

Menhaden fish oil encapsulation by spray drying process: influence of different biopolymer materials, inlet air temperature and emulsion ratios

Nurmaryam Aini Hashim^a, Siti Kholijah Abdul Mudalip^{a,b}, Rohaida Che Man^a and Siti Zubaidah Sulaiman^a*

^a Faculty of Chemical and Process Engineering Technology, Universiti Malaysia Pahang, Gambang, Malaysia

^b Centre for Research in Advanced Fluid and Processes, Universiti Malaysia Pahang, Gambang, Malaysia

ABSTRACT

Background: Incorporating fish oils into commonly consumed foods is an emerging technique for increasing the daily intake of omega-3 fatty acid. However, the high vulnerability of fish oil towards oxidative deterioration reduces shelf life stability. Microencapsulation by spray drying with different combinations of biopolymers and other parameters may provide a solution by preventing further oxidation of fish oil and permitting its delivery to food items. This study emphasised the influence of developed biopolymer materials (maltodextrin, maltodextrin + gum arabic, maltodextrin + starch, maltodextrin + whey protein isolates and maltodextrin + sodium caseinate) for emulsion formulation, inlet air temperature (160, 170, 180, 190 and 200 °C) and emulsion ratios (15, 20, 25, 30 and 35%) on the physicochemical properties of powdered menhaden fish oil by spray drying technique. **Results:** Microencapsulated menhaden fish oil was evaluated for its moisture content, size distribution, microcapsule efficiency, peroxide value, free fatty acid, acid value and morphological structure. It was observed that the coating materials of maltodextrin + whey protein isolates gave the lowest moisture content and peroxide value of 4.410% and 4.031 mEq kg⁻¹, respectively. The morphological images showed a smooth surface with no cracks and minimal shrinkage, indicating lower permeability to gases and effectively protecting the oil against deterioration. **Conclusion:** The spray drying procedure using maltodextrin + whey protein isolates at an inlet air temperature 190 °C and emulsion ratio of 30% successfully produced fish oil microcapsules with improved properties.

KEYWORDS

Menhadenfishoil; Spraydrying; Biopolymermaterials; Inletairtemperature; Emulsionratios

ACKNOWLEDGEMENTS

The authors appreciate the financial assistance through the Fundamental Research Grant Scheme FRGS/1/2019/K02/UMP/02/9 (Grant No. RDU1901134) from the Ministry of Education Malaysia and Postgraduate Research Grants Scheme (Grant No. PGRS2003180) awarded from Universiti Malaysia Pahang.