Effect of the drying process on the physicochemical characteristics and oxidative stability of microencapsulated amaranth oil

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In this paper, microencapsulation methods (spray drying and freeze drying) have been evaluated to estimate their influence on polyunsaturated fatty acids composition, tocopherol content and the shelf-life of amaranth oil. A commercial cold-pressed amaranth oil was used in the study. It was homogenized with the wall materials (maltodextrin, guar gum and whey protein concentrate) and after that spray dried at an inlet air temperature of 130°C (EAO 1) or freeze dried at -56°C (EAO 2).

Fatty acid composition of crude and encapsulated amaranth oils was determined by GC-MS and tocopherols by HPLC chromatography. The shelf-life of the microencapsulated oils was measured by the Rancimat test. The colour of encapsulated oils was measured using digital image analysis, and their microstructure and morphology were observed using a scanning electron microscope.

It was shown that the moisture content and the surface oil content of samples produced by different methods showed a significant difference ($p \leq 0.05$). Spray-dried microcapsules (EAO1) exhibited the highest microencapsulation efficiency (81.70%) when to compared to freeze dried samples (55.20%). In turn, freeze dried microcapsules (EAO2) had the highest surface oil content (12.87%) when compared to spray-dried (5.08%). The high surface oil content of freeze dried powder was related with the oxidative stability index. However, lower stability of EAO2 sample was not correlated with bioactive substance content. Amaranth oil microcapsules obtained by freeze drying were characterised by a higher content of tocopherols (47.67 mg/100g oil) and share of monounsaturated fatty acids (26.56%) when to compere to spray dried sample. In conclusion, the microencapsulation method had no strong effect on fatty acid composition and colour parameters but the tocopherols' profile changed significantly by spray drying.

Keywords: Encapsulation, Spray drying, Freeze drying, Fatty acid composition, Tocopherols, Amaranth oil