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Short communication

Eggshell nanoparticle reinforced recycled low-density polyethylene: A new material for automobile application



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ABSTRACT

Waste from low-density polyethylene products after lifespan accounts for 70% of solid waste in most dumpsites, contributing to environmental impacts. Eggshell foul smells are a threat to human and animal health. Before this study, there was no research documentation on transforming both wastes into green composites for engineering applications. This work developed composites using recycled low-density polyethylene (RLDPE) and eggshell Nanoparticles. They were evaluated structurally and mechanically. Straining, which affirms an improvement in the load-bearing capacity of the RLDPE due to the incorporation of eggshell Nanoparticles, was established by the composite XRD peak broadness. Structural integrities of the composites were confirmed with SEM. Maximum tensile strength was noted at 10% eggshell Nanoparticle additions to the RLDPE, equal to a 68% increase. About 52 and 19% enhancements in respective flexural strength and hardness value with a 0.85% reduction in impact energy were noted at 12% eggshell Nanoparticle additions. The probability value, 0.0481 < 0.05 established the significance of the mono-variate regression model to estimate the tensile strength of RLDPE/eggshell Nanoparticle composites, and the model has 92.7% confidence. A bumper fascia prototype was fabricated from RLDPE/10% eggshell Nanoparticle composite possessing 10.64 Nmm⁻² tensile strength, 21.964 Nmm⁻² flexural strength, 21.69 J impact energy, and 59 VHN hardness value using sheet forming technique. Therefore, future usage of the developed RLDPE/10% eggshell Nanoparticle composite is established.

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