Application of microwave superheated water extraction of dietary fibres for valuation of food industry by-products

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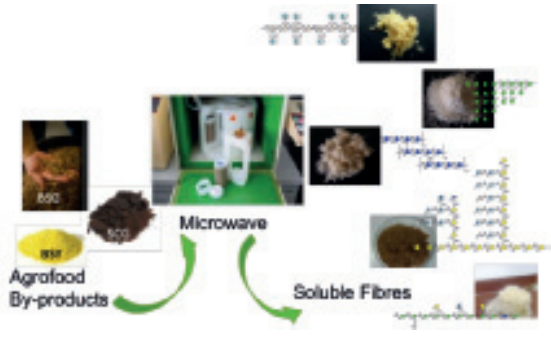
Microwave irradiation is becoming a feasible tool to extract dietary fibres from food industry by-products using only water or dilute aqueous solutions. Alternatively to the strong alkali treatments that have been applied, the use of microwave irradiation in closed vessels allows to achieve superheated water. Under these conditions, water soluble fibres can be obtained (Fig.1). The superheated water extraction can be applied to a wide range of by-products, allowing a distinct portfolio of soluble fibres. Spent coffee grounds (SCG), brewers' spent grain (BSG), and brewers' spent yeast (BSY) are three examples of available agrofood by-products, which can be used as raw materials for extraction of added-value polysaccharides for incorporation as dietary fibre into novel food industry formulations.

The short time of microwave irradiation (2-5 min) and the modulation of the operating conditions such as temperature and solid to water ratio, allow to obtain different fibres from different matrices: at 180ºC, BSG arabinoxylans, BSY mannoproteins, and SCG arabinogalactans are obtained, whereas BSY β-glucans and SCG galactomannans requires 200ºC. Furthermore, consecutive extraction cycles of extraction of SCG and BSG and/or different solid to water ratios allows to obtain different types of galactomannan and arabinoxylan structures, respectively.



Beyond the dietary fibre applications, these polysaccharide-based food ingredients present several other health-related properties such as prebiotic and immunostimulatory properties.

The methodology proposed, considering the extraction of fibres from SCG and BSG, was object of publication in three Elsevier Carbohydrate Polymers journal papers. One oral communication award for young scientists was received in a conference in Czech Republic (2011), and three best poster awards were received in conferences in Portugal (2009), Italy (2011), and India (2014).

In collaboration with ESTGA, at the University of Aveiro, the design of a prototype for continuous extraction is under way.

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FIGURE 1
Production of fibres from agrofood by-products using the microwave superheated water technology. Extraction of galactomannans and arabinogalactans from spent coffee grounds (SCG); arabinoxylans from brewers' spent grain (BSG); and β-glucans from brewers' spent yeast (BSY).