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RESEARCH ARTICLE

Enhanced mechanical characteristics of polylactic acid/tamarind kernel filler green composite filament for 3D printing

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Abstract

The significance and interest of printing green composites in three dimensions have recently grown, especially in light of the possibility of reusing waste to produce green fillers that can reduce the cost of biopolymers without compromising their processability and performance outcomes from a mechanical and environmental perspective. In the current work, the kernel powder obtained from the seeds of Tamarindus indica (TI) was added to polylactic acid (PLA) and extruded as a filament in the single screw extruder. It was then printed using an open source Fused Deposition Modeling printer and investigated for its density, mechanical, surface, and morphological characteristics. It was found that the composite performed better when the filler concentration was maintained at 2%, but when it went beyond that, the performance depreciated because of the rapid rise in material voids. When compared with a neat PLA matrix, 2% TI filler offered better

TI filler was found to promote crystallization within the PLA matrix, leading to a higher degree of crystallinity which have contributed to higher strength. The morphological study demonstrated that the occurrence of uniform filler distribution and inter-layer randomized bonding at 2% TI/PLA offered superior strength, whereas at higher TI concentrations it led to pullout and delamination. On the other hand, the hardness of the composite increased proportionally to the concentration of the fillers.

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DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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