

# **Managing textile waste as a prerequisite for implementing circular economy principles in Ukraine**

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*Abstract –Results of the analysis of textile waste management in Ukraine and the world are presented. The composition of textile waste was analyzed and recycling methods were established to solve the problem of shortage of raw materials and comply with the principles of circular economy. The methods of textile waste processing of garment factories of Khmelnytskyi region are proposed.*

Keywords –textile waste management, polymer waste, methods of waste processing.

## **Introduction**

A circular economy is an economic system aimed at eliminating waste and promoting the sustainable use of resources. It focuses on the three principles of reduce, reuse and recycle. One of the key principles of creating and maintaining such an economy is proper waste management, including textile waste.

Over the past few years, the topic of circular economy in the treatment of textile waste has become quite relevant in Ukraine. Textile waste generated during the production and consumption of clothing is a significant source of environmental impact. This waste contains a large amount of necessary resources that can be reused if the principles of a circular economy are applied.

According to research, more than 90% of textile waste in Ukraine ends up in landfills[1]. Khmelnytskyi region is characterized as a region of strong development of light industry. It was this that gave impetus to the creation of the Podillia fashion cluster in the Khmelnytskyi region. One of the tasks facing the cluster is the creation of a system for handling textile waste from garment factories within the framework of the circular economy.

## **Discussion**

Textile waste is a significant environmental issue worldwide, and Ukraine is no exception. In fact, Ukraine is estimated to generate around 250,000 tons of textile waste annually. Textile waste is composed of various materials such as cotton, polyester, nylon, and other synthetic fibers, as well as dyes and finishing chemicals used in textile production [2]. Globally, textile waste is a significant source of landfill pollution, with the fashion industry alone generating over 92 million tons of waste each year [3]. The United States is the largest producer of textile waste globally, generating approximately 16 million tons of textile waste each year. In the European Union, over 3.6 million tons of textile waste are generated annually, with only around 25% being recycled or reused [4]. Failure to dispose of textile waste can have serious environmental consequences, such as soil and water pollution, greenhouse gas emissions, and depletion of natural resources. Sustainable fashion initiatives, such as the use of organic and recycled materials, circular fashion models, and extended producer responsibility schemes, can help reduce the amount of textile waste generated and its environmental impact [5].

In Ukraine, research on the processing of textile waste into various materials is ongoing, but the imperfection of domestic production facilities is carried out with the possibility of full implementation of the developments [6].

Textile recycling is beneficial both for the environment and the economy. This allows you to avoid many polluting and energy-intensive processes that are used to manufacture textiles from primary materials [7].

There are four directions of processing of such waste Figure 1. Primary recycling is pre-consumer waste, where manufacturers select textile waste again in their own processing units. Secondary processing is mechanical processing through physical processing such as grinding, melting and reforming. Tertiary processing is chemical processing where polymer bonds are broken to create monomers, oligomers, or other intermediates. Quaternary recycling is recycling where the energy or fuel value of plastic waste is recovered through incineration or pyrolysis.

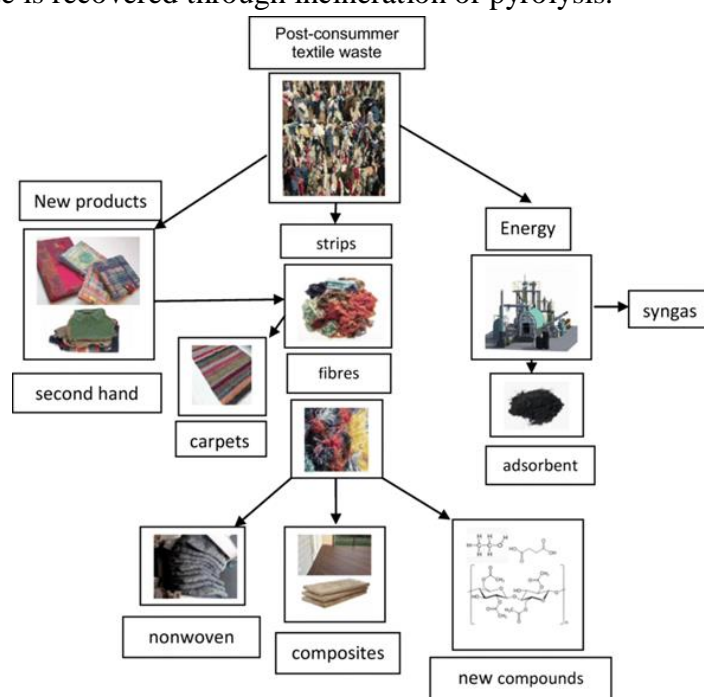


Fig.1 - Materials obtained as a result of textile waste processing [8]

Given the need to conserve natural resources, their depletion, and the increasing deficit of polymer raw materials, the search for effective methods of polymer waste processing with the production of secondary raw materials that can be used in light industry is a pressing task.

After analyzing the activities of the cluster's productions, the quantitative and qualitative composition of waste was determined. In order to verify the reliability of the given data and determine the operational properties of these fabrics, experimental studies were conducted. Based on the results of research, it has been proven that these enterprises generate such a range of waste as polyamide, polyester, cotton, nitron, diacetate and wool.

An algorithm for building a technological scheme of waste processing has been developed. Each of the stages of waste processing, which includes the mechanical preparation of raw materials, the production of yarn and the formation of finished products, is described in detail.

According to the developed algorithm of the waste processing scheme, equipment is selected for each of the stages of processing.

## Conclusions

Implementation of the project will allow to save on waste disposal, purchase of raw materials, its logistics and creation of a separate unit of the product, which has a high demand. The ecological aspect of this project is that the rational use of processed light industrial waste will allow to significantly reduce the area of landfills, which are constantly increasing every year. The developed project will have a strong image component for the cluster, because such technology does not exist in Ukraine today.

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