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Chitosan/Organophillic Clay Nanocomposites for Remediation: Synthesis and Characterization

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Abstract – Chitosan is a heteropolysaccharide and one of the most promising polymers for use in the production of nanocomposites. Organophilic clays have large number of applications in various technology areas and have being widely studied in the adsorption and retention pollutants. This work describes the preparation of organoclays and the synthesis and characterization of thin films composed by chitosan/organoclays. Initial results point out the interesting potential of these thin films for application in remediation of polluted environments.

Chitosan is a heteropolysaccharide composed predominantly of residues by β-1,4-D-glucosamine, that presents high biocompatility, biodegradability, nontoxicity, and widely available in nature. Due to these aspects, chitosan is one of the most promising polymers for use in the production of nanocomposites. Chitosan acid solutions when subjected to evaporation of the solvent or by precipitation are capable of forming biomaterials with different forms such as microspheres, membranes and capsules [1,2]. Clays are composed of tiny crystals platelets with a length of 0.5-1.0μm [3]. Despite their original highly hydrophilic nature, after a proper chemical treatment, clays can become organophilic with the introduction of organic molecules between the lamellae. Aiming nanocomposites manufacturing, these clay minerals are preferably used due to small size of crystals and the high cation exchange capacity (CEC) that causes the reactions of intercalation. Organophilic clays have large number of applications in several technology fields and have being widely studied for the adsorption and retention of industrial and hazardous waste. Besides this, they can also be used to treat contaminated water and effluent treatment [4,5].

Therefore, the objective of this work is the fabrication and characterization of thin films composed by chitosan 2% (w/v) dissolved in acetic acid 1% (v/v) and organoclays in concentrations of 1.0, 0.75, 0.5 and 0.25% (w/v) for application in remediation of waste and pollutants. Samples were evaluated concerning their swelling behavior in some pollutants such as gasoline, alcohol, chloroform, benzene, ethyl acetate and toluene. Mechanical tests, Infra-Red (FTIR), X-Ray diffraction (XRD), Dynamical Scanning Calorimetric (DSC) and Thermogravimetric Analyses (TGA) were also carried out.

Preliminary X-ray diffraction results pointed out the successful preparation of organo clays. Furthermore, it is possible to observe that the organophilic clays used presented a good capacity to remove the pollutants tested. Despite of the uniform distribution and dispersion of the clay particles on the polymeric matrix, a decrease on the films mechanical strength was also observed. These initial results indicate the great potential of these thin films for application in remediation of polluted environments.

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