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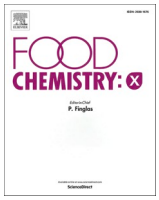

Preface

Recent advances in sustainable marine food utilization: Enhancing chemical, functional, and nutritional properties

The seafood industry is increasingly recognized as important for global food and nutritional security, providing approximately 178 million tons of fish annually from 2018 to 2020 (FAO, 2022) and comprising 17% of global animal protein and 7% of total protein intake (FAO, 2022). Seafood is rich in high-quality proteins, long-chain n-3 polyunsaturated fatty acids (LC n-3 PUFAs), particularly EPA and DHA, which are important for heart health, reducing inflammation, and supporting brain function (Wu, Forghani, et al., 2022; Zhang, Ahmmed, et al., 2024). Alongside traditional seafood, seaweed is emerging as a sustainable food resource, requiring no land, minimal freshwater, and significantly absorbs CO_2, which benefits the environment (Forster & Radulovich, 2015; Yong et al., 2022). Nutrient-rich in calcium, iodine, iron, vitamin B_{12} and C, LC n-3 PUFAs, phenolic compounds such as phlorotannins, and dietary fibers (Leandro et al., 2020; Shannon & Abu-Ghannam, 2019; Zhang et al., 2022), seaweed offers health benefits such as anti-inflammatory and antioxidant effects, and potential for the development of innovative food products (Shannon & Abu-Ghannam, 2019; Zhang, Ström, et al., 2023). However, the journey of marine foods from ocean to plate is complex and face multiple challenges that impact not only their quality but also environmental sustainability and nutritional security. The rapid perishability of seafood presents a primary challenge (Kontominas et al., 2021; Wu, Richards, & Undeland, 2022). This is mainly because of the high levels of unsaturated lipids, which are prone to oxidation (Zhang, Abdollahi, et al., 2023), as well as hemoglobin, a prooxidant (Wu, Tullberg, et al., 2022), and enzymes that accelerate spoilage (Ghaly et al., 2010). Microbial contamination poses another significant challenge, as seafood is frequently harvested from waters contaminated with pathogenic microorganisms or harmful algal blooms (Al-Busaidi et al., 2016). Underutilization represents another issue, with approximately 35% of global fisheries and aquaculture production being lost or wasted annually (FAO, 2022). Enhancing sustainable processing and utilization through methods such as life cycle assessments is crucial for developing eco-friendly marine food utilization (Coelho et al., 2022; Coelho et al., 2023; Ruiz-Salmón et al., 2021).

This special issue "Impact of Seafood Industry on Chemical, Functional and Nutritional properties: Chemical Utilization of Seafood and its Products" comprises articles on fish, shellfish, and seaweed. It explores processing effects, functionality, and allergy assessments of seafood-derived components, aiming to deepen understanding of marine foods through innovative research and promote sustainable utilization.

Seafood processing is the primary focus of this special issue. Dong et al. (2023) examined various stunning methods on the quality of large yellow croaker (*Larimichthys crocea*) fillets and found that methods such as gill cutting and ice/water slurry immersion reduced antioxidant activities, adversely affecting the gel properties of myofibrillar proteins and leading to increased water release. Conversely, methods like CO_2 narcosis preserved these qualities better. Xu et al. (2023) explored non-thermal processing, specifically the application of cold plasma (CP) on golden pompano (*Trachinotus ovatus*), demonstrating its effectiveness in reducing microbial counts and maintaining freshness. Zhang, Pan, et al. (2023) evaluated the effects of thermal processing techniques such as roasting, steaming, boiling, and microwaving on tilapia muscles, noting significant textural changes and distinct odor profiles determined through advanced analytical techniques. Zhang et al. (2022) found that soy protein isolate significantly enhances the quality of low-sodium surimi gels, improving texture and digestibility. Zhang, Ström, et al. (2023) demonstrated that phosphorylation with different phosphate salts improves the gel-forming properties of razor clam proteins, increasing their solubility and functional qualities. Sheng et al. (2024) revealed that plasma-activated lactic acid extends the shelf life of puffer fish fillets by inhibiting bacterial growth and maintaining quality during chilled storage. Research by Zhang, Hong, et al. (2024) on combining lingonberry press cake with herring co-products shows effective mitigation of lipid oxidation in fish protein isolates, promoting more sustainable food production. Chen, Tian, et al. (2023) explored how ultrasound-assisted high temperature-pressure treatment reduces the allergenicity of clam tropomyosin and enhances its digestibility, presenting a method to develop hypoallergenic seafood products. Collectively, these studies offer innovative solutions for enhancing seafood quality, safety, and sustainability.

Seafood-derived ingredients were also investigated. Li, Zhou, et al. (2023) explored the improved solubility and emulsifying properties of abalone foot muscle proteins hydrolyzed with different proteases, indicating their potential use in food production despite challenges with maintaining desirable sensory qualities. Han et al. (2024) successfully developed an emulsifier using cod fish skin collagen and ι-carrageenan through the Maillard reaction, significantly enhancing the stability and bioavailability of an Antarctic krill oil emulsion, which could serve as a functional food ingredient. Xu et al. (2024) identified a peptide from salmon bone that inhibits α-amylase by targeting its calcium-binding sites, showing promise for obesity treatment due to its effects on adipocyte differentiation and lipid metabolism. Huang et al. (2024) explored the encapsulation of zingerone using self-assembling peptides from fish viscera and found that encapsulation significantly enhanced the *in vitro* release and antiproliferative effects on Caco-2 colon epithelial cells. Additionally, Li, Zuo, et al. (2023) documented the immunostimulatory effects of a complex fucoidan from *Sargassum zhangii*, which notably increased nitric oxide production in macrophages,

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presenting a potential for enhancing immune function. These findings show the versatility of marine-derived ingredients in developing health-promoting food products and supplements.

Looking ahead, the future of seafood holds important potential for contributing to global nutritional security and environmental sustainability. Continued innovation in processing techniques and a deeper understanding of functional properties are important to unlocking this potential. Innovations such as advanced preservation methods and the development of new marine-derived nutraceuticals could significantly enhance the shelf-life and health benefits of seafood products. Additionally, expanding research into the efficient use of by-products and waste materials from the seafood industry could lead to more sustainable practices and reduce environmental impact. Future research should also focus on addressing regulatory challenges and ensuring that new technologies are accessible and economically viable for widespread implementation in the seafood industry (Wu et al., 2020; Wu et al., 2023; Zhang, Ahmmed, et al., 2024).

In conclusion, we believe this issue will serve as a crucial resource for researchers, educators, and industry professionals. It is a testament to our collective efforts to foster a more sustainable, health-conscious, and innovative approach to seafood utilization. We express our deepest gratitude to the authors, reviewers, editors, and the editorial office, as well as to everyone who has contributed to this special issue. Your contributions are instrumental in forging a path towards a sustainable and prosperous future for marine food research and the industry.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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