World Academy of Science, Engineering and Technology
International Journal of Nutrition and Food Engineering
Vol:12, No:08, 2018

Improvement of Oxidative Stability of Edible Oil by Microencapsulation Using Plant Proteins

Authors : L. Le Priol, A. Nesterenko, K. El Kirat, K. Saleh

Abstract : Introduction and objectives: Polyunsaturated fatty acids (PUFAs) omega-3 and omega-6 are widely recognized as being beneficial to the health and normal growth. Unfortunately, due to their highly unsaturated nature, these molecules are sensitive to oxidation and thermic degradation leading to the production of toxic compounds and unpleasant flavors and smells. Hence, it is necessary to find out a suitable way to protect them. Microencapsulation by spray-drying is a low-cost encapsulation technology and most commonly used in the food industry. Many compounds can be used as wall materials, but there is a growing interest in the use of biopolymers, such as proteins and polysaccharides, over the last years. The objective of this study is to increase the oxidative stability of sunflower oil by microencapsulation in plant protein matrices using spray-drying technique. Material and methods: Sunflower oil was used as a model substance for oxidable food oils. Proteins from brown rice, hemp, pea, soy and sunflower seeds were used as emulsifiers and microencapsulation wall materials. First, the proteins were solubilized in distilled water. Then, the emulsions were pre-homogenized using a high-speed homogenizer (Ultra-Turrax) and stabilized by using a high-pressure homogenizer (HHP). Drying of the emulsion was performed in a Mini Spray Dryer. The oxidative stability of the encapsulated oil was determined by performing accelerated oxidation tests with a Rancimat. The size of the microparticles was measured using a laser diffraction analyzer. The morphology of the spray-dried microparticles was acquired using environmental scanning microscopy. Results: Pure sunflower oil was used as a reference material. Its induction time was 9.5 ± 0.1 h. The microencapsulation of sunflower oil in pea and soy protein matrices significantly improved its oxidative stability with induction times of 21.3 ± 0.4 h and 12.5 ± 0.4 h respectively. The encapsulation with hemp proteins did not significantly change the oxidative stability of the encapsulated oil. Sunflower and brown rice proteins were ineffective materials for this application, with induction times of 7.2 ± 0.2 h and 7.0 ± 0.1 h respectively. The volume mean diameter of the microparticles formulated with soy and pea proteins were 8.9 ± 0.1 µm and 16.3 ± 1.2 µm respectively. The values for hemp, sunflower and brown rice proteins could not be obtained due to the agglomeration of the microparticles. ESEM images showed smooth and round microparticles with soy and pea proteins. The surfaces of the microparticles obtained with sunflower and hemp proteins were porous. The surface was rough when brown rice proteins were used as the encapsulating agent. Conclusion: Soy and pea proteins appeared to be efficient wall materials for the microencapsulation of sunflower oil by spray drying. These results were partly explained by the higher solubility of soy and pea proteins in water compared to hemp, sunflower, and brown rice proteins. Acknowledgment: This work has been performed, in partnership with the SAS PIVERT, within the frame of the French Institute for the Energy Transition (Institut pour la Transition Energétique (ITE)) P.I.V.E.R.T. (www.institut-pivert.com) selected as an Investments for the Future (Investissements d’Avenir). This work was supported, as part of the Investments for the Future, by the French Government under the reference ANR-001-01.

Keywords : biopolymer, edible oil, microencapsulation, oxidative stability, release, spray-drying
Conference Title : ICFSN 2018 : International Conference on Food Science and Nutrition
Conference Location : Paris, France
Conference Dates : August 27-28, 2018