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BOOK OF ABSTRACT

Transglutaminase-Crosslinked Protein Films Reinforced by Mesoporous Silica Nanoparticles

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The environmental impact of plastic wastes is escalating rising widespread global concern since disposal systems are inadequate. Therefore, it is crucial to find enduring plastic alternatives, especially in short-term food packaging and disposable applications. One possible solution is the production of bio-based (polysaccharide and/or protein-derived) biodegradable/edible materials. The major limit of hydrocolloid films in food packaging is their relatively poor mechanical and barrier properties which currently hinder their industrial use. The advancement of nanotechnology has boosted interest to new types of composites in which the filler has at least one dimension smaller than 100 nm (nanocomposites). These innovative biomaterials exhibit generally increased mechanical and barrier properties, as well as improved heat resistance compared to their neat polymers and conventional composites. We suggest here a new strategy to produce nano-reinforced biomaterials by using as polymer matrix protein mixture extracted from bitter vetch (BV) seeds and as filler the mesoporous silica nanoparticles (MSN) functionalized or not with (3-aminopropyl)-triethoxysilane (APTES). To improve the structural network, the nanoparticle containing film forming solution was incubated in the presence of transglutaminase (TG), a protein crosslinking enzyme. The obtained results showed that all the BV protein films reinforced with MSN or MSN-APTES showed improved mechanical and barrier properties to both gases and water vapor, and that TG addition further reduced film permeability values to the ones of the well known and widely commercialized starch-based MaterBi bioplastics.

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