DEMETER ARTICLE

USE OF DIETARY FIBRE FROM POMACES OF SECOND CLASS VEGETABLES AS FOOD INGREDIENT

In the scope of reducing food waste at the production stage, INRAE, the National Research Institute for Agriculture, Food and Environment in France, contributes to the development of food and food ingredients within the DEMETER project, an ERA-NET research project of the FACCE SURPLUS Cofund. At INRAE SQPOV in Avignon, by-products of fresh vegetables produced by the Belgian company Verduyn are assessed for their ability to be processed in juices and soups using minimal processing performed by the Belgian company Juicy Group. In this way, small and broken carrots have been processed in juices and soups, broccoli stems and florets in juices and leek and cabbage in soups. All matrices, raw and processed ones, have been characterized for quality traits such as texture and rheology, colour, acidity, pH, fibre content, polyphenols and carotenoids contents and composition. The diversity of chosen vegetables provides soups and juices with interesting and diverse nutritional interests (antioxidants, fibres), each product bringing specific microconstituents or/and fibre contents. The microbiological safety of the processed products has also been evaluated. For instance, the shelf-life of soups made of second-class vegetables may be several weeks under refrigeration and without any preservatives.

At INRAE BIA in Nantes, the objective is adding value to fruit and vegetable pomaces by innovative conversion to dietary fibre, used as texturing food ingredients. Processing of fruit and vegetables for juice generates pomaces which are rich in high-value compounds that can be used for food and non-food applications. In fact, apple and orange pomaces are traditionally used as source of the gelling food additive, pectin. These by-products can be used as technological and nutritional food ingredients rich in

antioxidants and dietary fibres. Pectin-rich fruit and vegetable pomaces can also texture food products. Processes to increase pectin solubility in liquid foods, such as soup, sauce or juice while helping the recovery of other high-value compounds, such as antioxidants and pigments are explored within DEMETER. New "green" solvents called natural deep eutectic solvents (NADES) are tested with a biorefinery approach. These solvents are made of hydrogen bond donor (HBD) and acceptor (HBA) molecules that melt at lower temperatures when combined than when they are alone and remain liquid at room temperature. The molecules involved are natural, inexpensive, renewable, recyclable, non-toxic and biodegradable. The very high number of combinations between HBA and HBD makes it possible to adapt the solvent to the desired solute extraction, which today in plant food by-products mainly targets secondary metabolites. A great number of NADES are based on choline chloride as HBA and on urea, lactic acid, glycerol as HBD. Based on our previous research on NADES treatments of apple pomace, a combination of choline chloride: lactic acid and choline chloride: glycerol was tested to improve pectin solubility from pomaces produced by the Juicy Group. Pre-treatment of hydrated pomaces by these combined solvents allowed to produce dietary fibre rich ingredients that are going to be tested for texturing and organoleptic properties in model foods. Recycling of the solvent during the process allowed enrichment in secondary metabolites and its characteristics are being assessed. The process also opens the way to extract further NADES pre-treated pomaces to isolate or enrich fractions in other valuable compounds besides pectin, such as cellulose for food and non-food applications.

At INRAE SQPOV, we investigate the potential of dietary fibre rich ingredients extracted from pomaces for their ability to provide nutritional components and to modify the texture and particle stability of juices by using model solutions mimicking the real juices. During juice processing, polyphenols are adsorbed on fibres. Hence, when fibres are extracted from the pomaces, they also contain a significant quantity of associated polyphenols. Moreover, the presence of polyphenols associated with fibres may significantly affect the functional and physiological properties and health effects of both polyphenols and fibres. By controlling the concentrations and interactions between dietary fibre and also polyphenols in our solutions, we are able to quantify and classify the compounds of interest and the concentrations required to reach a significant impact like an improved nutritional quality of the juices or a better particle stability to avoid fast dephasing of the juices.

As such, dietary fibres from the fruit and vegetable pomaces can be used as food ingredient in different food applications. This will lead to a higher value valorisation of the pomace as food ingredient, compared to the current valorisation of the vegetable by-products as feed.

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