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Textile Waste from the Fashion Industry: What Can Be Done?

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Abstract

This article examines various textile waste management methods in Russia and analyzes their environmental impact. It is determined that life-cycle extension through reuse or upcycling is the most optimal approach, which requires targeted public education. At the same time, recycling technologies must be developed for the portion of waste that cannot be reused.

Keywords: Clothing; Textile waste; Utilization; Recycling; Waste management

Introduction

In a consumer society, clothing production rates are rapidly increasing, while their life cycles are shortening due to frequent trend changes, increasing demand, and declining product quality. One of the fashion industry's pressing issues today is the increasing amount of production and consumption waste, much of which ends up in municipal solid waste landfills, dumps, or incinerators. The environmental impact of textile waste management depends on the choice of method. Therefore, it is necessary to study each of these methods.

Discussion

Textile waste management in Russia involves several stages: collection, processing, utilization, rendering harmless and sending waste to a landfill. The waste generation stage is fundamentally important for the rest of the chain, because it is there that the decision is made on how waste management will be carried out. Processing involves sorting, disassembling, and cleaning textile waste as part of preliminary preparation for utilization [1]. Waste sorting allows for the recovery of valuable components, which are then sent for recycling.

In Russia, the majority of the population does not dispose of unwanted clothing at designated collection points, so much of it ends up in landfills. About 97% of waste generated in Russia is disposed of in landfills [2]. Landfill disposal involves isolating waste that cannot be further disposed of in special storage facilities to prevent toxic substances from entering the environment [1]. Most waste is disposed of in open landfills and dumps that lack effective environmental protection measures. This practice results in the alienation of significant land—approximately 1,000 hectares that are appropriated for waste disposal annually [3]. This leads to the irreversible loss of valuable components contained in the waste. The creation and operation of landfills are associated with a number of negative consequences: soil, water and air pollution, a decrease in the socio-economic attractiveness of adjacent residential areas, and damage to public health [4].

Waste incineration reduces waste volume, but creates associated environmental problems: air pollution, the formation of toxic ash [2]. In addition, the service life of waste incineration plants is generally no more than 25 years; in Moscow, this is 15-20 years. Utilization is the most promising way to handle textile waste. It includes the use of waste for restoration of waste properties to the state of raw materials, recycling of waste to create new materials, extraction of valuable waste components, and their use as a renewable energy source after extracting useful components [1]. Waste incineration for energy production has been equalized with recycling in Russia since 2020. Recycling involves the reuse

of waste, including for its intended purpose [1]. Clothing reuse is developing in Russia through second-hand stores, vintage shops, digital platforms, clothing exchanges, rentals, and repairs, which extend the life cycle of items.

Recycling clothing minimizes waste and non-renewable resources to produce new materials. In Russia, there are more than 2,000 clothing collection points and 15 companies whose activities include the collection, redistribution, and recycling of textile waste. Importantly, the number of companies interested in collecting clothing, and consequently collection points is constantly growing. This is due to changes in waste management policies in the country. All clothing received at the sorting center is manually separated into two charities and usable (≈64%), which is distributed to second-hand stores and charity, and unusable (≈30%), which is recycled. Most textile products are recycled into wiping rags, which become waste and after one or two uses are sent to an incinerator or landfill.

The fashion market is represented by a large number of garments made from blended fibers. Recycling them presents a complex and unresolved challenge, as the fibers in the fabric are tightly interwoven, making them difficult to separate. Today, there are several main approaches to textile waste recycling: mechanical (the most common and relatively inexpensive, but suitable for natural or mostly natural fabrics); thermal (quite expensive, suitable for single-component polyester raw materials); chemical (under development, characterized by high cost and questionable advantages from the green chemistry perspective). In EU recycling countries, textile waste sorting technologies are currently highly developed. Clothing recycling facilities often utilize modern methods of identifying textile fibers for sorting and digitalize them. In Russia, textile waste sorting is carried out manually [5].

One way to extend the life cycle of clothing is upcycling, which involves reworking or decorating used clothing in various ways to create a new, unique item and increase its value. This method is an example of reuse.

Another way is to extract useful components for secondary use [1], for clothing this is the separation and subsequent reuse of fittings. In Russia, in most cases, hardware is removed from the garment to which it is attached and is not used. This is labor-intensive and time-consuming, which is not economically viable. One common method for textile recycling is its use refuse-derived fuel (RDF). RDF is produced by shredding, separating, and dehydrating waste, compacting it by pressing, and granulating it [6]. RDF is used as an alternative fuel in cement production plants. However, if sorting is deficient, waste of hazard classes I and II may get into in the fuel, which can have a significant impact on the environment and pollute it with heavy metals. This method has been little studied and is of interest given its potential to reduce accumulated textile waste and generate energy.

Conclusion

There is no universal solution to the textile waste problem in Russia or globally, so society is forced to calculate the risks and study this issue further. The accumulated amount of waste prevents any method of textile waste management from being completely abandoned, despite the negative impact on the environment. Among the recycling methods studied, reusing clothing, which extends its life cycle, has the least negative impact on the environment and human health. To address the problem of textile waste, public education is essential. Responsible consumption must become fashionable to reduce waste in the fashion industry and implement an effective utilization system. For the optimal functioning of the textile waste management system in Russia, it is important to create an intersectoral partnership (business, non-profit organizations, the state and society).

For the 4th year in a row, students and staff members of the Dmitry Mendeleev University of Chemical Technology are hosting the festival "Novy Smysl" (the festival "New Meaning"). This festival aims to educate children, young people, and everyone else about responsible clothing consumption. These actions contribute to achieving Sustainable Development Goal 12: "Ensure sustainable consumption and production patterns".

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