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Functional properties of fish roe hydrolysates produced by proteases

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Groper roe and salmon roe were hydrolyzed by three commercial proteases: Alcalase, protex 6L and neutrase, respectively, under their optimum pH and working temperatures for 90 minutes. The hydrolysates were produced with varied degrees of hydrolysis (10-40%), and then investigated for their physical and functional properties, including emulsion stability, solubility, antioxidant activity and anti-hypertensive effect. The hydrolysates from groper roe and salmon roe were firstly compared based on their water solubility and emulsifying capacity: The groper roe hydrolysates were much more hydrophilic than that from salmon roe; the water solubility of the latter is 75% lower than the former. Protex and neutrase hydrolysates from groper roe demonstrated full emulsion stability (100%) while the Alcalase hydrolysate from groper roe and all three hydrolysates from salmon roehad 55%-65%. The physical properties of the hydrolysates were also characterized via scanning electron microscope (SEM), circular dichroism (CD), and dynamic light scattering (Zetasizer) for structure imaging, protein secondary structure, particle sizes and electrostatic forces between molecules, and the changes of these properties under increasing temperature. The neutrase hydrolysate from groper roe displayed a distinctive fibrillar structure (long, linear and networked, rod-like shapes at 200-700 nm width). This fibrillar structure could explain the hydrolysates gelling ability when heated up to 85°C. In contrast, all the other hydrolysates were small, round, individual particles in 35-250 μm diameters without network connections, and none of these hydrolysates demonstrated the gelling property with increasing temperature up to 90°C. All hydrolysates from groper roe demonstrated antioxidant activities measured by DPPH assay at 5 mg/ml and above. The alcalase hydrolysates displayed increasing DPPH scavenging activity with increasing degree of hydrolysis, while the other two hydrolysates did not show this trend. The salmon roe hydrolysates didn't show convincing scavenging activity in any of the concentrations tested (0.1-10 mg/ml). Anti-hypertensive properties were measured via the angiotensin I converting enzyme (ACE) inhibition assay. All hydrolysates from both groper and salmon roe demonstrated ACE inhibition at the concentration of 1mg/ml. This inhibition appeared in the hydrolysate samples undergone 15 minutes' hydrolysis reaction (5-15% DH) and had only slight increase in samples undergone a 90 minutes hydrolysis (10-40% DH). At 1mg/ml, neutrase hydrolysate from groper roe has 100% inhibition, followed by alcalase hydrolysate (89%) and protex hydrolysate (55%). In salmon roe, both protex and neutrase hydrolysates demonstrated near 50% inhibition at 1mg/ml, while the alcalase hydrolysate only had 18%. In summary, the groper roe hydrolysates demonstrated better bioactivities and interesting physical properties in comparison to the salmon roe counterparts. As a low-value and abundant raw material from the fish industry, groper roe has the potential to be utilized (after enzymatic hydrolysis) as a food-grade functional ingredient in formulation applications.

Biography

Cynthia Q Sun obtained her PhD in 1999 jointly from the Chemistry Department and School of Biological Sciences at the University of Auckland, New Zealand. Her PhD research was about the bioactivity of hydrolysed milkfat catalyzed by lipases. Her interests in the discovery of functionalities in natural products after modification by enzymes continued after joining Callaghan Innovation. As a Senior Research Scientist, her recent research topics cover enzyme/protein purification, biotransformation of glycol-conjugates, post-harvest modification of natural products, and bioactive compound identification and extraction, all sharing a common goal - to develop novel and value-add ingredients from natural resources.

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