

Production of Cellulose Nanowhiskers from Red Algae Waste and Its Application in Polymer Composite Development

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Abstract : The red algae are available enormously around the world and their exploitation for the production of agar product has become as an important industry in recent years. However, this industrial processing of red algae generated a large quantity of solid fibrous wastes, which constitute a source of a serious environmental problem. For this reason, the exploitation of this solid waste would help to i) produce new value-added materials and ii) to improve waste disposal from environment. In fact, this solid waste can be fully utilized for the production of cellulose microfibers and nanocrystals because it consists of large amount of cellulose component. For this purpose, the red algae waste was chemically treated via alkali, bleaching and acid hydrolysis treatments with controlled conditions, in order to obtain pure cellulose microfibers and cellulose nanocrystals. The raw product and the as-extracted cellulosic materials were successively characterized using several analysis techniques, including elemental analysis, X-ray diffraction, thermogravimetric analysis, infrared spectroscopy and transmission electron microscopy. As an application, the as extracted cellulose nanocrystals were used as nanofillers for the production of polymer-based composite films with improved thermal and tensile properties. In these composite materials, the adhesion properties and the large number of functional groups that are presented in the CNC's surface and the macromolecular chains of the polymer matrix are exploited to improve the interfacial interactions between the both phases, improving the final properties. Consequently, the high performances of these composite materials can be expected to have potential in packaging material applications.

Keywords : cellulose nanowhiskers, food packaging, polymer composites, red algae waste

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