STRUCTURAL AND FUNCTIONAL PROPERTIES OF GELATIN-CLAY NANOCOMPOSITES

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Polymer-clay nanocomposites are a well known class of hybrid materials with enhanced functional and structural properties[1]. In particular bio-nanocomposites, which result from the interactions of biopolymers and inorganic solids with dimensions in the nanometric scale, are receiving increasing attention due to their potential as ecological, biocompatible and economically viable high performance materials[2-4].

Gelatin, which exhibits a transition temperature between coiled coil conformation and triple helix around 37 ºC, is a widely used biocompatible polymer whose molecular structure resembles that of collagen. Although the main uses of this polypeptide regard textural modification in the food industry, it has recently been subject of research to develop materials that present enhanced structural properties. This approach consists on the reinforcement of the polymeric matrix with layered expandable silicates such as montmorillonite to obtain gelatin-clay nanocomposites with improved tensile properties[5].

The present work reports the use layered silicates montmorillonite and vermiculite, fibrous clay sepiolite, and a layered double hydroxide ([Zn2Al(OH)6]Cl·nH2O) to develop functional and structural nanocomposites and micro-composites. Although gelatin could be intercalated into the layered solids through interactions at the nanometric scale, only montmorillonite displays clear evidence of this feature. Also sepiolite shows high affinity towards the gelatin matrix, originating homogeneous films similar to those obtained with montmorillonite. The Young's modulus of gelatin-sepiolite nanocomposites was increased by a factor of 2.5 with respect to neat gelatin without severe loss of elongation at break. The incorporation of methyl red pH indicator dye into the montmorillonite galleries, allowed the formation of an optical pH sensing nanocomposite film.

Results confirm sepiolite and montmorillonite as high performance fillers in gelatin nanocomposite films, enhancing structural and functional properties respectively.

References:

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[5] Darder, M., Ruiz, A.I., Aranda, P., Van Damme, H., and Ruiz-Hitzky, E., Current Nanoscience, **2**, 3 (2006) 231-241.

Figures:

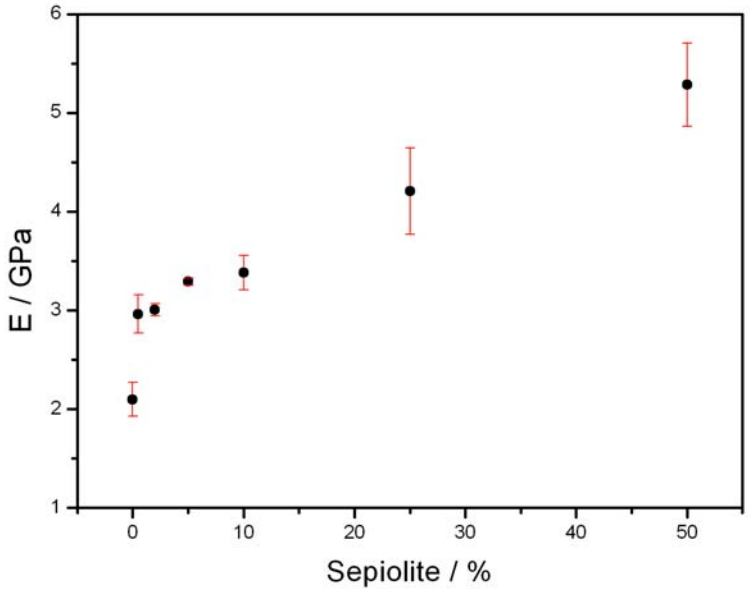

Figure 1 – Young's modulus of the gelatin-sepiolite nanocomposite as a function of clay content.

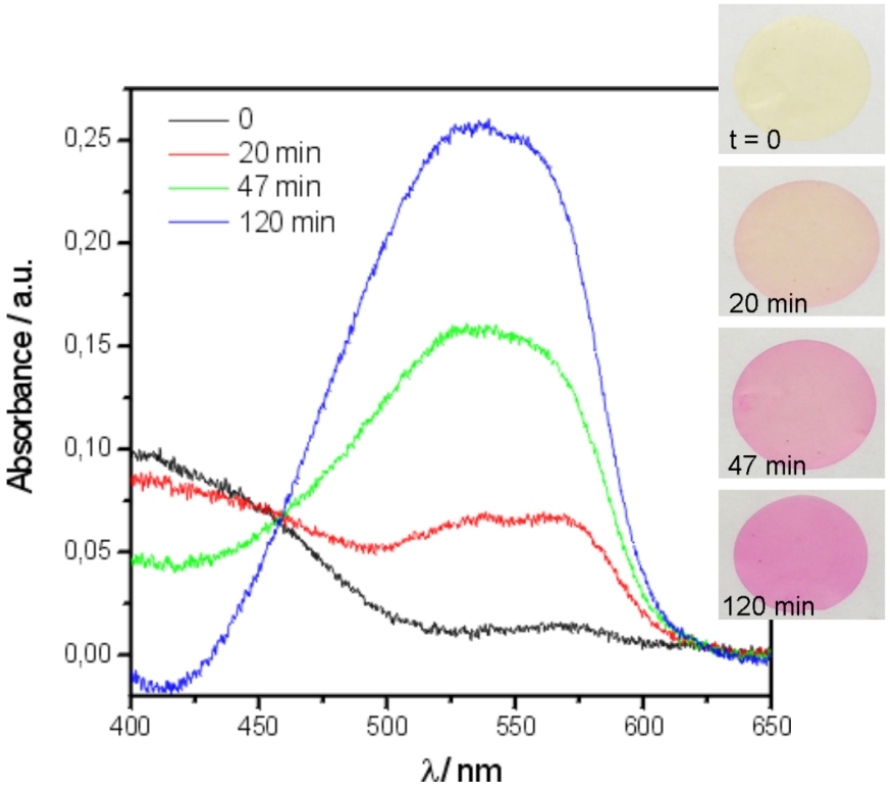

Figure 2 – Self-supported hybrid films of gelatin incorporating 50% of methyl red intercalated montmorillonite for optical pH sensing. Absorbance spectra and photographs at different time periods under acidic atmosphere.