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COMPARATIVE STUDY ON THE TREATMENTS APPLIED TO ECOLOGICAL TEXTILE MATERIALS USED IN THE MANUFACTURE OF MATTRESS COVERS

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Abstract:. *The use of organic natural fibres, such as organic cotton and hemp, reflects a sustainable and responsible direction in the textile industry, in the context of increasing awareness of the impact on the environment and the health of users. These materials, being grown without the use of pesticides, herbicides or other harmful chemicals, contribute to reducing the ecological footprint and promote a healthier and more responsible lifestyle. In the work, different materials for the manufacture of the two mattresses covers were treated and tested, using ecological natural fibers, in order to obtain basic information about the chemical process of treating these knitted materials. These treatments included, for example, the application of bio-based flame retardants, which are designed to provide fire-resistant properties without compromising the naturalness of the fibers and without introducing harmful chemicals. The components of the two mattresses covers were analyzed individually by cutting each layer, followed by collecting samples in small, appropriately labeled bags. Each sample was taken from its entire depth, from areas with a cross-section of about 1-2 cm. This paper also highlights the differences in finishing methods, depending on the composition of the knitted materials used to make mattress covers.*

Key words: *natural organic fibers, organic cotton, mattress cover*

1. INTRODUCTION

California and U.S. regulations were established to protect consumers and prevent fires and accidents caused by flammable textiles and materials. These regulations require that textile products must not be more dangerous than those existing on the market before the introduction of new standards [1]. The inclusion of flame-resistant fibers in mattresses is determined by the flammability regulations of California and the USA, which require that all textiles and materials used in the construction of consumer goods meet certain safety standards in terms of flammability [2]. The use of flame-resistant fibers in mattresses poses a potential health risk, as they can produce harmful fumes and gases when exposed to high temperatures or flames [3]. Such a risk is associated with the development of respiratory diseases, such as chronic bronchitis or lung cancer. Even though the treatments used and the components of the mattress cover are designed to meet safety and

environmental requirements, official certification and testing do not explicitly include them, which highlights a possible gap in the product evaluation process [4].

2. GENERAL INFORMATION

In this work, the materials used to make two mattress covers were analyzed and tested, with the aim of obtaining essential information regarding the chemical treatments applied to knitted materials from ecological natural fibers. This research aims to provide essential data on the chemical processing of fibers in new mattress covers [5], [6].

As a novelty, 100% natural fiber yarns composed of 85% organic cotton (BIO) and 15% hemp were used to knit a variant of the fabric. This choice reflects the commitment to meet the sustainability requirements of the textile industry.

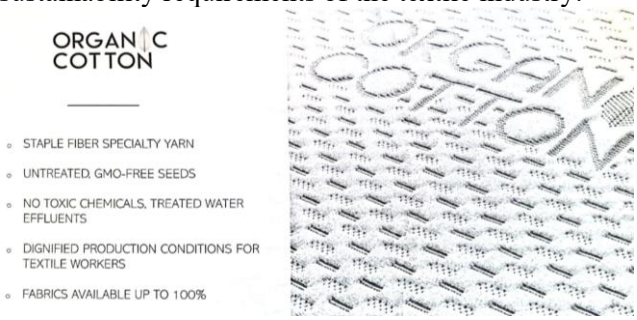

***Fig. 1**: Organic cotton*

***Fig. 2**: Cutting/stamping press G999*

The constituent components of the two mattresses covers were each subsampled by cutting each layer and then proceeding to collect samples in small, labeled bags. Each sample was sampled over its entire layer depth, with cross-section areas of about 1-2cm [7].

The preparation and analysis of the samples were carried out according to a standardized internal procedure, designed to ensure the consistency and reliability of the results in the evaluation of the fibrous content of the materials in the two mattress covers. This standardised methodology has been developed to ensure that each step of the preparation and analysis process is repeatable and accurate, thereby reducing variability in results and ensuring comparability between the samples tested. In the process of preparing the samples, the samples were extracted from the materials in the two mattress covers using a G999 cut/stamping press as shown in the **Fig. 2**.

This press was chosen for its ability to apply controlled and uniform pressure, thus ensuring homogeneous and representative samples for the entire material. The use of this press allowed the creation of precise sections, of standardized sizes and shapes, necessary for the subsequent stages of analysis. This methodological approach ensures that each step of the process has been controlled and documented, contributing to the transparency and reliability of the final results, which are essential for assessing the quality and conformity of the materials used in the production of mattresses

***Table 1:** Treatment of household cover (mattress) type 1*

Treatment	LIKROLL
Recipe	Citric Acid 0.2% Elastofin STO501 1.4%, Temp:130^{0}C
Request width	229-231 cm
Request weight	357-372 gr/m^2
Composition	25% Viscose from bamboo, 75%Pes
Color	Bleached+Natural

Table 2: *Treatment of household cover (mattress) type 2*

Treatment	LIKROLL
Recipe	Citric Acid 0.2% Elastofin STO501 1.6%, Bio-based F.R. EN 597 Part 2, Temp:130^{0}C
Request width	239-244 cm
Request weight	373-391 gr/m^2
Composition	85% Organic Cotton (BIO), 15%Hemp
Color	Natural

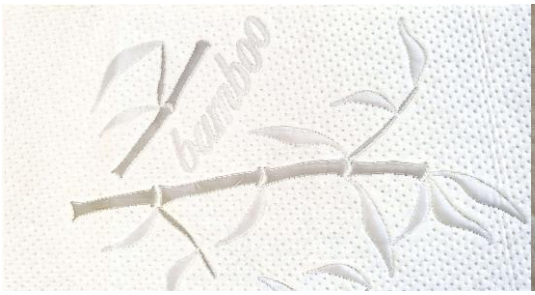

Fig. 3*: Treated material for household cover (mattress) type 1*

Fig. 4*: Treated material for household cover (mattress) type 2*

The main components of each mattress cover analysed, together with their compositions, are presented in Table 1 and Table 2. These covers, intended for home use, are made from blends of natural fibers, such as cotton and hemp, combined with additives and chemical treatments to meet safety and performance requirements [8]. In particular, the mixtures contain citric acid and elastofine, applied with a loading method known as 'pick-up', with a percentage of 100%. This process involves treatment at a controlled temperature of 130°C to ensure uniformity and efficiency of treatments. The essential difference between the two mattress covers lies in the Bio-based F.R. flame retardant treatment, applied according to the EN 597 Part 2 standard. This treatment includes rigorous cigarette and small flame tests aimed at increasing the fire resistance of materials, especially cotton and hemp fibers, which are naturally flammable. Natural fibers, being easily flammable, require such treatments to ensure compliance with safety requirements and reduce the risk of fire in daily use.

5. CONCLUSIONS

It is important to note that, in the process of fireproof treatment, the criteria for bio certification of materials have been preserved. This way, the use of harmful or harmful chemicals for the environment was avoided, maintaining the ecological character of the products, according to the requirements for bio and sustainable materials.

This treatment process has been carried out in such a way that it does not compromise the natural properties of the fibers, such as permeability and strength, while ensuring compliance with safety and quality standards.

In conclusion, the combination of these components and treatments ensures a safe, durable and eco-friendly mattress suitable for home use and environmentally conscious consumers.

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