interpretation. The block diagram of an integrated waste management system is developed. Matrix dependencies of the environment quality indicator for the integrated waste management system are obtained.

Conclusion

A mathematical model of the quality indicator of the environment, based on the Gaussian model, are presented. The hierarchical block diagram of the waste management system is presented, which allows to obtain the matrix dependencies of the environmental quality index for various variants of the integrated waste management system. The matrix equations of the model of the quality indices of the environment for the i -th pollutant for z -th object or group of objects, sources of pollution, are obtained.

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Use of spent active sludge for the production of organo-mineral fertilizers «AgroBellum»

Svitlana Potapchuk¹, Olena Popovych²

1. Department of Ecology and Sustainable Environmental Management Lviv Polytechnic National University, UKRAINE, Lviv, Stepan Bandera street, 12, E-mail: potapchuk.svitlana96@gmail.com

2. Department of Ecology and Sustainable Environmental Management Lviv Polytechnic National University, UKRAINE, Lviv, Stepan Bandera street, 12, E-mail: lpolenaeko@yahoo.com

Abstract – For the normal nutrition of plants, not only nutrients are required, but also the maintenance of biotic activity of the soil. AgroBellum NPK is also a unique microbiological fertilizer, in which live in useful biocenoses microorganisms that create soil fertility, promote better assimilation by plants of nutrients.

Keywords – fertilizer, aerobic silt, AgroBelum NPK's, biotechnological, complex organo-mineral fertilizer, mineral nutrition, macro- and microelements

Introduction

Enzim Company is a large Ukrainian company, which is the undisputed leader in the domestic market of yeast products and exports about 40% of its products to 13 European countries [1].

The enterprise uses biotechnological methods for industrial water purification using aerobic silt, which is represented by a fine dispersed suspension.

The whole process of dehydration is in automatic mode, but there is also the ability to manually manage the process to a certain extent by hand. The main task is to obtain an environmentally safe product that can be used as a complex fertilizer.

AgroBellum NPK is a highly efficient, balanced nutrient, ready-to-use, environmentally safe, complex organo-mineral fertilizer. Its use makes it possible to grow environmentally friendly agricultural production based on international standards [2].

AgroBellum NPK is a fertilizer of complex action and contains the necessary components for plant nutrition and soil fertility enhancement - organic basis, balanced mineral nutrition (NPK), macro- and microelements

Main part

The reason for the launch of the organo-mineral fertilizer production line is a significant increase in aerobic sludge (up to 50% of the consumption of CHC), which is used in the second stage of wastewater treatment.

Advantages of AgroBelum NPK over traditional organic and mineral fertilizers are the increase in the amount of mineral fertilizers introduced into the soil by intensive technologies, leads to undesirable environmental consequences. It was established that plants absorb only 40-50% of nitrogen, 20-30% of phosphorus, 50% of potassium, which introduced with mineral fertilizers. AgroBellum is an environmentally friendly fertilizer that does not have harmful toxic effects on humans and animals, enriched with trace elements, which in turn increases the time and reduces the loss when storing the crop. Also, fertilizers reduce the negative effect of chemical plant protection products. Nitrogen, phosphorus and potassium in AgroBellum are more effective due to the nature of their availability for the root system at the time of mineral nutrition of the plant, reduction of nitrogen losses due to nitrification and its washout in the case of the addition of mineral tukiv outside the root layer and losses in the processes of

denitrification. In mineral fertilizers faster pass processes retrogradation of phosphates (the formation of difficult soluble compounds) than in organomineral complexes, in which the highest factor is the use of plant nutrition elements. Mineral fertilizers have a one-sided influence on the agrochemical parameters of soil fertility, increasing the content of nitrogen, phosphorus or potassium with a one-time acidification of the soil solution due to the fact that all mineral fertilizers are physically or physiologically acidic compounds. Systematic application of only mineral fertilizers leads to decalcification and dehumidification of the soil. AgroBelum NPK's integrated action enables high yields at low doses of NPK in fertilizer and, at the same time, to obtain agricultural products with high quality characteristics, which in turn increases storage life and reduces crop losses and storage costs.

Nitrogen, Phosphorus, Potassium, Calcium is a compulsory component of all protein substances, its content in plant proteins varies within (14.7 - 19.5)%. With insufficient supply of nitrogen, the growth of plants is delayed, the size of the assimilation surface of the leaves decreases and the duration of their life, the content of chlorophyll decreases, the crop sharply decreases and its quality deteriorates. Insufficient provision phosphorus of plants at a young age can not be corrected by increased phosphorous nutrition at a later date and leads to a shortage of crops. Sufficient supply of potassium weakens the negative effect of excess nitrogen nutrition, increases the strength of the stem of cereals and their resistance to depletion, prevents for early maturing with excess phosphorus. Calcium in plants is required to convert absorbed nitrates into organic compounds.

Organic substance: 1) promotes the consolidation of individual soil colloids into larger aggregates with the formation of a stable soil structure that creates good conditions for intensive gas exchange, easy penetration of moisture into the soil, active root system growth and high biological activity; 2) serves as a transformer of nutrients in the soil; 3) promotes the development of soil microorganisms. Organic matter in the soil is constantly undergoing transformation, decomposition and mineralization, which results in a significant amount of nutrients available to plants.

Macro and microelements (magnesium (Mg), sulfur (S), iron (Fe), copper (Cu), manganese (Mn) - "elements of life", which are necessary for the normal life of plants that increase the immunity of plants, make it possible for the plant synthesize a full range of enzymes.

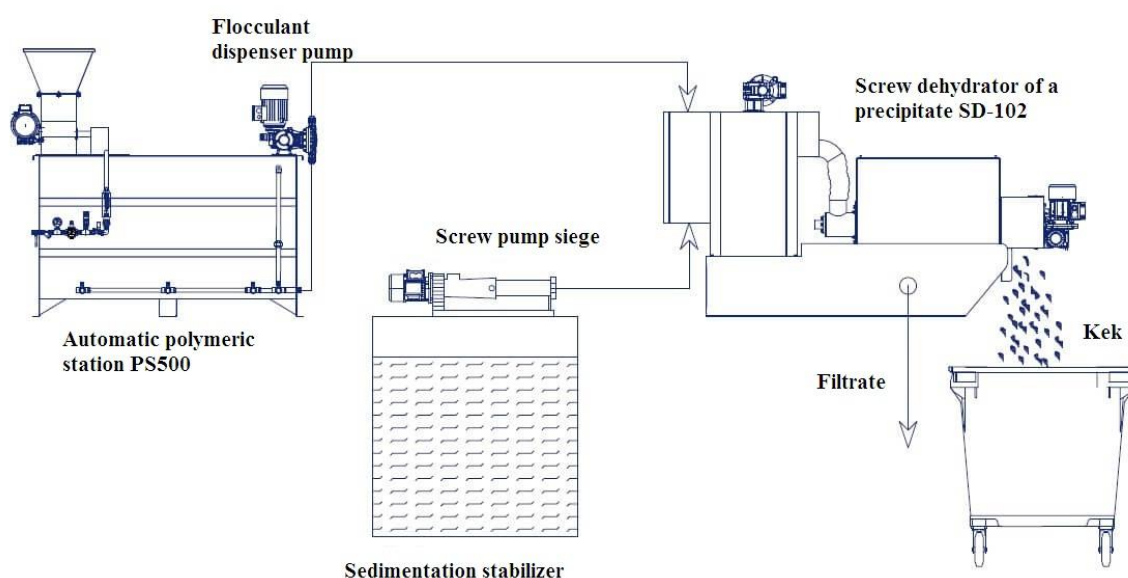


Fig.1. The technology of dewatering active sludge.

The technology of dewatering active sludge is shown in Fig 1. Dehydration of the active silt begins when excessive active silt, in a predetermined amount, pumps pumped from aerobic reactors to the sludge compactor. Then the silt through the pipeline gets to the sediment tank combined with the macerator. The macerator serves for grinding various kinds of coarse dispersion impurities. Next, the screw pump mules are fed to the decanter itself, where separation of liquid and dense phases occurs. To improve the effect section, a flocculent solution is also fed to the decanter, where he prepares at the flocculant preparation station Fig.2 . Further, the depleted silt is screwed onto the conveyor and shipped to the transport vehicle for export. The liquid phase, the so-called concentrate, falls into the reserve capacity, from where the pumping pumps 6 are pumped off to the beginning of the treatment facilities.

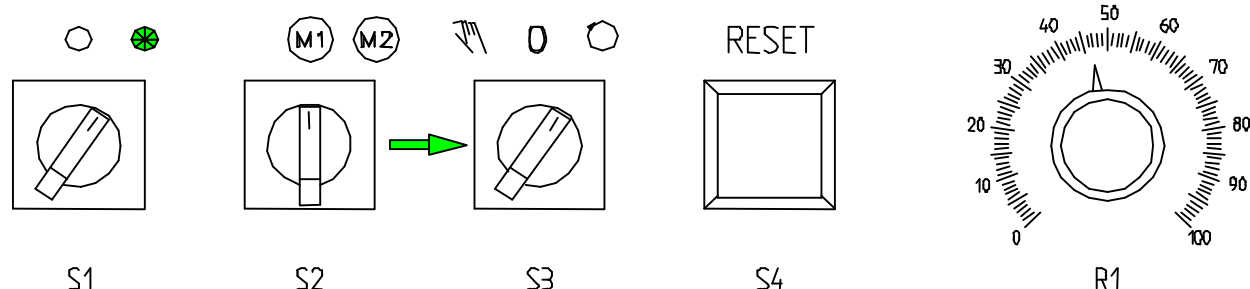


Fig.2. Control units of the flocculant dissolution station.

- S1 - Switch ON / OFF; S2 - Regime dosage, dry material / concentrate of liquid (M1 / M2);
 S3 - Dosage mode, Filling - 0 – Automatic; S4 - Failure Check (RESET)
 R1 - regulation concentration of solution

Conclusion

AgroBellum is an environmentally friendly fertilizer that does not have harmful toxic effects on humans and animals, enriched with trace elements, which in turn increases the time and reduces the loss when storing the crop. Also, fertilizers reduce the negative effect of chemical plant protection products. ecological fertilizer has no side defects - toxic effects of chemical fertilizers and a large number of bacteria remaining from the life of cattle: E. coli, etc. In addition, unlike manure, which slightly strengthens the soil, "AgroBellum" neutralizes it, because it alkaline environment

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Creation of a substrate for biological reclamation from used sewage sludge

Oksana Shkvirko, Ivan Tymchuk, Myroslav Malovanyy

Department of Ecology and Sustainable Environment Management, Lviv Polytechnic National University,
UKRAINE, Lviv, S. Bandery street 12, E-mail: oksanashkvirko@gmail.com

Abstract – The paper presents the results of the study on the possibility of using as a substrate as a mixture based on soil and spent sewage sludge for remediation and biological reclamation of disturbed lands. It was found that a sample with a content of 80% of soil and 20% of sewage sediment was the most optimum for germination of seeds.

Keywords – soil, sewage sludge (SS), bioindication, *Hordeum vulgare*, *Lepidium sativum*

Introduction

One of the problems that has arisen nowadays in Ukraine is the significant accumulation of man-made waste, the main of which is the sediment of sewage. These wastes have a negative impact on the environment, since they occupy large areas of arable land, which are necessary for their burial or storage, and thus pollute them. On the territory of Ukraine, the amount of accumulated sewage sediment exceeds 5 billion tons, 40 million tons of which are added each year. Today, there are many methods for the disposal of sewage sludge: incineration, dumping, use in various industries, etc. In economically developed countries from 30 to 70% of such sediments are utilized. Thus, in Portugal, Ireland, the United Kingdom and Spain 70% of sediments are used as fertilizers in agriculture; In the US, sewage sludge is used as an alternative source of energy, and in Japan - for the production of bricks, fuel and phosphorus [1,2]. We concluded that in Ukraine significant accumulation of sewage sludge and a large number of degraded lands, development of a substrate based on sewage sludge, which will be used as fertilizer (substrate) for remediation and biological reclamation of disturbed lands, is promising.

The purpose of the work was to evaluate the use of as a substrate for biological remediation of disturbed lands of a mixture of soil with man-made waste (sewage sludge). A chemical analysis of the composition of sewage sludge that was carried out showed that maximum permissible concentration for heavy metals and other hazardous substances was not exceeded. Therefore, the method of bioindication was proposed to determine the optimal amount of waste that will be added to the substrate composition.

Methodology for conducting research

A bioindication of a mixture of dark gray soil and sewage sludge using germination method was carried out. The method is based on the detection of pollutants in the environment, which makes it possible to determine the toxic effect of harmful factors on plant growth and development. In the process of conducting the experiment, the time of germination of the sprouts, the length of the aboveground and root systems is recorded. The development of plants and their germination was determined by the generally accepted methodology [3].

For the study, a mixture was created on the basis of soil and fresh sedimentation of sewage in ratios (%): 100:0; 80:20; 60:40; 40:60; 20:80; 0:100. 10 seeds of ordinary barley (*Hordeum vulgare*) and lettuce (*Lepidium sativum*) were planted in Petri dishes for each version. During the experiment, observations were made on the following indicators: time of emergence of germs, their number for each day, total germination, measurement of the length of the above-ground part, measuring the length of the roots. In one version, the barley seeds were etched with the fungicide Vitawax 200 FF. Experiments were carried out in four repetitions.

Research result

As a result of the experiment, observations were made on the germination of plants, fixed time and their number; at the end of the studies, measurements of the ground and root portion of the plants were treated with *Hordeum vulgare*, etched with fungicide, *Hordeum vulgare* and *Lepidium sativum* (Table 1). Studies have shown that untreated spent sediment is inappropriate to use in the ratio of more than 40%, since in these combinations there was no germination of plants, this may be due to the presence of a significant amount of pathogenic microflora.

Table 1 – Seed germination for 10 days

Date of the account	Option (soil:SS)	Similarity of experimental plants, pcs											
		Etched <i>Hordeum vulgare</i>				<i>Hordeum vulgare</i>				<i>Lepidium sativum</i>			
26.09 (2 nd day)	Control 100: 0	7	9	9	9	10	10	10	8	10	9	6	9
	Substrate 80:20	3	2	2	6	9	8	9	10	-	-	-	-
	Substrate 60:40	-	-	-	-	1	-	-	-	-	-	-	-
28.09 (4 th day)	Control 100:0	9	8	10	9	10	10	10	8	10	10	6	10
	Substrate 80:20	4	2	4	6	10	9	9	10	0	1	1	6
	Substrate 60:40	-	-	-	-	2	-	-	-	-	-	-	-
01.10 (7 th day)	Control 100:0	9	9	10	10	10	10	10	8	10	10	7	10
	Substrate 80:20	6	5	7	8	10	9	10	10	6	7	7	9
	Substrate 60:40	-	-	-	-	2	2	1	1	-	-	1	-
03.10 (10 th day)	Control 100:0	9	9	10	10	10	10	10	8	10	10	7	10
	Substrate 80:20	6	8	8	9	10	9	10	10	7	7	8	9
	Substrate 60:40	-	-	-	-	2	2	2	1	-	1	2	-

Conclusion

The data presented in Table 1 shows that as a result of the presence of sewage sediments in proportions of 100:0, 80:20, 60:40, the germination of the investigated plants is noted. The most optimal plants developed (except control) in the substrate with a ratio of 80:20, where the degree of plant stains was 70-100%. At the same time, the degree of germination for the substrate 60:40 was only 0-20%. Thus, as a result of the experiment, the possibility of further use of fresh sewage sludge as a substrate component for biological reclamation and remediation of disturbed lands was established. The optimal amount, which does not have a strong inhibitory effect on the similarity of plants, is 20% of the amount of substrate under the given conditions of its creation. Further research on the composition of the substrate is planned with the addition of other components to it.

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Antibiotics HABs Treatment: Pro et Contra

Christina Soloviy

Department of Ecology and Sustainable Environmental Management, Lviv Polytechnic National University,
UKRAINE, Lviv city, S. Bandery str; 12, E-mail: christina.gf@gmail.com

Abstract – *The purpose of the paper is to raise awareness on HABs as one of burning environmental problems. Antibiotics treatment is one of the problem's solution. Literature analysed, Ampicillin and Streptomycin under heat-shock treatment showed more pronounced effect if increasing concentratosn. Yet under freezing treatment the effect was lesser.*

Keywords – Antibiotic treatment, HABs, bacteria mutations, Ampicillin, antibiotic resistance, Streptomycin.

Introduction

HABs has become one of environmental burning issues worldwide. Even though public awareness on the topic does not fall behind authorized state targets, the problem does not fall in scales. Several methods are known for HABs reduction. Among them using antibiotics is questioned on giving decentralized positive results.

Even though using antibiotics in HABs treatment evokes controversy in an environmental protection, such method of treatment is still present both in experimental and procedural studies. The interactions between antibiotics and microorganisms have attracted enormous research attentions. Tan *et al.* have investigated the effects of two typical aminoglycoside antibiotics on the aggregation of the model cyanobacterium, *Synechococcus elongatus*, and the dominating strain in algal blooms, *Microcystis aeruginosa*, for instance. I strongly believe that antibiotics HABs treatment should be paid closer scientific critical attention to study all pro et contra cases for selected implementation.

Antibiotic Resistance

It is easy to find mutants resistant to antibiotics when we are talking about large populations that are located on antibiotics involved nutrient mediums.

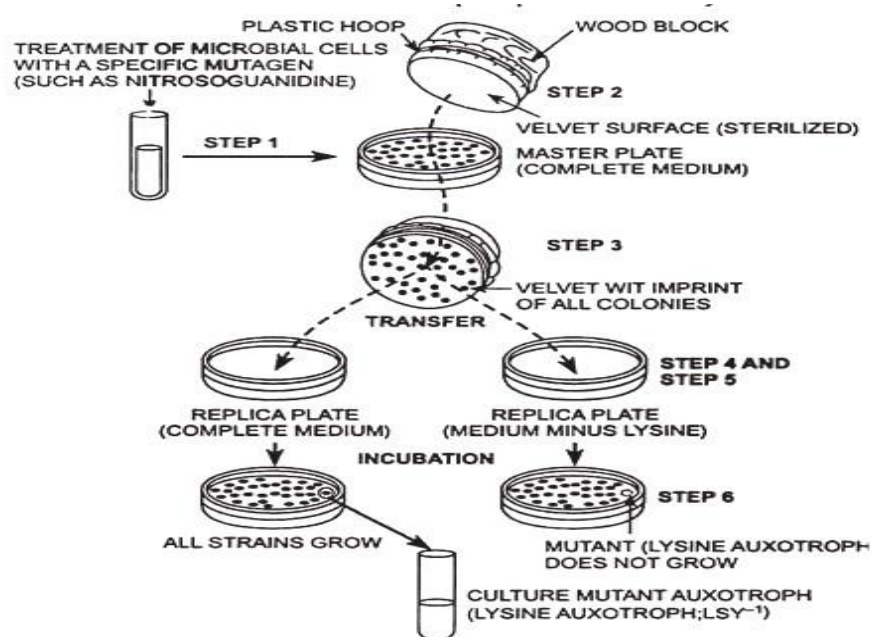


Fig.1. Spontaneous mutations in bacteria by Joshua and Esther Lederberg [1]

In 1952 Esther and Joshua Lederbergs have scientifically demonstrated that bacteria can be grown and maintained. Isolated colonies into which bacteria grow can be reproduced from an original plate to new plates by stamping the original plate with a cloth and then stamping empty plates with the same cloth. Bacteria from each colony are picked up on the cloth and then deposited on the new plates by the cloth. It has been hypothesized that antibiotic resistant strains of bacteria surviving an application of antibiotics had the resistance before their exposure to the antibiotics, not as a result of the exposure. More detailed is illustrated on Fig.1.

Jeffrey C. Cameron *et al.* in their studies have come to conclusion that glutathione contributes to antibiotic resistance in the cyanobacterium *Synechocystis* sp. PCC 6803. Study results of the scientists also suggest that glutathione protects photosystem from oxidative damage resulting from growth in the presence of gentamicin. It has also been discovered that antibiotic resistance can be manifested in many ways by the cell through enzymatic antibiotic modification, exclusion, export, and modulation of core metabolic pathways. [2]

Algal Growth under Antibiotics

Jai Eun HUH has studied effect of antibiotics on eukaryotic chloroplasts of *Chlorella Vulgaris* to see the growth of algae when treated with different types of antibiotics. In the study algae were cultivated with commonly used antibiotics such as Penicillin, Ampicillin, Chloramphenicol, Kanamycin, Cefazedone, Gentamycin, and Streptomycin and measured for growth after 48 hours. For 530 nm, only the algae treated with Ampicillin had a higher absorbance level than that of the control group. The algae treated with other antibiotics showed similar growth with that of the control group, while the algae treated with Cefazedone had a noticeably reduced growth.

To see if antibiotics specifically target algae's inner system, algal mixtures went through Heat-Shock Treatment to allow antibiotics to bypass algal cell wall and membrane, and inner organelles were directly exposed to antibiotics. Results obtained from algal Heat-Shock Treatment have shown that for both Streptomycin and Ampicillin, the higher the concentrations, the effect on algal growth was more pronounced. If bacteria were treated with higher concentration of antibiotics, bacteria would have died. But algae, when having been directly exposed to higher concentrations of antibiotics, showed less severe response to freezing. Thus, algae, when subjected to the initial stress from antibiotics, might have turned on self-defense mechanism to prevent severe damage from freezing. [3]

Conclusion

Both evolutionally and experimentally it has been proved that microalgae can bloom under certain antibiotics content. This means that applying antibiotics as one of means for HABs treatment might lead to controversial results depending on the temperature, dosage conditions.

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Application of biological technologies for purification of industrial water at the "ENZIM" PrAT

Iryna Svyryda¹, Olena Popovych²

1. Department of Ecology and Sustainable Environmental Management Lviv Polytechnic National University, UKRAINE, Lviv, Stepan Bandera street, 12, E-mail: irensvyryda@gmail.com

2. Department of Ecology and Sustainable Environmental Management Lviv Polytechnic National University, UKRAINE, Lviv, Stepan Bandera street, 12, E-mail: lpolenaeko@yahoo.com

Abstract - in this work, an analysis of the application of biological technologies for the purification of industrial water was carried out at the "ENZIM" PrAT. A comparative description of anaerobic and aerobic technological processes for the treatment of sewage was carried out, as well as it was investigated that in the process of sewage treatment the company received methane gas, which is used as source of electric power and heat for the needs of the plant and as a result of wastewater treatment, the ecological situation in the region will improve due to significant reduction of the concentration of pollutants and reduction Mission greenhouse gases that cause global warming.

Keywords – ENZIM", sewage, biological purification, anaerobic and aerobic environment.

Introduction

"ENZIM" Joint Stock Company (Lviv Yeast Factory) is one of the most powerful yeast producers in Ukraine, which delivers to all areas of the state and beyond.

Lviv yeasts are known for their high quality, their specifications correspond to the technical specifications developed by PJSC ENZIM. In fact, qualitative indicators of finished products exceed the normative, which is confirmed by qualitative certificates for each batch and consumer responses.

The main consumer of PRZ ENZIM products is the bakery industry (bakery, bakery, mini bakery). In addition, yeast is used in pharmacy (production of antibiotics), livestock (fattening of poultry and animals), etc.

The technology of sewage treatment.

Extremely relevant is the treatment of sewage from food industry enterprises.

The wastewater treatment plant PJSC "Enzim" is based on technology and using the know-how of the Dutch firm Biotin. Work on the site is based on biological processes and meets the modern world standards for wastewater treatment using advanced technology. Wastewater treatment is carried out using anaerobic and aerobic biomass [1].

As a result of wastewater treatment, the ecological situation in the region will improve due to the significant reduction of pollutant concentrations and the reduction of greenhouse gas emissions, which cause global warming [2].

In the process of wastewater treatment, the company has received gas - methane, which is used as a source of electricity and heat for the needs of the plant. Thus, the company also received a significant economic effect, because there was a real opportunity to save on energy carriers. Stove water from the production is cleaned at the wastewater treatment plant by means of an anaerobic reactor with purification in aerobic reactors of successive action.

In this technology, the most efficient reactor with a pseudo-permeable layer, operating under anaerobic conditions of sewage treatment is used [3].

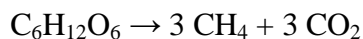
In accordance with the technological process, two well-known processes of cleaning - anaerobic and aerobic.

An experiment was conducted to study the properties of active sludge used for industrial water purification. The microbiology of anaerobic purification process, which is the process of decomposition of organic substances characterized by biogas production, is also researched. Biogas consists of methane (60 - 90% CH₄) and carbon dioxide (10 - 40% CO₂).

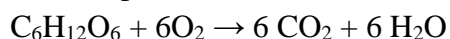
Most of the organic matter is converted into biogas and a small amount of biomass growth.

The comparison between aerobic and anaerobic processes can be illustrated by the example of glucose conversion.

Anaerobic process:



Aerobic process:



The anaerobic glucose reaction releases 7 times less energy (free enthalpy) for consumption by the microbes than aerobic. About 85% of energy is released in the form of methane and can be recycled. This explains why the increase in anaerobic biomass is only 2 - 5% compared with 30 - 50% in the aerobic process.

Active microorganisms acting in the anaerobic process belong to the group of anaerobes. This group is quite diverse, but they are linked to existence in the absence of oxygen.

Anaerobic degradation is a step-by-step process. At each level a certain group of microorganisms works.

Organic substances pass different stages of the decomposition and at the end are converted into biogas. Only at the last methane stage pollutants are removed from wastewater. Organically bound carbon is removed from water in the form of methane and CO₂. In this sense methanogens play a key role in the conversion process, they are responsible for the last stage.

The next stage of the study is the microbiological aerobic process.

In the aerobic process, a large number of microorganisms are artificially maintained in treatment plants that consume a large number of pollutants. Since these organisms are aerobic, in these buildings consumes a large amount of oxygen [4].

The following factors influence the aerobic process:

- Temperature

The optimum temperature of the aerobic process is within the range of 15 - 30 °C. At higher temperatures, the solubility of oxygen in water drops so that it becomes impossible to provide oxygen to aerobic bacteria, and they die. In general, for any biological process, significant temperature fluctuations are undesirable.

- Influence of pH

Depending on the composition of sewage and environmental conditions in each biological system, a specifically adapted biomass is created. Variations in the pH value have a significant effect on the behavior of bacterial biomass. Avoid pH lower than 6,5 and increase by more than 8,2. Particularly harmful sudden changes in pH. In general, for the aerobic process, the pH should be neutral (pH 7-7,5).

- Need for macronutrients

Macronutrients, such as N and P, are necessary for both anaerobic and aerobic conversion processes. The amount of nitrogen and phosphorus required can be deducted from the following ratio.

CSF: N: P = 100 : 5 : 1

- Need for micronutrients

The presence of trace elements is also important for the aerobic system. During the anaerobic stage, many trace elements are converted into insoluble sulfides. This can cause a deficiency of trace elements in the aerobic stage.

- Toxicity

The influence of toxic components depends on their concentration in water. Some components, such as chlorinated bicarbonates, cyanides, heavy metals, can be toxic in very low concentrations. In general, it can be stated that the aerobic process is less susceptible to toxins due to greater dilution in the purification system.

Conclusion

The main goal of the company is to satisfy the needs of the consumer, improve the quality of products, introduce the latest technologies, in particular, the opening of a wastewater treatment plant for yeast production, the analogs of which in Ukraine do not exist. Already for 2 years wastewater in the production is cleaned by the technology of the Dutch firm BIOTAN. The program provides for purification with an anaerobic reactor with purification in aerobic reactors of successive action.

The advantages of biotechnology are the production of energy resources - biogas (methane), low production of damaged silt (2-5% of the KSC), and therefore there is no need for construction and equipment for treatment and utilization of sludge, high volume loading of the reactor, the stability of anaerobic sludge to changeable influence the quantity and quality of the inlet solid water, the flexibility of process control (the possibility of interrupting and seasonal cleaning of sewage), small capital expenditures, because the reactors are compact, vertical and do not occupy large areas.

Due to the high concentration of biomass and its high activity in a bioreactor with a pseudo-charged layer, high productivity of sewage treatment is achieved.

For anaerobic treatment of sewage, the efficiency of purification by XSK is 60-65%.

The company also monitors the impact of production on the environment. Besides, PJSC "Enzim" adheres to social and legal norms, in particular, the introduction of environmental norms and standards, conducting mandatory examinations, implementation of environmental programs and the dissemination of non-waste and clean technologies through a system of exhibitions and fairs.

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Assessment of parameters of groundwater quality in Lviv

Vasylyna Vaskiv¹, Olena Popovych²

1. Department of Ecology and Sustainable Environmental Management Lviv Polytechnic National University, UKRAINE, Lviv, Stepan Bandera street, 12, E-mail: Vasylyna_Vaskiv@ukr.net

2. Department of Ecology and Sustainable Environmental Management Lviv Polytechnic National University, UKRAINE, Lviv, Stepan Bandera street, 12, E-mail: lpolenaeko@yahoo.com

Abstract – *The thesis is devoted to the research of indicators of groundwater quality in the Lviv region and the city of Lviv in particular. The peculiarities of formation and distribution of groundwater in Ukraine are described. The monitoring data on the potential of natural sources in administrative areas are given. The features of natural waters in the Lviv region and the main factors influencing the distribution of groundwater in the region are shown. In summary, the results of the obtained studies, their analysis and comparison are presented.*

Keywords – underground water, sampling, research methods, water analysis.

Introduction

The source of drinking water supply in the Lviv region is mainly groundwater (more than 95% of the water supply of settlements is carried out from underground sources and about 5% - from the surface). The area is approved in the category A + B + C1 = 1237.39 thousand m³/day and in the category C2 = 47.3 thousand m³ / day of underground fresh water.

For use, groundwater accounts for 35%. The predicted resources of fresh groundwater in the oblast are 36,644.1 thousand m³/day (all stocks with mineralization of water up to 1 g/dm³).

Favorable conditions for the formation of groundwater have developed in the Lviv region, this is a moderately continental climate, a significant amount of precipitation, and, accordingly, a developed river network, as well as the geological structure of the region, which is characterized as complex.

Since the territory is in the zone of excessive humidification with shallow groundwater deposits, this contributes to the formation of groundwater resources, due to the infiltration of atmospheric precipitation.[1, 2]

Description of the problem

The quality of water in the city of Lviv is influenced by many indicators, among them the significant influence of the human factor, which in its power may vary in different parts of the city.

For the zoning of the city of Lviv for the anthropogenic load, the following indicators were used: loading of the territory by automobile, rail and air transport, density of development, presence at industrial sites and occupancy of areas by green plantations.

According to these parameters, 11 districts are distinguished in Lviv according to the level of anthropogenic loading. Indicated zoning is shown in Fig. 1. [3]

To study the quality of underground water in Lviv, samples of waters from the selected three locations with natural sources were selected:

1. Stryjsky Park, Lviv;
2. Park of culture and rest to them. B. Khmelnytsky (Park of Culture), Lviv city;
3. Park "Pohulyanka", Lviv.

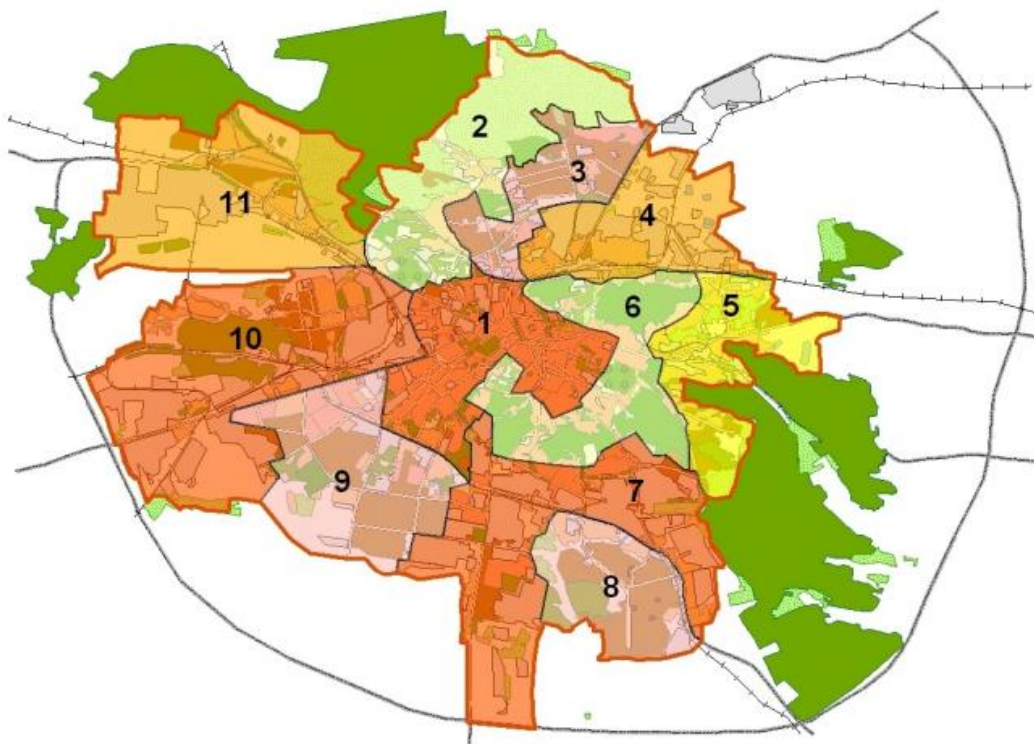


Fig. 1 Areas of Lviv on the degree of anthropogenic load

Additionally, the research of the quality of drinking water was selected from the well on the street. Andrey Sheptytsky, Lviv, and, for comparison, the results of the analysis of water quality parameters from the center of Lviv city, where technogenic influence on groundwater is most observed, is taken.

The results of chemical studies are given in Table. 1

Table 1

Obtained results of testing water samples

Name of metrics	Actual values				Norm according to SSRaN2.2.4-171-10 [4]
	Street Andrew Sheptytsk.	Park of culture	Stryisky Park	Park "Pohulyanka"	
Indicator of the concentration of hydrogen ions, pH	7,4	7,8	7,15	7,2	6,5 – 8,5
Total hardness, mmol / dm ³	6,6	8,6	10,4	8,6	Not more 10,0
Total alkalinity	-	6,6	7,6	6,9	Not determined
Calcium, mg/d ³	94,2	128,26	116,23	132,26	Not determined
Chlorides ,mg/m ³	33,7	35,56	39	21,34	Not more 350
Sulfates, mg / dm ³	40,1	206,4	249,6	158,4	Not more 500
Total iron, mg / dm ³	0,06	0,3	Absent	Absent	Not more 1,0
Phosphates, mg /dm ³	3,2	1,8	0,28	0,4	Not determined
Ammonium, m /dm ³	Absent	Absent	Absent	Absent	Not more 2,6
Nitrates,mg/dm ³ (nitrate tester)	25	26-28	29-31	28-30	Not more 50,0

From the obtained results it is clear that all the parameters in the selected samples are within the limits of the norm in accordance with SSRaN 2.2.4-171-10 for wells and sources of copper. However, there is a slight increase in water hardness in Stryjsky Park - 10.4 mmol/dm^3 at a norm of 10.0 mmol/dm^3 . The presence of calcium is most often observed in the source located in the park "Pohulyanka", but if the results of water quality are compared in the central part of Lviv, then the concentration of calcium in these waters is $215\text{-}230 \text{ mg/dm}^3$. The main reason for exceeding the above indicators is the feature of the geological structure of the region.

The presence of chlorides in our selected sources is small, the maximum concentration is concentrated in the underground waters of the Stryisky Park, but in the central part of the city the presence of chlorides varies within the range of $230\text{-}270 \text{ mg/dm}^3$, which though it is within the limits of norm, but significantly exceeds the indicators of groundwater in parks sources. The reason for this is human activity, because the chloride content is due to the discharge of industrial and domestic sewage into the water. Regarding the presence of sulfates in water, the smallest value of the presence of this component belongs to a sample of water taken from the well on the street. Andrei Sheptytsky, the highest levels of sulfate presence are observed in Stryisky Park - 249.6 mg/dm^3 and in the center of Lviv - 260 mg/dm^3 . However, on the street. Andrey Sheptytsky has the highest concentration of phosphates - 3.2 mg/dm^3 . Among other indicators there was no significant difference; in two of four samples, the presence of iron, the concentration of which is within the normal range, was detected. In the study of water for the presence of ammonium, the results showed its absence.

Conclusion

Sampling of water, and conducting research with these samples of water, was carried out in accordance with the guidelines. The results obtained have made it possible to compare the water quality in the selected sampling points. And also evaluate the possibility of using these sources for the drinking water supply of the population.

In selected samples of water there was no significant excess of the above mentioned indicators, but the chemical composition of water, which was selected from the central part of the city of Lvov, significantly differed. In all samples of water, we identified an increased rigidity, among the chemical elements most dominated by the concentration of calcium. To the elements that were partially or completely absent in water are iron and ammonium.

According to the results of the research of selected samples from underground sources, it can be argued that the selected water satisfies all requirements related to drinking water and therefore it can be recommended for consumption by the population.

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PROJECT SUPERVISOR

Dr. O. BEREZKO, Ph.D.

Associate Professor, Lviv Polytechnic National University
berezko@gmail.com

PROJECT COORDINATOR

Dr. O. IVASHCHUK, Ph.D.

Associate Professor, Lviv Polytechnic National University
oleksandr.s.ivashchuk@lpnu.ua

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вул. Ф. Колесси, 4, Львів, 79013
тел. +380 32 2582146, факс +380 32 2582136
vlp.com.ua, ел. пошта: vmr@vlp.com.ua