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Study on the Mechanical Properties of Water Hyacinth Fiber Reinforced High Density Polyethylene Composite

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Abstract

Natural fibers have recently gained attention due to low environmental impact, biodegradability, low cost and easy availability. In this research work, water hyacinth (WH) fiber was used as reinforcement in the fabrication of the natural fiber composites. WH plant fiber reinforced high density polyethylene (HDPE) thermoplastic composites were fabricated by compression molding process. Fabrication parameters such as water hyacinth content, alkali treatment concentration, treatment time and coupling agent amount were varied in three levels and composites specimens were fabricated according to Taguchi's L9 orthogonal array. Grey Relation Analysis (GRA) was used to optimize the fabrication parameters. The results showed that the increase in WH fiber volume fraction, NaOH concentrations and treatment time increased the tensile and flexural strength of the composite up to some point and after that, it decreased. However, the strength of the composite was found to decrease with the increase of NaOH concentration and decrease of coupling agent concentration. ANOVA analysis revealed that the water hyacinth particle content had the highest contribution to tensile and flexural strength, followed by coupling agent dosage, treatment time, and NaOH concentration in order. Mechanical properties were optimized when the WH/HDPE composite fabricated with 30% water hyacinth fiber treated with 5wt% NaOH concentration for 12 hours and mixed with 15% coupling agent. The simultaneous effects of fabrication parameters on tensile and flexural strength of the WH/HDPE composites were studied. The fabricated WH/ HDP composite can be used as a viable alternative material for making furniture, ceiling, tile and partition boards

Author Keywords

Natural Fiber, Water Hyacinth, High Density Polyethylene, Taguchi method, Grey Relational Grade Analysis

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