AN EXPERIMENTAL STUDY ON THE SUITABILITY OF VALUE-ADDED COIR FIBER REINFORCED POLYMER COMPOSITE FOR PARTITION BOARDS

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MSc in Textile and Clothing Management 2019/20

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University of Moratuwa, Sri Lanka

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Thesis submitted in partial fulfillment of the requirements for the degree Master of Science in Textile and Clothing Management

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidate has carried out research for the Masters thesis under my supervision.

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Signature of the supervisor: Date: 25.11.2024

(02). Name of the supervisor: Eng. S.N. Niles

Signature of the supervisor: Date: 25.11.2024

ABSTRACT

This study was targeted to develop composite partition boards with different weight percentages (wt%) loading of coconut fibers (coir) and waste low density polyethylene (LDPE), inter alia aiming at improving their overall quality. This study investigated the thermal stability and sound absorption of polymer composite panels enhanced with various weight fractions of coir fiber.

Initially, a literature review was conducted to understand the properties of coir fiber, LDPE, and relevant background information. The development of the composites involved using coir fiber as the reinforced material and waste LDPE as the matrix material, with variations in coir weight fractions. This study also provided the optimal manufacturing conditions and assessed value-added properties of a new composite through experimental procedures and testing standards

The Lees' disc method was used to evaluate the thermal conduction of the composite, and the sound absorbency and drop weight impact tests were carried out to analyze the best samples with soundproofing and the maximum composite absorbing force, respectively. Consequently, the research achieved the creation of the composite unit panel that satisfied the required properties.

The research findings indicate that a coir fiber weight fraction (CWF) of around 30% provides the best balance of mechanical performance and material workability, leading to significant improvements in structural integrity and durability. This makes the composites suitable for partition board applications.

The new composite's sound coefficient value range of 0.27-0.39 surpasses that of Gypsum Board, Wood Fiber Board, Straw board, MDF, and closely aligns with Mineral wool board, Polyester Fiber Board, and Fabric-Wrapped Panel. The thermal conductivity of 0.0241 (W/mK) of the new composite is relatively higher than Mineral wool board and Ploystar Fiber Board, and is closer to that of Gypsum board.

The findings suggested that 30% CWF provided a balanced combination of mechanical performance and material workability, leading to significant

enhancements in structural integrity and durability, making the composites suitable for partition board applications.

Keywords: Coir fiber, LDPE, CWF, partition board, value added composite, polymer.

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Abbreviation	Description
LDPE	Low density polyethylene
CWF	Coir weight fraction