

**INVESTIGATION OF WASTE PLASTIC-BASED
COMPOSITE ROOF TILES AS A SUSTAINABLE
ALTERNATIVE FOR ROOFING MATERIAL**

Krishnamoorthy Mayuresan

(198415A)

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Department of Mechanical Engineering
Faculty of Engineering

University of Moratuwa
Sri Lanka

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DECLARATION

I declare that this is my own work, and this dissertation 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. I retain the right to use this content in whole or part in future works (such as articles or books).

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The above candidate has carried out research for the master's thesis/dissertation under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of the supervisor: Prof. H.K.G. Punchihewa

Signature of the supervisor:

Date: [27/04/2024](#)

Name of the supervisor: Dr. H.M.C.C. Somarathna

Signature of the supervisor:

Date: 28/04/2024

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Sincerely,

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ABSTRACT

Improper disposal of plastic waste poses a significant threat to both land and ocean environments. Given that Low-density Polyethylene (LDPE), High-density Polyethylene (HDPE), Polypropylene (PP), and Polyethylene terephthalate (PET) together make up about 65% of the global demand for plastic resins, repurposing these materials as components for roof tiles offers a promising avenue for mitigating environmental contamination. Hence, this investigation delves into the urgent challenge of plastic waste by exploring the feasibility of utilizing LDPE, HDPE, PP, and PET waste and determining the optimal combination for composite roof tile production. The investigation focuses on identifying the perfect blend of waste plastic types, with particular emphasis on LDPE and HDPE when integrated with granite quarry dust as a filler.

Comprehensive testing, including assessment for Water absorption, Specific gravity, Water impermeability and Transverse strength was carried out. Optimal combinations were successfully identified for LDPE and HDPE, demonstrating the feasibility of utilizing these plastics in composite roof tiles with minimal machinery requirements, i.e., a shredder and a hot plate. The determined optimal granite quarry dust content was found to be 10% by weight. It is noteworthy that the suitability of LDPE and HDPE for roof tile production implies a cost-effective and simplified manufacturing process. However, it was observed that other plastic types may necessitate additional machinery and a controlled environment, potentially increasing the initial and production costs. The findings suggest that the proposed roof tiles, fabricated from LDPE and HDPE, are well-suited for applications with lower fire risk. It's worth noting that no additives were incorporated, aiming to cut costs and streamline the manufacturing process, thus incentivizing smaller industries to embrace eco-friendly practices. This research contributes to the overarching goal of reducing plastic waste and promotes the evolution of smaller industries towards sustainable practices. From this research, future developments may include testing the fire performance of roof tiles and analysing ways to improve it by incorporating various fire retardants.

Keywords: Plastic wastes, Recycling, Composite, Roof tiles, LDPE, HDPE

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LIST OF ABBREVIATIONS

Abbreviation	Description
LDPE	Low-Density Polyethylene
HDPE	High-Density Polyethylene
PP	Polypropylene
PET	Polyethylene terephthalate
SLS	Sri Lankan Standards
BS	British Standards
ASTM	American Society for Testing and Materials
ANSI	American National Standards Institute