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Editorial

Applications of Pectin: A Multipurpose Biomolecule

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Editorial

In recent decades it was observed a great interest in obtaining new composite materials which have attractive and well adapted functionalities to different technological applications when compared with its components separately, such as improvement in mechanical, thermal, permeation, optical and chemical properties and resistance to wet ability by solvents [1,2]. In this context, the production of new high added value materials from sustainable, renewable and abundant sources is not only strategic from technological and economics points of view, but also from an environmental perspective. These biomaterials are a great alternative in decreasing the production of materials from non-renewable sources (fossil fuel reserves), solving problems caused by the emission of pollutants into the environment. Cellulose, starch, chitin, soy protein, corn proteins and pectin are typical examples of renewable biodegradable polymeric matrices that have attracted research investments by scientific and productive sectors.

Most countries, including the United States of America, import pectin mainly from Europe and Central and South America, in which Brazil figures as one of the world leaders in pectin production. Nevertheless, it is estimated that the orange juice production generates approximately 10 million tons of residue rich in pectin per year and only a small portion is utilized as animal feed [3].

Pectin's are glycosidic macromolecules with high molecular weight (ranging from 25 to 360 kDa), which are composed primarily of D-galacturonic acid units linked by α-1,4 bonds, partially esterified by methyl ester groups. The main commercial extraction sources of this biopolymer are apple pomace and citrus peels, which are by-products from juice industry [4,5]. The orange peel pectin has a high degree of methoxyl groups and hence, a high gelling power in an aqueous medium due to the presence of polar groups that interact strongly with water molecules, producing viscoelastic solutions. Due to its rheological properties and null toxicity, pectin is widely used in the food industry as stabilizers, thickeners, texturizers and emulsifiers [5].

Pectin is also a very promising biopolymer due to its gelling and film formation properties, biocompatibility and non-toxicity, and it can be used as packaging and edible coatings for food protection [6]. Biodegradable porous aerogels composed of pectin and clay with overall mechanical properties similar to those of rigid polyurethane foams were previously obtained. The increased mechanical strength of the aerogel by incorporating the clay makes them promising materials for various engineering applications [7]. In a nobler application, pectin can be used as carriers for controlled drug release. Furthermore, it is possible to modify chemically pectin to improve some of its properties for various specific applications [8].

Pectin and clay have also been used with carboxymethylcellulose to make edible nanocomposite films. In this case, the incorporation of clay reduced permeability to water vapour in 333% and increased the tensile strength of these films [9]. Hybrid films with good thermal stability and mechanical properties similar to many traditional plastics were also obtained from pectin and two different clays (laponite and hallosyte) [10]. The work of Zerrin et al. also demonstrated that the nanobiocomposite film with pectin, starch and clay showed remarkable elasticity and barrier properties compared with Low-Density Polyethylene Film (LDPE) and may be applied as food packaging [11]. It is also possible incorporate antioxidant and natural antimicrobial additives, such as carvacrol or cinnamaldehyde [12] and lime essential oil [13] to prepare active edible films with those properties.

Several drugs can be efficiently incorporated in pectin formulations by simple processes [14,15]. Pectin derivatives with higher charge density are capable of penetrating deeply into tissue, prolonging the residual time of drug incorporation, thus enhancing its penetration. Gels compounds of zein and pectin are able to release one or a combination of several drugs to a particular gastrointestinal segment in specific intervals of time. Thus, pectin formulations appear to be important potential carrier systems for controlled drug release [16].

In addition to applications above mentioned, new materials based on pectin macromolecules have been studied for different purposes, such as, the use of pectin in the removal and separation of heavy metals and antimicrobial activity [17], removal of dyes in an aqueous medium [18], formulation of nanocomposite films with electrical and magnetic properties [19], biomaterials composed with hydroxyapatite for potential application in the biomedical field [20], hybrid aerogels containing silica particles with interesting mechanical and wet ability properties [21], nanocomposites containing pectin and clay for use as adsorbents [22].

With a view to developing innovative materials using pectin, electrospinning [23] and spray-drying [24] techniques have been used to obtain biodegradable polymeric nanocomposites. Another strategy that can be intensely exploited for obtaining new high performance materials is the acquisition of nanocomposites formed by pectin and cellulose nanowhiskers or nanocellulose. These nanocomposites are quite appropriated in formulations of new products with unprecedented mechanical, thermal, optical and permeability properties. Thus, despite the pectin is widely studied, new ways to

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obtain biomaterials formed by this macromolecule remain to be explored in order to use them in innovative applications.

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