

The Influence of Utilizing High-performance Fibers on the Breathability of Doctors' Clothing Fabrics (scrubs)

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Abstract:

After protective features, comfort is the second most important aspect of medical clothing. Doctors and nurses' jobs require amazing effort as doctors work for long periods of time without breaks in varying temperatures due to the procedural demands of their work at hospitals. As a result, we see that doctors clothe in a variety of methods. The need to produce scrubs that improve physiological comfort while also achieving performance aspects such as breathability, moisture management, thermal conductivity, and quick drying has boosted the demand for complicated medical textiles. This requires the use of high-performance fibers known as microfibers. Its superior functional capabilities make it surpass standard synthetic fibers in areas such as air permeability, moisture absorption, wicking, and flexibility. The study aims to include these high-performance materials into the manufacturing process of breathable scrub fabrics in order to meet their physiological comfort requirements while maintaining their practical performance features. This study discusses how to produce nine (9) breathable doctors' scrub fabrics made from cotton, polyester microfiber, and nylon fibers. The fabrics have several fabric structures, such as Plain 1/1, Twill 3/1, and Oxford 2/2 pinpoint in the weft direction. The test results and statistical analysis revealed that using different weft material blending ratios and fabric structures significantly improved scrub materials' performance properties, particularly breathability and physiological comfort. This improvement is due to the combination of high-performance fibers. The need for healthcare clothing has become critical and includes scrubs and textiles used in hospitals to prevent infection. comfort is the second most important aspect of medical clothing after its protective properties. The jobs of doctors and nurses require great effort, as doctors work for long periods, approximately 24 hours a day. Hence, we find that doctors' scrubs must be designed in a way that enhances physiological comfort and achieves performance properties, so it must have performance characteristics such as breathability, moisture vapor transfer, and quick drying to achieve comfort when the body exerts high levels of activity by achieving an appropriate balance in skin temperature through sweating, and ventilation. As a result of the increasing demand for highly efficient medical textiles, has led to major developments in the field of fiber production, the most important of which is high-fine fibers called microfibers. Which are mainly used in medical textiles. These microfibers can be used alone or mixed with natural fibers such as cotton and viscose, and due to their high-performance functional properties, such as air and moisture permeability, super absorbency, imbibition, flexibility, and ease of washing, which made them superior to their traditional synthetic fiber counterparts. Structure is one of the most important factors that contribute to the quantitative and qualitative properties of a medical tissue, which determines how it performs. This affects the functional properties of fabrics depending on the structural composition factors of the fabric, which in turn is reflected in the aspects of thermal physiological comfort, sensory comfort, and performance for the wearer. It is controlled by the properties of the fiber (material, thickness, thermal conductivity, moisture), and the properties of the fabric (thickness, permeability, or porosity), as well as by the temperature and humidity of the external environment. Then, the research touched on improving functional performance properties, such as breathability and achieving physiological comfort for scrubs clothing fabrics, using high-performance materials and different fabric compositions.

Problem Statement: The research problem can be formulated in the following question:

How can breathable and functional fabrics for doctors' scrubs be produced by employing structural components, to meet the desires of users and provide wearable comfort?

Aims and objectives 1. Improving the performance properties of scrubs clothing fabrics to achieve the required physiological comfort properties. 2. Study the effect of using microfiber threads on achieving the breathability property of the fabrics produced. 3. Arriving at the most appropriate structural composition that achieves the comfort properties of scrubs.

Experimental Work: The main goal of the research is to improve the breathable fabric properties of scrubs fabrics through the use of different structural factors (textile materials - textile compositions) to examine the effect of the research variables. The practical experiments of this research adopted a new approach by producing a number (9) samples of fabrics using different mixtures of textile materials used as wefts (cotton - polyester - polyester microfiber - nylon) to take advantage of their physical and mechanical properties to improve the breathable property (Breathable Fabric). For the fabrics of doctors' clothes (scrubs), simple textile compositions were used such as (plain 1/1 - Twill 3/1 - Oxford (Pin Point) 2/2 in Weft Direction).

Results and Discussion: By evaluating the samples of fabrics produced under the research to determine the best sample: The ideal sample that achieves the best performance is sample No. (5). It achieved the highest area of the radar shape with a quality factor of (92.58%), produced with a material (cotton + nylon) and with a structure Twill 3/1 compared to the other samples under study.

Conclusion: The experimental result indicates improving the performance properties of scrub fabrics by increasing their breathable fabric and their ability to evaporate sweat using different structural factors (textile materials - textile compositions) to achieve the requirements for physiological comfort properties and performance properties. The practical experiments of this research adopted a new approach by producing fabric samples using different mixtures of textile materials used as wefts (cotton - polyester - polyester microfiber - nylon). Simple textile compositions were used such as (plain 1/1 - Twill 3/1 – Oxford (Pin Point) 2/2 in Weft Direction). It became clear from the results that the difference in structural composition factors has a significant effect on the functional performance properties of the fabrics produced, such as (weight per square meter, thickness, water vapor permeability, air permeability, wicking in the warp and weft directions, and drying speed). The research revealed important variables that significantly affect the performance of the fabric and achieve physiological comfort properties. These findings are expected to have a significant impact on the development of scrub fabrics designed to meet the exacting requirements of medical textiles that must be available in hospitals and healthcare facilities.

Keywords:

Medical clothing (scrubs) - breathability - high-performance materials - textile structures.

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