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Biobased Plastics and Bionanocomposites: Current Status and Future Opportunities

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Abstract: This paper presents a broad review on the recent advances in the research and development of biobased plastics and bionanocomposites that are used in various applications such as packaging, durable goods, electronics and biomedical uses. The development of biobased materials is driven by renewability, low carbon footprint and in certain cases biodegradability (compostability) issues and helped them in moving from niche markets to high-volume applications. The inherent drawbacks of some biobased plastics such as the narrow processing window, low heat deflection temperatures, hydrophilicity, poor barrier, and conductivity and inferior biocompatibility can be overcome by bionanocomposites. The first part of the paper reviews the recent advances in the development of biobased and biodegradable materials from renewable resources and their advantages and disadvantages. In the second part, various types of bionanocomposites based on four types of fillers i.e. nanocellulose, carbon nanotubes, nanoclays, and other functional nanofillers are discussed. This review also presents up-to-date progress in this area in terms of processing technologies, product development and applications.

Keywords: Biobased plastics; Bionanocomposites; Nanofillers; Biodegradable; Compostable; Melt Intercalation; Solvent casting; Surface treatment; Packaging; Biomedical; Electronics;