Volume 4, Issue 4 April 2026 **ISSN (E):** 2938-3757

COMPREHENSIVE ASSESSMENT OF THE QUALITY OF KNITTED FABRICS AND SELECTION OF RATIONAL STRUCTURES

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Abstract
This article discusses the issues of comprehensive quality assessment of double-layer and combined knitted fabrics intended for outerwear. An integral approach to quality assessment is proposed, taking into account structural, parametric, physical-mechanical, and performance indicators. Variants of imported knitted fabric samples are compared, and the advantages of rational structures are substantiated. The results demonstrate the possibility of implementing resource-saving technologies in knitwear production.

Keywords: Knitted fabric, comprehensive quality assessment, double-layer knit, structure, physical-mechanical properties, integral indicator.

Introduction

Currently, the textile and knitwear industry is one of the fastest-growing sectors of the global economy. The growing demand of the population for clothing from ear to ear, the strengthening of consumer requirements for the quality, comfort, and aesthetic appearance of products, creates the need to expand the range of knitted products and improve their quality. In particular, outerwear knitted fabrics occupy an important place in the production of modern clothing, and high demands are placed on their operational properties.

Upper knitwear should perform such functional tasks as protecting the human body in cold and variable climatic conditions, retaining heat, providing comfort, and maintaining its shape for a long time. These requirements are directly related not only to the raw material composition of knitted fabrics but also to their structure, weave type, and technological parameters. Therefore, the issue of assessing the quality of knitted materials is of particular scientific and practical importance today.

Practice shows that the quality assessment of knitted products is often carried out based on individual physical-mechanical or technological indicators. However, this approach does not fully reflect the real operational properties of the material. Since the indicators that determine the quality of knitwear are inextricably linked, their combined influence forms the consumer value of the product. In this regard, developing a scientific approach based on a comprehensive assessment of the quality of knitted fabrics is one of the urgent tasks.

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In recent ears, the share of imported double-layered and complex-woven topwear products in the markets of our republic has been increasing. Despite the high performance indicators of these products, their high cost, dependence on chemical fibers, and high raw material consumption create certain economic problems for local producers. Therefore, the development of high-quality, competitive, resource-saving, and modern knitted fabrics based on local raw materials is of great scientific and practical importance.

The relevance of this research lies in the fact that it studies the comprehensive assessment of the quality of outerwear knitted fabrics, taking into account the structure, parameters, physical-mechanical and operational indicators of the fabric. In particular, the possibilities of selecting rational structures for double-layered and blended weaves and integrating their quality indicators are analyzed on a scientific basis. Of particular importance in the research is the use of diagram (graphical) methods in assessing the quality of knitted fabric, which allows for visual and quantitative comparison of the quality level of various knitted fabric variants. Based on the comprehensive evaluation diagram, the ways to choose the most optimal structure, reduce material intensity, and improve operational characteristics are determined.

Thus, this study is aimed at a comprehensive assessment of the quality of upper knitwear, the results of which have important theoretical and practical significance for the development of the domestic knitting industry, the production of import-substituting products, and the creation of scientifically based rational knitted structures.

The process of assessing the quality of knitted fabrics is complex and multifactorial and is not limited to individual physical or technological indicators of the material. Practical experience shows that the real operational properties of a knitted product are formed as a result of the interaction of its structural-parametric, physical-mechanical, and hygienic indicators. Therefore, a comprehensive (integral) methodological approach to assessing the quality of knitted fabric was adopted in this study. The main essence of the comprehensive evaluation methodology lies in systematizing the important indicators characterizing the quality of knitwear, bringing them to a single evaluation criterion, and creating an opportunity for their mutual comparison. This approach serves to objectively assess the consumer value of knitted structures.

The indicators used in the comprehensive assessment of knitted fabric quality were divided into three main groups:

- Structure and parametric indicators: surface density, thickness, volume density, ring density
- Physical and mechanical indicators: tensile strength, tensile elongation, reversible and irreversible deformation, wear resistance.
- Operational indicators: shape stability, heat protection, air permeability, comfort level.

These indicators reflect how well the product meets consumer demands in the context of practical use.

Below, the main quality indicators of knitted fabrics are presented in the form of a diagram. Determining the best variants of knitted fabrics produced from various weaves allows for the identification of numerous factors that shape the structure and properties of fabrics. Therefore, to process the obtained test results, a method for constructing a comprehensive diagram and histogram for assessing the quality indicators of knitwear was chosen.

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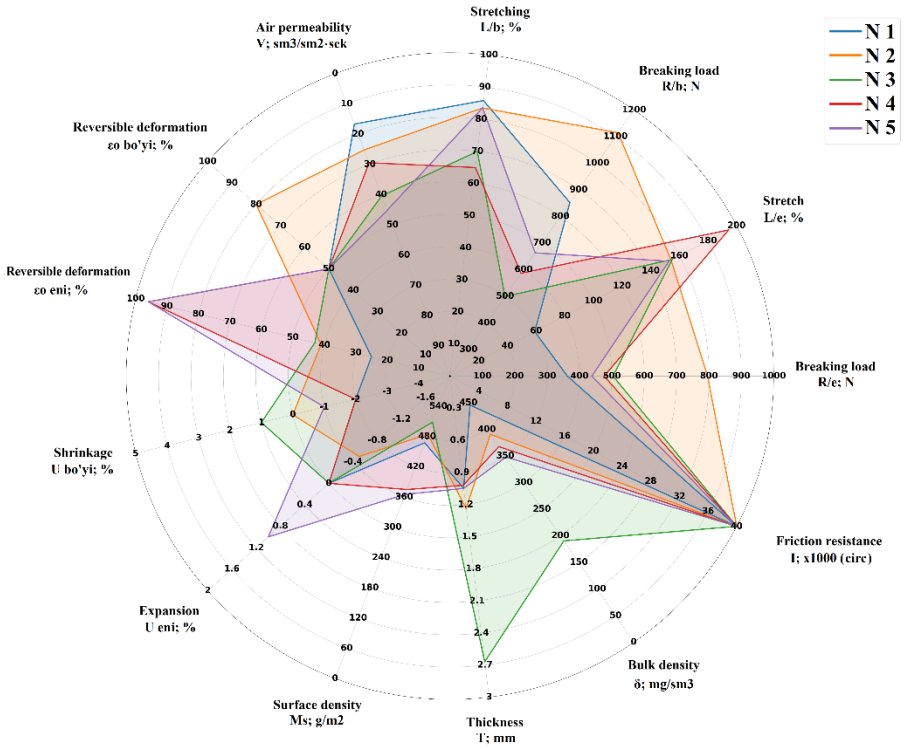
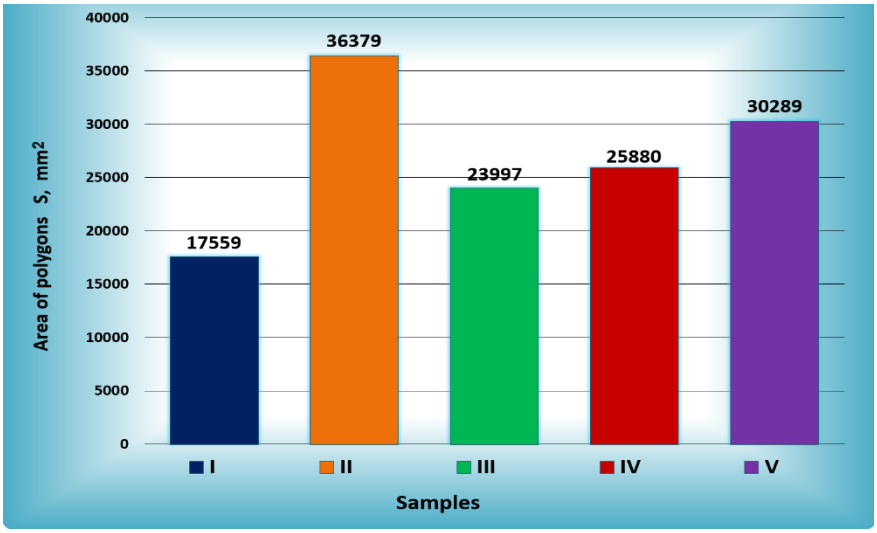


Comprehensive evaluation of knitted fabric quality



Gistogram of knitted fabric quality indicators

The results of the complex diagram and histogram of the quality indicators of the knitted fabric showed that the best variants of the knitted fabric are the II, IV, and V variants.

They are most suitable for making outerwear, as they have high shape stability, wear resistance, and low air permeability. Analysis of the research results shows that the structure of the proposed knitted fabric variants contributes to a decrease in bulk density, an increase in the strength of the knitted fabric along the length and width, a decrease in stretchability and shrinkage of the knitted fabric, as a result of which the shape-stability properties are improved, which positively affects the consumer properties of the produced single knitted fabric samples.

Conclusion

During the research, it was established that double-layer and combined knitted fabrics have an advantage over traditional single-layer structures in terms of shape retention, heat retention, and deformation resistance. The presence of interlayer binding elements in such structures limits loop movement, which ensures the geometric stability of the fabric during operation. In particular, the use of elongated stretchers and incomplete weave elements contributes to the normalization of stretchability along the width and length of the knit.

Analysis of imported double-layered knitted fabrics showed that their high quality indicators are mainly provided by complex structural solutions and a high proportion of chemical fibers. However, the conducted research has scientifically substantiated the possibility of creating knitted structures with similar, and in some cases even superior, performance properties using local raw materials. This will create an important basis for the production of import-substituting products in the local knitwear industry.

Thus, the results of the conducted research clearly demonstrate the need for a comprehensive approach to assessing the quality of knitwear, as well as a promising direction for the assortment of outerwear of double-layer and blended knitwear with a rational structure. These conclusions serve as a solid scientific basis for formulating further general conclusions and developing practical recommendations.

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