Mycoprotein as novel functional ingredient: mapping of functionality, composition and structure throughout the Quorn fermentation process

LONCHAMP J. (1), STEWART K. (2), MUNIALO C. (3), WILLOUGHBY N. (2), CLEGG P. (4), EUSTON S. (2)
1 Queen Margaret University, Edinburgh, United Kingdom
2 Heriot-Watt University, Edinburgh, United Kingdom
3 Coventry University, Coventry, United Kingdom
4 University of Edinburgh, Edinburgh, United Kingdom

The production of mycoprotein by Quorn Foods for use in their meat-replacer products offers a potential sustainable alternative to functional ingredients of animal origin. We previously showed that an extract from the Quorn fermentation co-product (centrate) displayed high foaming, emulsifying and rheological properties.

This current study characterised the functional profile of mycoprotein material throughout the whole fermentation process in relation to changes in its composition and structure at different processing steps. The different fermentation streams and their centrifugation deposits and supernatants were investigated: broth, RNA-reduced broth (following a heat-shock RNA-reduction process) and centrate (following a second heating step and centrifugation).

The broth, RNA-broth and their deposits showed high viscosities while their hydrogels displayed high viscoelasticities in comparison with a whey protein concentrate (WPC) control. The RNA-broth and centrate supernatants showed higher foaming ability and stability than WPC. Oil-in-water emulsions prepared with the broth or its supernatant displayed similar emulsifying activity, emulsifying stability and oil droplet size distribution to WPC.

Large hyphal structures were observed in the broth, RNA-broth and their deposits, which contributed to their high rheological properties, while small fungal fragments contributed to oil droplet stabilisation in emulsions prepared with these samples. A cerato-platanin was found in higher concentrations in the RNA-broth supernatant and centrate as a result of cell damage following the two heating steps and possibly contributed to their higher foaming properties. Proteomic and metabolomic analyses showed evidence of upregulation of the mRNA decay pathway following the two heating steps. As a result guanine and guanosine derivatives were reported in higher concentrations in RNA-broth and centrate samples and possibly contributed to their foaming, emulsifying and rheological properties.

This study highlighted the potential of mycoprotein material from different Quorn fermentation streams as novel functional ingredient and the possibility to modulate its structure and functional properties by heating.