

High-value food ingredients from agri-food by-products and wastes: overview, strategies and prebiotic oligosaccharides as case study

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The extraction, isolation and characterization of bioactive and functional compounds from by-products and wastes recovered from many food chains is considered today a strategic aim in modern food and nutrition sciences. According with the “circular economy” concept, often strictly related to the development of bio-based “green” processes, a large number of by-products is an interesting source of new ingredients/molecules, addressed to functional foods and food supplements market, beside the pharmaceutical one. Pigments, antioxidants, fibers, within a potential unique role in nutrition and food technology, can be extracted, isolated and – following scale up - used. Unfortunately, some performing technical approaches and processes sometimes faces with some regulatory-related limits, leading to novel ingredients and novel foods (Regulation EU 2015/2283).

Within the extreme large portfolio of bioactive compounds useful as food ingredients with peculiar characteristics, prebiotic oligosaccharides (PO) from animal and plant sources represent an interesting case study in circular economy. PO from cow whey (fucose- and sialic acid-containing oligosaccharides, very similar to those contained in human milk) are a strategic tools to improve nutritional quality of milk formula or food for children, modulating the microbiota profile in humans [1]. Moreover, a large number of plant-derived oligosaccharides can be easily isolated from wastes and by-products (e.g. perisperm/hulls from roasted seeds; grape seed; wastes from vegetables processing) [2, 3].

This oral communication will concisely explore the field of the circular economy, specifically focusing in food and pharma areas, debating the gaps, the expectations and the challenge of the next future.

[1] Barile D., Tao N., Lebrilla C.B., Coisson J.D., Arlorio M., German J.B. (2009) Permeate from cheese whey ultrafiltration is a source of milk oligosaccharides. *International Dairy Journal*, 19, 524-530.

[2] Montella R., Coisson J.D., Travaglia F., Locatelli M., Bordiga M., Meyrand M., Barile D., Arlorio M. (2013). Identification and characterisation of water and alkali soluble oligosaccharides from hazelnut skin (*Corylus avellana* L.). *Food Chemistry*, 140, 717-725.

[3] Bordiga M., Meudec E., Williams P., Montella R., Travaglia F., Arlorio M., Coisson J.D., Doco T. (2019). The impact of distillation process on the chemical composition and potential prebiotic activity of different oligosaccharidic fractions extracted from grape seeds. *Food Chemistry*, 285, 423-430.