Other

UDC 677.017

Teselko Yurii

Founder & Owner of Murmur Studio LLC

MODERN TEXTILE MATERIALS AND INNOVATIONS IN UNDERWEAR TEXTILES

Summary. The article is devoted to studying the features of modern textile materials and innovations in textiles for underwear. The study's main hypothesis is that using innovative textile materials with special functional properties can significantly increase the comfort, durability, and aesthetic appeal of underwear, which, in turn, will positively affect consumer preferences and demand. The project goal is to identify modern textile materials and technologies used in the manufacture of underwear, as well as to analyze their impact on the comfort and functionality of this type of clothing. Research objectives: to study the existing textile materials used in the manufacture of underwear, to analyze the application of innovative technologies in the textile industry, and to identify promising areas of development of the textile industry in the underwear segment. The results of the study showed that modern underwear is increasingly made from new textile materials such as microfiber, bamboo fiber, Lycra, and innovative synthetic fibers with the addition of components for antibacterial and moisture-wicking protection. And made of sustainable and environmentally friendly materials, which has become an important aspect for the modern consumer. Innovative technologies, such as 3D technologies and electronic fabrics, open new horizons for seamless design and an individual approach to product creation.

Key words: textile materials, underwear, hypoallergenic materials, synthetic fibers, modern technologies, production, comfort, health.

Introduction. With the development of technology and changing consumer preferences, the textile industry is actively looking for innovative solutions that can improve the quality and functionality of underwear. Modern textile materials offer unique properties that allow them to satisfy the requirements of the most demanding consumers.

Materials and research methods. This study used methods of analyzing existing textile materials and technologies. The literature analysis allowed us to study the characteristics of various textile fibers, and their application in the production of underwear, and to identify innovative trends and patents in this area.

Results and discussions. One of the key trends in underwear production is the creation of light weight, weightless materials. This is achieved by using ultrathin synthetic fibers such as nylon and elastane, which provide excellent stretch and comfort when worn. Lightweight fabrics allow you to create models that are almost not felt on the body, which is especially important for active women. To ensure maximum comfort, especially in the summer months, many underwear manufacturers use moisture-wicking technologies. Special fabrics such as Coolmax and Dryfit wick moisture away from the body, keeping the skin dry and cool. This is especially true for sports underwear, which should not only support but also provide comfort during physical activity [1].

Modern materials also have antibacterial properties, which is especially important for underwear, as this type of clothing is in direct contact with the skin. The use of threads with the addition of silver ions or specialized chemical treatments helps reduce the development of bacteria and unpleasant odors, thereby increasing the service life of products and comfort when worn.

With consumers becoming more environmentally aware, many manufacturers are turning to eco-friendly materials. For example, organic cotton, recycled synthetic fibers, and textiles made from bio-based materials have become extremely popular. Modern technological advances have also led to the emergence of smart underwear. The introduction of wearable technology allows for the creation of models that can track physical activity, heart rate, or even sleep quality. Such innovations provide consumers with the ability to track their health and well-being in real-time [2].

The main requirements for underwear materials include softness, durability, breathability, moisture absorption, and heat retention. Soft fabrics provide comfort when worn, durable materials increase the service life of products, breathability allows the skin to breathe, and hygroscopic materials can absorb moisture and dry quickly, preventing irritation. Cotton is a classic material that has time-tested advantages such as breathability, hygroscopicity, and softness. Modern technologies have improved the properties of cotton: organic and Supima cotton have appeared, which are more durable and long-lasting. Using cotton in underwear provides comfort when worn and is suitable for sensitive skin.

Modal and lyocell are fibers made from wood pulp. They have excellent moisture absorption and breathability, making them ideal for underwear. Modal is softer and stronger than regular cotton, while lyocell is antibacterial and easy to wash. Not only are these materials comfortable, but they are also more sustainable because they are produced with minimal environmental impact [3].

Synthetic materials such as polyester, elastane, and nylon are widely used in the production of underwear due to their properties. Polyester allows you to create lightweight and quick-drying products, and elastane provides elasticity and support, which is especially important for bras and corsets. However, it is worth noting that high-quality synthetic fibers can be quite elastic and do not lose their property even after repeated washings.



Scheme 1. Types of textiles

With the growing interest in ecology, biodegradable materials such as plantbased nylon or recycled polyester are emerging. These innovative textures have the same properties as traditional ones but have a significantly lower environmental impact. Using these materials in underwear helps reduce the carbon footprint [4].

Modern developments also include the use of protein materials obtained from silk or other natural sources. These materials have unique properties such as softness and thermoregulation. Nanomaterials, in turn, add antibacterial and antifungal properties, which are especially important for underwear.

Organic fabrics, unlike conventional fabrics, are produced without the use of synthetic pesticides, herbicides, and chemical fertilizers. This makes them safer for the skin, especially sensitive areas. People who suffer from allergies or have hypersensitive skin may notice significant improvements when changing their

clothes to organic fabrics. The production of organic fabrics is significantly less destructive to the environment. Growing organic cotton, for example, does not require the use of toxic chemicals and helps preserve degraded ecosystems. In addition, growing organic crops usually uses less water, which is especially important in the context of global climate change [5].

Organic fabrics generally have good performance properties. They are stronger and more durable than their synthetic counterparts, allowing them to last longer, and reducing the need for frequent replacement of clothing. High-quality organic fabrics also allow the skin to breathe better, which is especially important for underwear.

However, organic fabrics are generally more expensive. This is due to higher production costs, smaller volumes, and higher quality requirements. For many buyers, price can be a deciding factor when choosing clothing. Although the organic fabric market is constantly evolving, the choice compared to traditional materials is still limited. This can make it difficult to find the right style, color, or texture. Inflexible approaches by manufacturers sometimes limit the variety of models and designs [6].

Some organic fabrics may be less resistant to wear than synthetic ones. For example, organic cotton items may wear out faster, especially if washed frequently. This may cause the garments to deteriorate more quickly. Some organic materials may not provide the same level of UV protection as synthetic fabrics with appropriate additives. This may be an important factor for people who spend a lot of time outdoors.

The relevance of the skin health problem is confirmed by statistics: according to the World Health Organization, up to 50% of the adult population of the world faces skin problems. Skin diseases such as dermatitis, eczema, acne, and others require qualified treatment and careful care. Therefore, doctors and dermatologists

are increasingly paying attention to the impact of materials with which the skin comes into contact with its health. One of the important aspects of skin care is the use of antibacterial materials. Antibacterial materials can kill bacteria and prevent their proliferation. This is especially important in cases where there are open wounds, scratches, or inflammations on the skin, which can become a gateway for pathogenic microorganisms. The use of antibacterial materials helps to minimize the likelihood of wound infection and the development of infection [7].

Hypoallergenic materials also play an important role in skincare. Hypoallergenic materials do not cause allergic reactions, which is especially important for people with sensitive skin. Allergies to certain materials can manifest themselves in the form of skin rashes, itching, redness, and other unpleasant symptoms. Therefore, the use of hypoallergenic materials helps prevent the development of allergic reactions and reduces discomfort on the skin. Modern technologies and scientific developments in the field of materials make it possible to create antibacterial and hypoallergenic materials that meet all quality and safety requirements. For example, in the textile industry, special departments have appeared that are engaged in the creation of fabrics with antibacterial and hypoallergenic properties. These fabrics undergo special processing using innovative technologies that allow preserving the properties of the material throughout its entire service life [8].

Popular materials with antibacterial and hypoallergenic properties are bamboo fiber, organic cotton, medical fabrics, and others. Bamboo fiber is highly absorbent, durable, and has antiseptic properties. Organic cotton has a natural composition and is great for people with sensitive skin. Medical fabrics contain special additives that kill bacteria and prevent infection.

The use of antibacterial and hypoallergenic materials helps reduce the risk of developing skin diseases and allergic reactions. The correct choice of materials for

clothing, bed linen, furniture, and other household items helps maintain healthy skin and prevent skin diseases. Therefore, it is important to pay attention to the composition of materials when purchasing goods and choosing products made from antibacterial and hypoallergenic materials [9].

Modern technologies produce fabrics using various antibacterial properties. The most common methods include:

- Silver ion coatings: silver is known for its antibacterial properties. Many manufacturers are starting to use silver ions in the production of underwear, which allows them to significantly reduce the number of bacteria on the surface of the fabric.

- Treatment with special solutions: fabrics can be treated with special chemical compounds that prevent the growth of bacteria. However, it is important to remember that the compounds must be safe and approved for human use.

Hypoallergenic materials also play a key role in reducing the risk of skin diseases. Several approaches have been developed in this direction:

- Use of natural fibers: such as organic cotton, bamboo and linen, which are less prone to skin irritation and do not cause allergies.

- Biodegradable and eco-friendly materials: they are an alternative to traditional synthetic fabrics, which also play a role in reducing allergic reactions.



Scheme 2. Modern technologies in the textile production process

The production of underwear has undergone significant changes in recent years. Modern consumers increasingly pay attention to the comfort, durability, and sustainability of products. This is due not only to changing consumer habits but also to global environmental challenges and demands for ethical production. Let's consider the main trends in this area [10].

1. Comfort as a priority

Modern brands focus on creating underwear that provides maximum comfort. This is expressed in the use of soft and breathable fabrics such as bamboo, organic cotton, and elastane. Many collections take into account the anatomical features of the figure, which helps to improve the fit and make the underwear more comfortable to wear throughout the day. Trends also include the absence of unnecessary seams and stitches, which minimizes the risk of chafing and discomfort.

International Scientific Journal "Internauka" https://doi.org/10.25313/2520-2057-2025-2

2. Durability of materials

With growing interest in ecology and sustainable consumption, manufacturers are focusing on creating products that last. This includes using durable fabrics that can withstand everyday wear and tear, as well as manufacturing methods that help maintain the quality of the product over many washes. Brands are beginning to actively implement technologies that increase the durability of underwear, which helps reduce waste and reduce carbon footprint [11].

3. Sustainable materials and ethical production

The sustainability trend covers the entire production process, from the selection of raw materials to the packaging of finished products. Manufacturers are increasingly using recycled and organic materials, such as recycled polyester and organic cotton. Many companies are switching to zero-waste technologies and actively looking for ways to minimize their impact on the environment. In addition, ethical production is becoming an integral part of brands. Consumers expect transparency in the supply chain and are ready to support those companies that monitor the working conditions of their workers and conduct business without exploitation.

4. Innovation and technology

Technological advances are also influencing the production of underwear. In recent years, interesting solutions have emerged, such as smart underwear with temperature management, moisture absorption, and antimicrobial properties. In addition, 3D printing is beginning to find application in the production of underwear, allowing for customized models and a perfect fit.

5. Increase diversity and inclusion

The modern lingerie market strives to ensure diversity and inclusivity. Brands are expanding their size ranges to meet the needs of a wider range of consumers. As far as possible, creating models that fit different body types, as well as taking into account the various cultural and ethnic characteristics of members of society, is becoming an important aspect in the development of new collections [12].

Conclusions. Thus, trends in the production of underwear indicate that comfort, durability, and sustainability are becoming the main factors determining the choice of the modern consumer. Brands that know how to combine these aspects gain a competitive advantage in the market and find a response from a demanding audience. In the future, we can expect an even greater emphasis on ethical practices and innovation, as well as an increase in choice and customization of products.

The use of antibacterial and hypoallergenic materials is an important trend in modern technology and design. These materials help maintain skin health, reducing the risk of developing various skin diseases and allergic reactions. With the use of modern materials, people can comfortably and safely remain in the modern world, preventing negative consequences for skin and health.

References

1. Nguyen T.L., Aparicio M., Saleh M.A. Detection of suspected carcinogen AZO dyes in textiles using thermogravimetric analysis. *Journal of Environmental Science and Health*. Part A: Toxic/Hazardous Substances and Environmental Engineering. 2021. Vol. 56, No. 8. P. 896-901.

2. Blocher S., Linti C., Jachan D., Metter J., Eberhardt-Fonseca A., Liebeton E., Bartsch V., Gresser G.T. EMG pants for smart textile-based monitoring of the muscle activity in the pelvic floor in physical therapy. *Current Directions in Biomedical Engineering*. 2024. Vol. 10, No. 4. P. 95-98.

3. Mirhosseini M., Afzali M., Molla Hoseini H., Khaleghizadeh S. Evaluation of antimicrobial effects of nisin/chitosan composite on cotton fabric textile. *Avicenna Journal of Clinical Microbiology and Infection*. 2023. Vol. 10, No. 2. Pp. 58-64.

4. Cheng Zh., Wu X., Kuzmichev V., Adolphe D. The influence of major ergonomic factors on the demand for underwear in the highly educated male group. Sustainability. 2022. Vol. 14. No. 19.

5. The best fabrics for underwear. URL: https://www.cimmino.com/en/the-best-fabrics-for-underwear/ (date of request: 19.02.2025).

6. The Most Common Fabrics Used To Make Underwear And Lingerie: Find Out In This Guide. URL: https://recovo.co/en/blog/article/the-most-common-fabrics-used-to-make-underwear-and-lingerie-find-out-in-this-guide (date of request: 19.02.2025).

7. Hong W., Mohd Tajuddin R., Shariff Sh. Design of smart underwear nursing service system to assist elderly walking based on kano model. *Environment-Behaviour Proceedings Journal.* 2024. Vol. 9, No. SI17. P. 553-561.

8. Huang Yu., Ji X., Zhai L., Ocran F.M. Development and application of temperature-sensing underwear for breast monitoring. *International Journal of Clothing Science and Technology*. 2024. Vol. 36, No. 2. P. 317-337.

9. Nagy Szabó O., Geršak J., Koleszár A., Halász M. Influence of Undergarments on the Comfort Level of Scoliosis Brace Wearers. URL: https://www.mdpi.com/1996-1944/16/17/5925 (date of request: 19.02.2025).

10. Ornaghi H.L., Neves R.M., Monticeli F.M., Agnol L.D. Smart Fabric Textiles: Recent Advances and Challenges. *Textiles*. 2022. No. 2. P. 582–605.

11. Tawara D., Nishiki T., Ninomiya S., Okayama H., Naito K., Morikawa Sh. Development of primary design guidelines for supportive underwear to elevate the bladder neck in women based on finite element analysis of the pelvis. Proceedings of the Institution of Mechanical Engineers, Part H. *Journal of Engineering in Medicine*. 2022. Vol. 236, No. 2. P. 269-278.

12. Wang J., Zhang B., Yao X., Shen J., Yuan L., Pan T., Shen D., Li Yu. Single-sided jacquard knit fabric development and seamless ski underwear zoning

design based on body mapping sportswear. *Autex Research Journal*. 2023. Vol. 23, No. 4. P. 483-494.