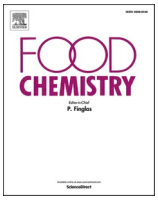
Food Chemistry 456 (2024) 140000

Contents lists available at ScienceDirect

Food Chemistry

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



Preface

Strategies for optimizing the molecular, structural, and functional properties of food bioactive components: Improving the stability and bioavailability of food-derived bioactives

ARTICLE INFO

Keywords
Dietary bioactive compounds
Food ingredients
Solubility
Stability
Functionality
Supramolecular chemistry

The design of novel or improved functional foods and beverages is an important driver of innovation in the food sector. Researching and sustaining these innovations is vital for meeting the expanding consumer demand for health-promoting foods. Bioactive food components are constituents of foods or dietary supplements that can exert beneficial effects on human health, beyond basic nutrition (Martirosyan & Miller, 2018). These extra-nutritional compounds occur naturally in a myriad of edible plants, fungi, algae, as well as animal products, and are characterized by the ability to interact with one or more components of certain living tissues and to promote health based on their bioactivity profiles. Examples of dietary bioactives include phenolic compounds, quinones, carotenoids, terpenes, sulfur compounds, phytosterols, omega-3 fatty acid, biopeptides, probiotics, along with some dietary fiber, vitamins and minerals. Mounting evidence suggests that their dietary intake is associated with a lower incidence of cardiovascular diseases, type 2 diabetes, neurodegenerative diseases, certain cancers and gastrointestinal disorders, among other chronic diseases, which is accelerating their use in novel food applications. However, there are significant hurdles to the effective incorporation of these biologically active substances in food and beverage products often due to poor solubility and stability. Manufacturers also face various challenges related to the unpleasant off-flavors associated with some bioactive compounds and their limited bioaccessibility in the gastrointestinal (GI) tract.

This special issue of Food Chemistry presents state-of-the-art research that investigates the effective incorporation and targeted delivery of food-derived bioactives, as well as the impact of food processing and food matrices on the bioactivity and bioavailability of dietary bioactives. It features new developments on subtopics of interest to food chemists, biochemists and technologists, including the extraction, preservation and characterization of naturally occurring bioactive compounds, as well as their effective incorporation into foods with desired quality and functional attributes. This special issue also presents novel insights into the changes in molecular structure, bioactivity and bioavailability of food bioactives that result from processing and interactions with food matrices or specific food components. Recent advances regarding the supramolecular strategies that effectively improve the stability and delivery of dietary bioactives are prominently featured too, together with advances in the assessment and enhancement of bioaccessibility/bioavailability.

Over 48 peer-reviewed papers have been published, including two timely review articles that examine the effects of microbial fermentation on the structure and bioactivity of polysaccharides in fermented plant-based foods (Liu et al., 2024), and the effectiveness of delivery systems designed to optimize the stability and suitability of lipophilic biofunctional ingredients in food processing (Lee, Kim, & Jang, 2024). The following examples further illustrate the range of studies included in this special issue. Chao Song et al. (2023) reported the fabrication and characterization of a novel plant-based antioxidant emulsifier prepared from young apple polyphenols and soy proteins. They concluded that these protein-polyphenol complexes could be used to nano-deliver functional oils and nutrients. Guo, Liu, Xiang, and Liang (2023) sought to improve the water solubility of red clover isoflavones by dispersing them in β-cyclodextrin. The resulting dispersion was more effective than the control in modifying the intestinal microbiota composition in mice, suggesting improved bioactivity and bioaccessibility of the isoflavones. For their part, Ma et al. (2023) demonstrated the effectiveness of a microbial fermentation method to modify the structure of soluble dietary fiber from grapefruit peel and to improve their biofunctional properties, including cholesterol adsorption capacity *in vitro*. In another study, piperine was found to play an important role in inhibiting the oxidation of myofibrillar protein and the formation of advanced glycation end products (Yu et al., 2023). Several reports, such as the findings presented by Chao Song et al. (2023), Zhou et al. (2024), Bai et al. (2024), and Xiang et al. (2024), expand the fundamental and

https://doi.org/10.1016/j.foodchem.2024.140000

Available online 6 June 2024

applied understanding of the interactions that mediate the biological activity of specific bioactive compounds (*e.g.*, polyphenols, chlorogenic acid, phycocyanin, biopeptides), as well as the potential mechanisms underlying their effects in health and disease prevention.

The guest editors are appreciative to the authors and reviewers for their invaluable contributions. We expect that this curated collection of papers will continue to draw attention from food scientists worldwide to gain a deeper understanding of the strategies that effectively improve the stability, functionality, and bioavailability of bioactive compounds with high potential as biofunctional food ingredients. The path forward calls for more research into the effects of real food products on the solubility, stability and bioavailability of bioactive compounds and their optimized delivery systems. Most of the evidence currently available comes from relatively simple model systems, with little or no evidence of bioaccessibility and bioefficacy in humans, which precludes many foods from being recognized as functional. Additional testing conducted in representative food products with robust *ex vivo* and *in vivo* models, including human clinical trials, is needed to demonstrate how food and meal characteristics impact the stability and pharmacokinetics of food bioactive compounds through mechanisms such as enhanced solubility, changes in GI physiology and microbiota, as well as interactions with nutrients or non-nutrient compounds. Further research in these areas will lay the ground for optimal pairing of specific bioactive compounds/systems with food vehicles. It will also provide evidence for optimal dosage in functional food products. Future research is also needed to develop standardized testing methods, building on those that streamline the development of "food for specific health use" (FOSHU) in Japan and recognizing that the effects of bioactives delivered through foods are expected to be moderate and largely preventive in nature. All in all, these prospective developments open exciting opportunities for the functionalization of dietary bioactives in applications that will benefit human health more broadly.

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