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The Mechanical Properties of Double Cloth Kenaf Fabric

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Structured Abstract

Background: The rising environmental issues of synthetic fibres have increased the need to develop sustainable and biodegradable textile materials. Kenaf (Hibiscus cannabinus) is one of the locally sourced natural fibres that has promising mechanical strength, renewability, and low environmental footprint. While previous studies have mainly focused on kenaf in single-layer woven fabrics or composite applications, limited research has explored its performance in multilayer textile structures. Double cloth weaving, which consists of two interconnected fabric layers, providing greater thickness, durability and functional versatility. However, the mechanical, physical, and permeability properties of kenaf double cloth fabrics remain largely unexplored.

Methods: This study investigated the effects of stitching density on the properties of double cloth kenaf fabrics. Kenaf yarns were woven into double cloth structures at varying fabric densities using a hand loom. The fabrics were subjected to physical tests such as fabric thickness, fabric weight, yarn crimp percentage, yarn size, and fabric density. Mechanical properties were evaluated through tensile and shear strength tests, while permeability performance was assessed using air permeability and water vapour transmission tests. All tests were carried out in accordance with ASTM and ISO standards, and the results were statistically analysed to determine performance trends.

Results: The results showed that increasing stitch density significantly influenced fabric performance. Fabric thickness increased (2.42 to 3.10 mm), while fabric weight increased (598.64 to 697.74 g/m²). Yarn crimp percentage also increased, with warp crimp rising (4.10% to 5.96%) and weft crimp from (4.44% to 6.74%), indicating stronger yarn interlacement at higher densities. Mechanical properties improved with increasing stitch density, as denser fabrics demonstrated greater resistance to tensile and shear forces. Conversely, permeability properties decreased as stitch density increased, with air permeability reducing (174.8 cm³/s/cm² to 101.5 cm³/s/cm²) and water vapour transmission decreasing from (581.25 g/m²·24 h to 488.84 g/m²·24 h), reflecting reduced fabric porosity.

Conclusion: The findings confirm that stitch density plays a crucial role in balancing strength, durability, and comfort properties of kenaf double cloth fabrics. The results demonstrate the potential of kenaf double cloth fabrics for sustainable apparel, interior, and technical textile applications, supporting the use of kenaf as an eco-friendly alternative to synthetic fibres.

Keywords: Kenaf fabric, double cloth, stitch density, mechanical properties, sustainable textiles

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