Uniaxial Tensile Properties of Polyester Textile Waste Fiber Reinforced Thermoplastic Waste Composite

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The textile industry plays a significant role in the Sri Lankan economy. However, the management of textile waste has become a critical challenge faced by the industry. Most of the generated textile waste typically goes to open dumpsites, disposed of through open burning or incinerated. However, due to the large volumes of waste generation, the textile sector has paid clear attention to seeking better solutions to manage their waste. As such, there has been an increased interest to develop novel materials from industrial waste. Hence, the aim of this work is to develop and characterize composite materials using post-industrial polyester textile waste as fiber reinforcement and waste packaging materials as the polymer matrix as a new solution to the generated waste. The materials have been selected as polyester textile waste as the fiber reinforcement and thermoplastic waste packaging material as the matrix. Both materials were collected from the Sri Lankan textile industries. The composites containing 0%wt, 2.5%wt, 5%wt, 7.5%wt, 10%wt, 15%wt, and 20%wt reinforcement were manufactured using the compression moulding technique. No additional binders were added. The uniaxial tensile test was conducted according to the ASTM D 638 standard, and the Ultimate Tensile Strength and Young's Modulus were focused for the study. According to the obtained results, the Ultimate Tensile Strength and the Young's Modulus have increased up to a certain percentage of fiber reinforcement weight in the composite. Moreover, both uniaxial tensile strength and young's modulus have reduced with increasing reinforcement fiber loading when passing that particular percentage. Accordingly, among the seven types of composite materials developed with different fiber reinforcement weight percentages, 7.5% wt. waste polyester textile fiber-reinforced composite shows the best performance for the uniaxial tensile properties. Experimental findings show that the uniaxial tensile properties of the developed composite show a positive trend to use as a substitute for non-structural applications such as particleboards.

Keywords: Polyester textile fiber; Textile waste; Thermoplastic; Tensile properties