NANO-CELLULOSE FOR ACTIVE FOOD PACKAGING: CHARACTERISATION, ANTIMICROBIAL, ANTIOXIDANT, AND MECHANICAL PROPERTIES

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LITERATURE REVIEW

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ABSTRACT

NANO-CELLULOSE FOR ACTIVE FOOD PACKAGING: CHARACTERISATION, ANTIMICROBIAL, ANTIOXIDANT, AND MECHANICAL PROPERTIES

Due to environmental demands for better solid waste management, the demand for the use of biopolymers in the manufacturing of food packaging materials has stopped to increase, and research is thus underway to produce alternative ecologically acceptable packaging materials. Biopolymers, in contrast to commercial packaging currently in use, have poor thermo-mechanical and barrier properties. Controlling and altering the physicochemical properties of biopolymers used in food packaging is critical for the material's performance. Growing environmental concern has sparked interest in biodegradable polymer composites made from renewable sources such as cellulose and its derivatives. The usage of nanocellulose is a cutting-edge food packaging trend. The incorporation of cellulose nanocrystals (CNCs) and cellulose nanofibrils (CNFs) into biopolymers is also appealing for the production of strong nanocomposites, as it may give additional value materials with higher performance and a wide range of applications for next-generation biodegradable materials. This study provides an overview of the state of nanocellulose materials in active food packaging applications. Specific emphasis is given to antimicrobial and antioxidant packaging systems. Furthermore, the characterization, mechanical characteristics, antimicrobial activity, and morphological examination of nanocellulose materials are thoroughly discussed. For example, the FTIR results of nanocellulose extracted from sugarcane bagasse show improvement in chemical structures and exclusion of non-cellulosic constituents. The SEM results revealed a smooth fractured surface indicating strong interface adhesion between the LNP and PLA matrix. Tensile test are also carried out about the synergic effect of cellulose and lignin nanostructures in polylactic acid (PLA) based systems for food antibacterial packaging. According to the findings, ternary nanocomposites exhibited greater strength and modulus values than PLA and PLA binary systems. Antimicrobial-function nanocomposite are also discovered to reduce the growth contaminating microorganisms that persist after post-processing, prolonging food shelf-life, and improving food protection. Finally, a composite film show excellent antioxidant activity by incorporating carboxymethyl cellulose-based antioxidant and antimicrobial active packaging film with curcumin and zinc oxide. Hence, it was suggested that these nanocellulose materials could be used as promising materials for active food packaging applications.

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