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Evaluation of the Mechanical and Thermal Characteristics of Polypropylene Composites Reinforced with Benzoylation-Processed Banana Fibre and Sisal Fibers

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Abstract. The research investigated the mechanical and thermal properties of composites reinforced with Banana fibre (BF) and Sisal fibre (SF). Benzoylation treatment was applied to enhance the properties of Banana fibre / Sisal fibre composites. Hybrid bio-composites (PP/BF/SF) with a total weight percentage of 10% were fabricated using varying ratios of Banana fibre and Sisal fibre. Thermal stability was assessed using thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC). Flammability testing indicated that the treated hybrid composite (BF/PP/SF) exhibited the slowest burn rate (28 mm/min). The stiffness damping factor (Tan δ) and loss modulus (E") of the ideal PP/BF/SF hybrid composite, T-BF5SF5, were determined to be 0.058 and 86.2 MPa, respectively. Thermomechanical analysis (TMA) was employed to study the dimensional coefficient (m) versus temperature, revealing that T-BF5SF5 exhibited the highest dimensional coefficient (m) of 30.11 at 110°C.

1. Introduction

The synthetic fibres have many drawbacks, such being highly hydrophobic, non-biodegradable, and flammable [1]. As scientists become more aware of the drawbacks of synthetic fibres, they are increasingly interested in developing polymers that include natural fibres. Because of the negative effects that synthetic fibres have on the environment and human health, natural fibres are increasingly being seen as a practical alternative. Researchers are looking into bio composite materials because of escalating environmental concerns like the greenhouse effect and a desire in using sustainable materials [2]. Natural fibre composites are used in many different types of modern manufacturing, from aero planes, race cars, wind turbine blades, bicycle frames and car upholstery. Natural fibre composites have caught the eye of the business world because to their great performance, biodegradability, non-abrasive light weight, and low cost [3]. The widespread adoption of natural fibres and biopolymers as green materials is further encouraged by the rapid depletion of petroleum supplies and a growing awareness of global environmental concerns associated to the consumption