CHAPTER 6

Chitosan-based bionanocomposites: Synthesis, properties, and applications

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6.1 Introduction

Bionanocomposites are a hybrid material originating from biopolymers and other inorganic solids containing at least one dimension on the nanometer scale (1–100 nm). While nano-sized inorganic fillers are added, biopolymers changes and improve their characteristics. Bionanocomposites are gaining popularity worldwide for being cost-effective, eco-friendly, biodegradable, and simple to make. Bionanocomposites made from chitosan are nontoxic and possess a strong affinity for proteins. Because of their remarkable biological activity, biocompatibility, biodegradability, and nontoxicity these bionanocomposites have achieved tremendous appeal in the bioscience research areas. Bionanocomposites are broadly used as antimicrobial packing materials, medicinal aids, culinary additives, and functional coatings. Moreover, they have been successfully employed in the textile and agro-industries [1], wound dressings [2], wastewater treatment [3], and tissue engineering [4].

Chitosan has been studied for numerous purposes in the industrial, environmental, and biomedical fields because it has advantageous diverse properties. However, the polymer exhibits poor moisture barrier properties and hampered mechanical stability, which poses a hindrance to nearly each of its uses. A large number of approaches have also been implemented to boost the physicochemical characteristics of chitosan, including chemical/enzymatic modification, copolymerization, and incorporation of nanomaterials in chitosan to generate nanocomposites with enhanced mechanical properties and controlled biocompatibility. According to researchers, these nanocomposites exhibit better chemical and physical properties with a substantial surface-to-volume ratio, improved optical clarity and stability, and reduced moisture permeability. Characteristics like film-forming ability and dimensional variability provide benefits to these polymer-based

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