

High-value resistance measurements for temperature sensitivity characterization of PLA composites with biochar from olive pruning biomass

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Description Electrical measurements are widely used in material characterization due to their simplicity, sensitivity, and ability to reveal compositional information. In polymer systems, electrical resistivity can provide valuable insights into morphological changes, processing consistency, and the effects of such external stimuli as temperature or ageing. This study investigates the electrical behavior of polylactic acid (PLA) composites filled with 1 wt.% biochar (BC), a sustainable carbon-based filler obtained from olive pruning residues via pyrolysis. The composites were processed using two dispersion techniques — mechanical stirring and ultrasonic agitation — to evaluate how processing may influence morphological and electrical properties. Filler distribution was analyzed using Scanning Electron Microscopy (SEM), while volume resistivity was measured at controlled temperatures (namely, 18, 23, and 28 °C) to assess thermal dependence. All samples exhibited clear Positive Temperature Coefficient (PTC) behavior, with a marked increase in resistivity between 18 and 23 °C, followed by a slight decline, suggesting a dielectric transition or relaxation effect. Composites prepared using ultrasonic mixing consistently showed lower resistivity values, indicating more uniform filler dispersion and improved conductive network formation compared to those processed by mechanical stirring. These results align with existing literature on polymer composites, where ultrasonic treatments are known to enhance dispersion quality and interfacial contact. Furthermore, the use of biochar from agricultural residues supports circular economy principles by valorizing waste ...

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