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TOPIC(s) : Polymers or composites

Clay-added ? and ?-chitosan-based films for agricultural applications ? Conception, characterization of Physicochemical properties and behavior towards fungi and bacteria

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PURPOSE OF THE ABSTRACT

Conventional polymeric films are widely used for food packaging as they prevent foods from spoilage and extend their shelf-life. However, as petroleum-based products, these types of films resist biodegradation. The widespread distribution and accumulation of these products in the environment have become a matter of a great concern [1]. Therefore, much attention has been paid to the synthesis of eco-friendly films with good performance [2-4].

Chitosan, which is a chitin-derivative biopolymer, is a convenient natural material for the preparation of thin, edible, biodegradable and antibacterial films [5]. It is a copolymer composed of glucosamine and N-acetylglucosamine units, and it exists in three allomorphic forms: alpha, beta and gamma. As compared to the beta form, the alpha-chitosan is most abundant and consists of antiparallel chain orientation with strong inter- and intramolecular bonds [6,7].

Studies dealing with the physical/mechanical properties of chitosan-based films have been mostly performed on alpha-chitosan films containing one nano-dimension filler, e.g., montmorillonite. The incorporation of limited amounts of montmorillonite (chemical formula: Mx(Al4-x,Mgx)2Si8O20(OH)4, M is a charge compensating cation, and $0.5 < x < 1.3$) to chitosan-based films improves their barrier ability and enhances mechanical properties [7].

However, much less attention has been paid to the study of the beta-chitosan films and to the effects of the incorporation of two or three nano-dimension fillers, such as palygorskite (natural hydrated magnesium aluminum silicate Si8Mg5O20(OH)2(H2O)4.4H2O) and geopolymer. It must be noticed that palygorskite and montmorillonite are naturally occurring non-harmful minerals.

The first aim of this work was to study the effects of the additions of montmorillonite, palygorskite and geopolymer-containing material (GCM, synthesized aluminosilicate material derived from kaolinite and presenting a polymeric structure [8]) on the performance of the alpha- and beta-chitosan-based films. For these purposes, the main physical and mechanical properties of films were followed as function of filler additions, and the

microstructure of the films was also investigated (Figure 1) [9]. On a second time, the antimicrobial activity of the chitosan-based films on soil bacteria (Pseudomonas fluorescens and Brevibacillus brevis) and fungi (Aspergillus niger and Fusarium oxysporum) was tested in vitro, as well as the degradation of the films by these microorganisms. These experiments provide information on the possibility of using these films to cover soils in crops.

FIGURES

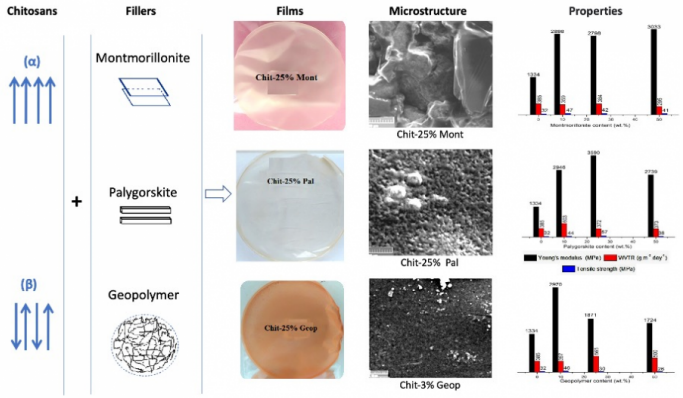

FIGURE 1

FIGURE 2

Figure 1.

Chitosan-clay-based materials and related properties

KEYWORDS

Chitosan-clay films | physicochemical properties | antibacteral behavior | antifungal behavior

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