BIONANOCOMPOSITES BASED ON NATURAL POLYMERS AND NANOCLAYS. AN EXTENDED PHYSICO-CHEMICAL STUDY TO EVIDENCE THE ROLE OF THE POLYMER NATURE AND THE NANOCLAY SHAPE

GIUSEPPE CAVALLARO, GIUSEPPE LAZZARA, STEFANIA MILIOTO*

Department of Chemistry "S. Cannizzaro" University of Palermo, Palermo, 90128, Italy
milioto@unipa.it

This study was developed along the idea that the combination of biopolymers, derived from renewable resources, and nanofillers, environmentally friendly, may form a new family of hybrid materials at low cost, namely bionanocomposites, with excellent and unique properties. To this aim, as polymeric matrices were selected two pectins (with different degrees of methyl esterification) and hydroxypropyl cellulose; as fillers two nanoclays with dissimilar shape were chosen, i.e. halloysite (nanotubes) and laponite RD (nanodisks). The casting method was used for the nanocomposites preparation. A very good compatibility between the biopolymer and the nanoclay allowed us to obtain a good dispersion of the filler into the polymeric matrix. These systems were studied in both the aqueous and the solid state from the physico-chemical view-point in dependence of the composition of both components. The thermodynamic studies (Isothermal Titration Calorimetry, Differential Scanning Calorimetry and densitometry) and the structural (Dynamic Light Scattering) characterizations on the aqueous mixtures were able to discriminate the interactions, which control the adsorption of the biopolymer onto the solid substrate. The gained insights were useful to interpret the microscopic structure of the nanocomposites highlighted by scanning electron microscopy, optical transparency and percolation theory. Moreover, the dynamic mechanical analysis allowed us to determine the tensile and the rheological properties. The surface features were explored through the contact angle measurements while the thermal stability through the thermogravimetric experiments. The attained fundamental knowledge represents a solid basic point for designing new hybrid nanostructures for specific purposes

Keywords: surface properties, tensile properties, thermal stability