

Optimization and Characterization of LLDPE/Cauliflower Leaf BioComposites for 3D Printing Applications

Hussien Amro, Mahmoud Nassar, Baraaa Tamimi, Salah Abdo, Malik Tamimi

Palestine Polytechnic University, Hebron, Palestine

Abstract

Composite materials that mix natural fibers with polymer matrices, especially those derived from agricultural waste, are becoming more popular as eco-friendly choices in material engineering. These materials provide not just environmental benefits, but also economic gains and promising performance in a variety of engineering applications. The study focuses on the creation of a novel biocomposite material by combining cauliflower leaf agricultural waste with linear low-density polyethylene (LLDPE), with the objective of producing a sustainable feedstock suited for 3D printing applications. The study will investigate the mechanical, physical, and thermal properties of the developed biocomposite and evaluate the influence of key processing parameters. The study will focus on treating agricultural waste with the hornification process, which is expected to strengthen the interfacial bonding of filler and polymer matrix. To assess the data and optimize the formulation and processing conditions, the study will utilize a statistical technique based on Design of Experiments (DoE), which will include Response Surface Methodology (RSM) and Analysis of Variance (ANOVA). The findings are expected to add to the developing field of sustainable materials and offer up new possibilities for using agricultural leftovers into modern manufacturing methods.