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Development of Nanocomposite Materials Based on Chitosan and Cellulose as Edible Packaging.

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PURPOSE OF THE ABSTRACT

"Development of Nanocomposite Materials Based on Chitosan and Cellulose as Edible Packaging"

Edible packaging are attracting more intention in recent years, since healthy and sustainable food become an important aspect in order to fulfil consumer demand. Utilization of materials which are originated from natural resources appears prefeerably due to their inherent biodegradability. Various biopolymers have been explored to reduce the use of non-degradable petroleum-based materials such as cellulose, chitosan, starch, collagen, pectin, etc. However, problems of strong hydrophilic character, high degradation, and inadequate mechanical properties in moist environments still limit the applications of biopolymers [1]. To become more applicable in practice, biopolymers have to be modified in terms of properties and functionalities . In food packaging applications, for instance, the incorporation of reinforcement fillers into the biopolymers matrix has shown to be an efficient strategy to overcome some critical issues such as low mechanical resistance, hydrophilicity, and poor barrier to water vapor compared to those of pure polymer or conventional (microscale) composites [2,3]. More importantly, the process is less expensive compared to the development of new synthetic polymeric materials.
In this line of research, the use of cellulose and chitosan as biodegradable material to create edible packaging is an increasing subject of studies. Cellulose is the most abundant renewable biopolymer produced in the biosphere, and is obtained mainly from vegetables (plants and some algae species) and microbes (bacteria). It is a fibrous, tough, water-insoluble biomaterial, which can play a substantial role in blending with different biopolymers to produce various bio-based composites[4,5,6]. On the other hand chitosan, a natural polysaccharide prepared by N-deacetylation of chitin, has great potential as a biomaterial in part due to its antibacterial properties that, can conveniently enhance protection against fruit or vegetable rottenness. Several works have been conducted on the preparation of composite combining cellulose and chitosan and it was shown that the properties of the composites are greatly enhanced when using biopolymer at the nanoscale. Indeed, nanocomposites represent an alternative to conventional technologies for improving biopolymer properties, by adding nanoparticles for which at least one dimension is in the nanometer range[7,8,9].

Here we therefore would like to present our work on the preparation of edible film through combination of nanocellulose and nanochitosan. In a first part we will present our newly developed approach to produce nanocellusose from bacterial cellulose obtained from nata de coco. A simple and an eco-friendly methodology was implemented to produce small needles of (164.51 ± 7.56) nm in length and (25.05 ± 2.80) nm diameter that can form fibrillated structures. The process is based on a sequential two steps protocol (1) partial depolymerization of bacterial cellulose under ultrasonic conditions; (2) extraction of crystalline regions by treatment with diluted HCl catalyzed by metal chlorides ($MnCl_2$ and $FeCl_3.6H_2O$) under microwave irradiation.
In a second part combining high speed homogenisation and ultrasonic treatment nanocomposite (nanocellulose and nanochitosan) solution were prepared to produce edible films by simple evaporation. First results of capability of nanocomposite film to resist water vapour and the material characterization will be presented. Finally the film ability to protect strawberry from rotting will be studied.

FIGURES

FIGURE 1
Solution
Solution nanocomposite

FIGURE 2
FILM
Nanocomposite Film

KEYWORDS
Edible Packaging | Nanocomposite | Water Resistance

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