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Structured nanocomposite materials from biopolymers and cellulose nanomaterials: Manufacturing, characterization and applications

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Structured materials from biopolymers and cellulose derivatives are of interest as sustainable, renewable and environmentally friendly materials. In this context, biopolymers are considered potential replacements for conventional plastic materials; nevertheless, some of their properties must be improved to position them as materials that can be competitive with fossil derivatives, especially their poor mechanical, thermal and barrier properties. However, the reinforcing technology using nanofillers has already been proven as an effective way to produce new structured biopolymer-based materials with controlled properties for various functional applications. Recently, the use of elongated cellulose nanocrystals (CNC) for biopolymer-based nanocomposites development has attracted more and more attention in the field of nanotechnology, due to the unique properties of CNC. It has been widely demonstrated that the incorporation of CNC into biopolymers can result in fully green nanocomposite materials with high performances. The present work describes the design and development of biopolymer-based nanocomposite materials filled with cellulose nanocrystals extracted from various lignocellulosic bio-sourced materials, such as sugarcane bagasse, alfa fibers, red algae waste, vine shoots and miscanthus fibers. Herein, some aspects related to the manufacturing of structured materials from biopolymers and cellulose nanomaterials will be given, with emphasis on i) the extraction of CNC and their physico-chemical characterization, ii) the manufacturing and characterization of new biopolymer-based nanocomposite materials for friendly packaging applications.

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