Comparison of foam stabilized by plant protein microgels

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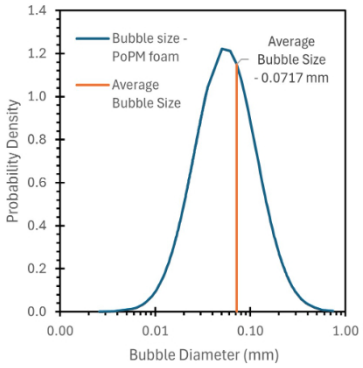
Protein microgels are soft, deformable colloidal particles that can adsorb strongly at fluid-fluid interfaces, offering a route to forming highly stable foams, stabilised via the Pickering-type mechanism, much more stable than those stabilised by plant protein isolates, for example. Microgel-stabilised foams exhibit substantially longer half-lives than isolate-stabilised foams across all protein sources, consistent with Pickering-type stabilisation [1].

In this work, microgels prepared from potato protein isolates are investigated as stabilisers of aqueous foams, with the ultimate objective to achieve sustainable dietary shifts by transitioning from animal to plant protein based food ingredients. Protein microgels were produced via thermal gelation of the protein (80 °C/ 30 min) followed by high pressure shearing.

Bulk rheological characterisation of the parent potato protein gels confirmed the formation of elastic protein networks [2], providing insights into the mechanical properties and deformability of the resulting microgels, which possessed a mean hydrodynamic diameter of 170 nm. Potato protein microgels were able to form stable foams, reaching at least 100% foam capacity. Image analysis of 1600 bubbles revealed an average bubble size of 72 μm, with approximately 80% of the number of bubbles < 100 μm in diameter and at least 5 % 'microbubbles' (diameters < 10 μm) indicating effective suppression of bubble coalescence and especially disproportionation.

These findings demonstrate that the microgel state of the protein, rather than the protein isolate itself, has a larger impact on foam stability. The formation of robust, particle-stabilised foams makes plant protein microgels a promising platform for the development of sustainable foams. Future research will focus on understanding the impact of these microgels on long-term stability of the foams and their other physical characteristics.



Probability density distribution of bubble diameters in potato microgel foam. The blue curve shows the measured size distribution, and the orange line indicates the mean diameter (71.7 μm). The distribution indicates a mostly fine and moderately polydisperse bubble structure.

References:

[1] Lee, J., & Duggan, E. (2022). Whey protein microgels for stabilisation of foams. International Dairy Journal, 132, 105399. https://doi.org/10.1016/j.idairyj.2022.105399

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