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Utilization of Dye-Colored Primary Sludge from Paper Industry as Reinforcing Filler in Poly(lactic acid) Composites.

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Highlights

Primary sludge from paper industry was used as reinforcing filler in PLA composites.
The composite aims to create sustainable and biodegradable filaments for 3D printing.

Abstract

This project aims to develop and characterize a poly(lactic acid) (PLA) composite reinforced with primary sludge from the pulp and paper industry, colored with Congo red dye. The objective is to create a sustainable material from recycled and biodegradable sources to be used as a filament in 3D printing. The sludge, obtained from a local industry, was characterized by various techniques, such as X-Ray Diffraction (XRD), Fourier-Transform Infrared Spectroscopy (FTIR), and Scanning Electron Microscopy (SEM), to analyze its morphology and composition. The sludge underwent acid and alkaline chemical treatments to improve its interaction with the polymer matrix. The composite was produced by thermomechanically mixing PLA with the sludge in different proportions (1, 5, and 10%). The chemical, physical, and mechanical properties of the composite will be evaluated through tensile and flexural tests. Preliminary results indicate that the acid treatment alters the sludge's structure, as evidenced by the XRD technique which showed a reduction in CaCO3 peaks, while the alkaline treatment does not cause significant changes. Through SEM, the interaction of cellulose fibrils with the dispersed filler in the material was observed. The final composite exhibits different shades of red, which become darker as the sludge concentration increases.

Preliminary results show that acid treatment changes the sludge structure, decreasing the calcite peaks, while the basic treatment does not cause significant changes. The final composite displays different shades of red, which become darker as the sludge increases concentration.

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