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PAPER

ECOLOGICAL SAFETY AND RECYCLING ISSUES OF GASES

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Abstract

The article analyzes the issues of environmental safety and recycling of fabrics. The impact of natural and synthetic fiber fabrics on the environment during production and consumption is highlighted, and their environmental advantages and disadvantages are indicated. Natural fiber fabrics are biodegradable and hygienically comfortable, but the high consumption of water resources and the use of chemicals in cotton production are noted. Synthetic fiber fabrics exacerbate environmental problems through microplastic waste, but the possibility of using them as secondary raw materials using chemical and mechanical processing technologies is analyzed. According to the results of the study, it is proved that the widespread introduction of fabric recycling technologies, the use of environmentally friendly materials and the improvement of consumer culture are important factors in solving global environmental problems.

Key words: natural fiber fabrics, synthetic fiber, mechanical processing, chemical processing, polyester fabrics, air permeability, the concept of "green fashion", nanotechnology.

INTRODUCTION

In the 21st century, against the background of industrial development, changes in the daily lifestyle of mankind and the deepening of global environmental problems, the issue of the environmental impact of the production process of light industrial products, in particular fabrics, is becoming increasingly relevant. Because fabrics are an integral part of human life, they are widely used not only in the creation of clothing and household items, but also in engineering, medicine, construction, transport and many other areas. Therefore, the issues of environmental safety of fabrics, their recycling capabilities and use as secondary raw materials are considered today in close connection not only with technological, but also with economic and social problems. Fabrics are, first of all, divided into two large groups according to their properties: natural fiber fabrics (products obtained from cotton, wool, silk, linen and other plant or animal fibers) and fabrics made from

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synthetic or chemical fibers (polyester, nylon, acrylic, lavsan, etc.).

LITERATURE ANALYSIS AND METHODOLOGY

Natural fiber fabrics have been used by mankind since ancient times and are considered relatively environmentally safe, since they are biodegradable. For example, cotton fiber decomposes in the soil in a short time and enters the natural cycle. Also, wool and silk, since they are made of natural proteins, do not harm human health, but on the contrary, are distinguished by their hygienic properties. However, natural fiber fabrics also have problems in the production process. For example, a large amount of water is consumed in the process of growing cotton. This process causes environmental problems, especially in regions with limited water resources. Also, pesticides and defoliants used in cotton cultivation have a negative impact not only on plants, but also on soil and water bodies. As a result, the purity of natural fabrics also depends on the technology of their production. Synthetic fiber fabrics exacerbate environmental problems. They are obtained from products of the petrochemical industry and do not biodegrade in the natural environment. For example, polyester fabrics take more than a hundred years to completely decompose. This leads to the accumulation of waste, its large storage in landfills, and the release of harmful substances into the atmosphere. Also, microplastic fibers released into the water during the washing of synthetic fabrics end up in seas and rivers, negatively affecting the entire ecosystem. Today, microplastic pollution is recognized as a global problem, and one of its main sources is synthetic fabrics. Therefore, it is necessary to ensure environmental safety when using such materials, to abandon them or to introduce recycling technologies.

RESULTS

The issue of textile recycling is being solved today with the help of innovative technologies. The first stage of recycling begins with sorting waste. In this process, natural and synthetic fiber textiles are separated, and their further processing methods are determined. Recycling methods are divided into several types. In the mechanical recycling method, textile waste is crushed, re-processed into yarn or fiber and used as a secondary product. Although this method is simple and cost-effective, the quality of the resulting yarn may be low. Chemical recycling is more advanced, in which synthetic textiles are returned to their original monomer or polymer form and new high-quality fibers are produced. Although this method is more expensive, the quality of the resulting product is equal to the primary raw material. Another direction is waste-to-energy technologies. In this process, the heat generated when waste is burned is used as electricity or other types of energy sources.

Fabrics are an integral part of human life, and they must meet not only appearance and aesthetic requirements, but also functional and hygienic properties. In this regard, the air permeability and heat retention properties of fabrics are considered their most important indicators. Because these properties directly affect the heat exchange of the human body, the level of comfort, healthy living conditions and the quality of use of clothing. The air permeability and heat retention of a fabric directly depend on its fiber composition, yarn structure, weaving density, thickness, moisture content, surface treatment technology and operating conditions. Therefore, in-depth scientific study of these properties is of great importance in improving the quality of light industrial products.

The air permeability of a fabric is understood as the ability of atmospheric air to pass through it at a certain speed. This indicator is related not only to the breathability of clothing, but also to ensuring the natural breathing of human skin, removing excess moisture and heat. For example, cotton fabrics are characterized by high air permeability. They have a breathable structure, quickly remove moisture from the human skin and facilitate the natural heat exchange process of the body. On the contrary, fabrics made of synthetic fibers, such as polyester or nylon, often have low air permeability. Their fibers are smooth, densely packed and restrict the free passage of air, which leads to the accumulation of moisture on the human skin, excessive sweating and discomfort. Therefore, high air permeability is required for sportswear and fabrics intended for everyday use.

Air permeability also depends on the type of weave of the fabric and the thickness of the

threads. For example, loosely woven fabrics are more breathable than tightly woven fabrics. Special processing processes on the surface of the fabric also affect this property. If the fabric is covered with special polymer films to make it waterproof, then its air permeability is sharply reduced. Therefore, manufacturers strive to maintain a balance when processing the fabric, taking into account hygienic requirements.

The heat-retaining properties of fabrics depend on the air layers in their composition, and the more gaps there are between the fibers of the fabric, the more heat it retains. Because air is a poor conductor of heat and acts as a natural insulator. Therefore, clothes made of wool or mixed fiber fabrics worn in winter have high heat-retaining properties. Wool fibers have their own natural curl, which creates a large number of air layers between them, and as a result, they effectively retain heat. Therefore, wool fabrics are widely used in winter clothing. Although cotton fibers are hygienic and breathable, they have a lower heat retention rate than wool fibers. Therefore, cotton fabrics are more commonly used in the production of summer clothing.

The heat retention properties of synthetic fiber fabrics vary depending on their structure and production technology. For example, special "hollow fiber" technology made from polyester-based fibers has good heat retention properties and is widely used in sportswear and winter jackets. Since synthetic fibers have a hydrophobic surface, they do not absorb moisture well, and as a result, the body's heat exchange is limited to a certain extent. Therefore, manufacturers often mix synthetic and natural fibers to create a balance between heat retention and air permeability.

The heat retention properties also directly depend on the thickness of the fabric. Thicker fabrics retain more heat than thinner fabrics. However, as the thickness increases, air permeability decreases. Therefore, the most comfortable clothing for a person should retain heat sufficiently, but at the same time release excess heat and moisture. Modern science is making great progress in solving this problem. For example, membrane fabrics have been developed that block the ingress of cold air from the outside, but allow moisture and air from the inside to escape. Such technologies are creating new opportunities for human comfort.

The air permeability and heat retention properties of fabrics are also closely related to their ability to absorb moisture. Sweat formed on the surface of the skin is absorbed by the fabric and cools the human body through the process of evaporation. If the fabric does not absorb moisture well, heat exchange in the human body is disrupted. Cotton fibers are distinguished by their good moisture absorption, therefore they provide comfort in summer clothes. Wool fibers absorb moisture relatively less, but retain heat well, which is an important advantage in winter clothes. Synthetic fibers often do not absorb moisture well, which is why fabrics made from them often cause discomfort. However, with the help of modern technologies, synthetic fibers are given a special hydrophilic treatment, artificially increasing their ability to absorb moisture.

DISCUSSION

Also, the properties of air permeability and heat retention are inextricably linked to the hygienic and physiological indicators of the fabric. Thermoregulation of the human body is aimed at maintaining a constant heat balance. In this process, the fabric acts as a kind of mediator between the external environment and the body. If the fabric has low air permeability, heat exchange is disrupted, sweating increases, as a result of which the person feels uncomfortable. On the contrary, if the fabric does not have the property of heat retention, the body quickly cools down in cold conditions and harms health. Therefore, the indicators of air permeability and heat retention should be optimal together. In recent years, the concept of "green fashion" has been taking shape in light industry. The main idea of this concept is aimed at ensuring environmental safety in the production of fabrics, introducing waste-free technologies, using organic fibers and establishing recycling processes. For example, abandoning chemical dyes and using natural pigments is becoming widely popular. At the same time, there is a widespread trend to create new products based on the recycling of old clothing and textiles. This not only ensures environmental safety, but is also economically beneficial, as using waste as raw material reduces production costs.

Fabrics created on the basis of nanotechnology are also playing an important role in reducing

environmental problems. For example, fabrics treated with special nanostructures can be stain-resistant, waterproof, and antimicrobial. Most importantly, the amount of harmful chemicals in such fabrics is reduced and they are safe for the human body. At the same time, scientific research is being conducted to create synthetic fabrics that are completely biodegradable in the future.

CONCLUSION

In conclusion, the issues of environmental safety and recycling of fabrics have become an important part of the development of modern society. Although natural fabrics are distinguished by their ecological purity, the use of water resources and chemicals in the process of their production creates problems. Synthetic fabrics, on the other hand, pose a threat to the environment due to their non-biodegradability. Therefore, improving recycling technologies, establishing waste-free production, using organic and innovative fibers, as well as implementing the concept of ”green fashion”in practice are among the most important tasks today. In the future, the solution of these issues will play a major role in the sustainable development of humanity and the preservation of the ecological environment.

The issues of environmental safety and recycling of textiles are one of the most relevant areas at the present time. Because in the production of light industry products, in particular, textiles, a large amount of natural resources are consumed, various chemicals are used, and this has a significant impact on the environment. Therefore, the issues of environmental friendliness of textiles, their recycling and secondary use are among the global environmental problems.

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