Rheological investigation through 3D printed omega-3 rich analogue meat using grass pea and microalgae biomass

MOUSAVI M. (2), KIANI H. (1,2), AZIMI YOUSHANLOUEI Y. (1,2), HALIM R. (1)
1 University College Dublin, Dublin, Ireland
2 University of Tehran, Tehran, Iran

In this study, a 3D printed plant protein-based meat analogue was formulated using a blend of grass pea protein, starch, and microalgae cells. Protein concentrates from *Lathyrus Sativus* and *Lathyrus Rotundifolius* were extracted by an alkaline method and the chemical, rheological and functional properties of the proteins were investigated. *Nannochloropsis ocenica* was cultivated on nanofiltered acid whey permeate to form omega-3 rich cells. Then the microalgae cells and protein concentrate were used for the formulation of an ink for 3D printing. Meat analogue samples were printed using a 3D printer equipped with a syringe pump. The textured product was fabricated based on blends of 6 % protein, 14 % starch, and 1 % microalgae biomass by a heating-cooling cycle followed by 3D printing. Both grains provided high amounts of proteins with acceptable functional properties, i.e. 12 % gelation concentration and high sulphuric amino acid content. Rheological investigations revealed that the ink was Newtonian initially, while a gel structure was formed upon heating and cooling. *L. Sativus* exhibited higher viscosity values during gelation. Texture analysis of the printed product revealed that the hardness of the 3D printed product was decreased in comparison with the moulded gels. Incorporation of microalgae cells decreased the hardness significantly while the stickiness was increased. In conclusion, the application of grass pea protein in combination with microalgae biomass can be regarded promising for the formulation of 3D printed analogue meat.