



Issue 50: November 2025: This e-bulletin is aimed at personnel in fisheries & aquaculture, at fish packers, processors, retailers, health professionals & finally, consumers.

Potential innovations for the seafood sector

SeaHealth-ucd has reached its 50th issue milestone and will continue with 3 to 4 issues per annum. This issue highlights three recent review papers on new developments with potential application in the seafood sector: (i) Use of soluble gas stabilization technology on food (Esmailian et al., 2021); (ii) Sustainable utilisation of fish proteins (Yuan et al., 2023) and (iii) Electrospinning: enhancing quality and ensuring safety of seafood products (Rahati et al., 2025).

Soluble gas stabilisation

Soluble gas stabilization (SGS) is a food processing technique where carbon dioxide (CO₂) is dissolved into a food product before packaging to extend its shelf life. This is a pre-step to modified atmosphere packaging that increases the concentration of CO₂ in the food matrix thus limiting microbial growth and other deteriorative processes. By dissolving the gas directly into the food, it becomes a more effective part of the packaging system, allowing for a higher degree of filling and preventing package collapse. However, the diffusion of CO₂ can be time-consuming thus slowing potential high-volume industrial applications. SGS contributes to packaging efficiency, lower distribution costs and less usage of plastic packaging materials through headspace reduction and other factors. Combining SGS treated fish with thermal (e.g. *sous vide*) and non-thermal (e.g. pulsed electric fields) technologies allows more gentle processing conditions with positive impact on product quality, safety and economic aspects. However, the extent of the effect depends on the type of product and its microbiota. Most of the R&D to date on SGS has been at laboratory level i.e. pre-industrial. However, a new project has been funded recently by the Norwegian Research Council aimed at up-scaling the technology.

Utilisation of fish proteins

Collagen, gelatine, protein hydrolysates, low molecular weight peptides and purified enzymes are among proteins found in fish by-products/waste. These proteins exhibit high bioactivity and functional properties with application in medical tissue engineering, health foods, food packaging and cosmetics. Novel extraction and purification processes such as supercritical extraction, steam explosion assistance, ultra-high pressure and cold plasma are central

to protein recovery and purification; combinations with fish enzymes pave the way for industrialisation (e.g. biorefinery) in an efficient and environmentally-friendly way. Key proteinaceous bio-actives of pharmaceutical/medical interest from fish waste include those with antioxidant, antihypertensive, anticancer, antimicrobial, and anti-inflammatory properties - - also calcium binding peptides and those promoting food digestion and absorption. Continued research on correlations between fish protein chemical structures and their anti-cancer activities is essential as are bioinformatic methods based on molecular docking which focus on the digestion and absorption of antioxidant peptides.

Electrospinning vs seafood quality & safety

Electrospinning involves a high-voltage power supply, a spinneret (needle), and a collector, with the electric field causing a feedstock (e.g. polymer solutions) to stretch into a jet that solidifies en-route to a collector thus forming nanofibres. These are ultrafine fibres with a diameter less than 100 nanometers with a very high surface area-to-volume ratio and other unique properties. Electrospun polymers used in seafood applications include gelatine, zein, polyvinyl alcohol, polycaprolactone, chitosan, and some plant-based proteins. The resulting nanofibers have controlled release properties and encapsulation capacity thus enabling the integration of antimicrobial, antioxidant, and sensing functionalities into a single matrix. Such matrices can: (i) be incorporated into packaging materials to generate smart and intelligent films/packages that sense product properties and safety, and (ii) applied to the surfaces of fish fillets to extend shelf life. For example, zein-based coatings with laurel extract reduced microbial growth by over 45 % and delayed lipid oxidation in rainbow trout thus extending shelf life. Future R&D should focus on nanofibre stability, biodegradable materials, regulatory compliance and industrial scale-up.

References:

*Esmailian, S. & 6 co-authors. 2021. The use of soluble gas stabilization technology on food – A review. *Trends in Food Science & Technology*, 118 (Part A), 154-166.

*Yuan, Z. & 3 co-authors. 2023. Sustainable utilization of proteins from fish processing by-products: Extraction, biological activities & applications. *Trends in Food Science & Technology*, 143(5):104276.

*Rahati, S. & 5 co-authors. 2025. Electrospinning: An emerging technology for enhancing the quality & ensuring the safety of seafood products – A comprehensive review. *Trends in Food Science & Technology*, 165:105350.

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