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PRODUCTION OF PECTIN FROM CITRUS WASTES

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Abstract
Pectin is a biocompatible polysaccharide with intrinsic biological activity, which may exhibit different structures depending on its source or extraction method. The extraction of pectin from various industrial by-products presents itself as a green option for the valorization of agro-industrial residues by producing a high commercial value product. Pectin is susceptible to physical, chemical, and/or enzymatic changes. The numerous functional groups present in its structure can stimulate different functionalities, and certain modifications can enable pectin for countless applications in food, agriculture, drugs, and biomedicine. It is currently a trend to use pectin to produce edible coating to protect foodstuff, antimicrobial bio-based films, nanoparticles, healing agents, and cancer treatment. Advances in methodology, use of different sources of extraction, and knowledge about structural modification have significantly expanded the properties, yields, and applications of this polysaccharide. Recently, structurally modified pectin has shown better functional properties and bioactivities than the native one. In addition, pectin can be used in conjunction with a wide variety of biopolymers with differentiated properties and specific functionalities. In this context, this review presents the structural characteristics and properties of pectin and information on the modification of this polysaccharide, its respective applications, perspectives, and future challenges.
Key words: pectin, extraction, polysaccharide

The development strategy of the chemical industry in recent years is aimed at maximizing the use of domestic raw materials, meeting the urgent needs for chemical products in other sectors of the economy, expanding the export potential of the industry, and sustainable development of agriculture.

At the same time, special attention is paid to expanding the production of mineral fertilizers, which is associated with the presence of a raw material base, the high capacity of the domestic market in this type of product, and increasing the efficiency of agricultural production.

In our country one of the developing industry is agricultural industry. Citrus fruits are also produced in our country. As we know citrus fruits contains a lot of vitamins and bioactive compounds. Pectin is also can be produced from citrus fruits. Pectin is a heteropolysaccharide, a structural polymer contained in the primary lamella, in the middle lamella, and in the cell walls of terrestrial plants. The principal chemical component of pectin is galacturonic acid (a sugar acid derived from galactose) which was isolated and described by Henri Braconnot in 1825. Commercially produced pectin is a white-to-light-brown powder, produced from citrus fruits for use as an edible gelling agent, especially in jams and jellies, dessert fillings, medications, and sweets; as a food stabiliser in fruit juices and milk drinks, and as a source of dietary fiber [1].

Pectin is composed of complex polysaccharides that are present in the primary cell walls of a plant, and are abundant in the green parts of terrestrial plants. Pectin is the principal component of the middle lamella, where it binds cells. Pectin is deposited by exocytosis into the cell wall via vesicles produced in the Golgi apparatus. The amount, structure and chemical composition of pectin is different among plants, within a plant over time, and in various parts of a plant. Pectin is an important cell wall polysaccharide that allows primary cell wall extension and plant growth. During fruit ripening, pectin is broken down by the enzymes pectinase and pectinesterase, in which process the fruit becomes softer as the middle lamellae break down and cells become separated from each other. A similar process of cell separation caused by the breakdown of pectin occurs in the abscission zone of the petioles of deciduous plants at leaf fall.

On an industrial scale, pectin is extracted mainly from the citrus peel (85%), apple pomace (14%), and beetroot (1%). However, current studies report that pectin can be extracted from many by-products of the food industry, making it possible to value agro-industrial waste. Some of the by-products explored in recent years are passion fruit peel, mango peels, grape mare, jackfruit peels, kiwi peels, potato pulp, melon peels, watermelon peels, coffee pulp, cocoa shells.

Acid extraction and alcoholic precipitation are commonly used to obtain pectin on an industrial scale, which can be explained by its lack of operational complexity, despite the high energy and solvent costs. Acid extraction is usually based on the hydrolysis of protopectin at high temperatures. Many researchers have investigated the effects of different acid solvents and extraction conditions (pH, temperature, time, and solid:liquid ratio) in the extraction yield, structure, and physicochemical properties of pectin.
Most of the time, sulfuric, hydrochloric, or citric acids were used at high temperatures (60–90◦C) for extended periods (1–6 h), followed by alcoholic precipitation [2].

Pectin is generally used in the food industry as a gelling, thickening, stabilizing, and emulsifying agent. Pectin forms hydrogels and is therefore widely used in hydrated and viscous foods. Popular for use in jams, fruit juices, desserts, dairy products, and jellies, which is why the gelling properties of pectin are well known.

The use as a stabilizing agent in colloidal dispersions varies between emulsions, foods fortified with antioxidants, acidified milk drinks, and fruit drinks with high protein content [3].

Conclusion

In summary, pectin can be tailormade to generate new applications, as structural changes result in different functions and greater bioactivities. Still, it stands out that pectin can be extracted from the most varied sources, being the by-products of the food industry a green solution (due to the valorization of agro-industrial residues), which is associated with more environmentally friendly methods, allow a sustainable extraction and an environmentally friendlier product. Among the technologies described in this review, we can highlight the potential of power ultrasound technology in the degradation and oriented modification of pectin to obtain this polysaccharide with new bioactive structures and functions to be applied in the most varied areas.

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