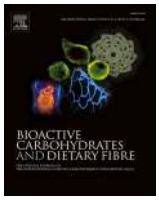
Bioactive Carbohydrates and Dietary Fibre 32 (2024) 100437

Contents lists available at ScienceDirect

Bioactive Carbohydrates and Dietary Fibre

journal homepage: www.elsevier.com/locate/bcdf



Innovative approaches to pectin processing: Enhancing techno-functional properties for applications in food and beyond

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ARTICLE INFO

Keywords:
Application
Functionality
Mechanism
Modification
Rheology
Stability

ABSTRACT

Pectin, a natural polysaccharide, has a great scope in food industries due to its valuable techno-functional characteristics including stabilization, gelation, and thickening and emulsification. To widen the applicability and address specific challenges associated with food formulations, there is a need to explore some promising techniques to further enhance its techno-functional properties. This review provides an overview of some novel approaches as well their combinations with other techniques to process pectin. Non-thermal techniques such as high-intensity ultrasound (HIU), high hydrostatic pressure processing (HHPP), pulsed electric field (PEF) are the commonly adopted which lead to pectin modification, promotion of enzymatic reactions and hence, improve weight distribution, gelation, emulsifying and rheological properties. Furthermore, use of combined HIU and Enzyme Systemhas emerged as a green and sustainable protocol which improves pectin solubilization and its better dispersion in food products. Apart from this, a controlled oxidation reaction known as Fenton system has been investigated for its scope in pectin modification either used individually or coupled with other methods. Thus, a deep insight of these techniques is need of hour to assist food processors in designing pectin based novel food products along with unlocking the primary factors to be considered and their optimization for future food developments.

1. Introduction

Pectin, a structural heteropolysaccharide, is commonly present in cell wall of terrestrial plants which consists of three groups of polysaccharides, namely pectin, cellulose, and hemicellulose.The complicated structure of pectincomprises around 65% α-1,4-D-galacturonic acid (GalA), <10%xylogalacturonan (XG), 25-30%rhamnogalacturonan I (RGI), and 3-8%rhamnogalacturonan II (RGII), connected with the 64%homogalacturonan (HG) skeleton (Fig. 1) (Ma et al., 2020). The ratio of the methyl-esterified GalA units to the overall number of GalA units in the HG skeleton shows the degree of esterification (DE) (Ngouémazong et al., 2015).On the basis of DE, pectins are divided into two categories, namely high-methoxyl (HM) (DE more than 50%) and low-methoxyl (LM) (DE less than 50%). HM pectins are able to form gel in acidic solutions (pH < 3.5) with a large number of soluble solids. Similarly, LM pectins are capable of forming gel over a broad range of pH values (2.0–6.0) in the presence of a suitable concentration of calcium ions or multivalent cations (Freitas et al., 2021; Wang et al., 2018). Due to capacity of this macromolecule to trap water, form hydrogel and a flexible network, it is one of the most commercialized biopolymers

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https://doi.org/10.1016/j.bcdf.2024.100437
Received 29 August 2023; Received in revised form 14 June 2024; Accepted 2 July 2024
Available online 3 July 2024