Ratchanee Charoen 2012: Characterization of Rice Bran Oil Encapsulation and Its Application in Food Model. Doctor of Philosophy (Agro–Industrial Product Development), Major Field: Agro–Industrial Product Development, Department of Product Development. Thesis Advisor: Associate Professor Anuvat Jangchud, Ph.D. 185 pages.

Rice bran is an underused coproduce of rice milling. The value is partially captured through extraction and refining of the rice bran oil which contains high nutritional benefits as a mixture of antioxidants and phytosterols. For novel product development, it should be able to use in wide range of food products, not only used as the cooking oil. Therefore, the encapsulation method was selected to study. The objectives of this study were to determine the effect of the oil extraction methods from rice bran, then study the effect of biopolymer type and environmental stresses (pH, salt and heat) on the stability of rice bran oil (RBO) in water emulsion including lipid oxidation during storage. The spray drying was selected to encapsulate the RBO (o/w emulsion) to produce the powder form and the characterization of RBO powder was also investigated. Finally, the utilization of RBO powder was studied. Initially, RBO extracted by cold pressed extraction was selected for the study of the encapsulated RBO due to the safety and the qualities of edible oil including high bioactive content. Biopolymer type had an effect on the stability of RBO in water emulsion under the different environmental stresses. The results indicated that extensive droplet aggregation occurred in whey protein isolate (WPI) stabilized emulsions around their isoelectric point (4<pH<6), at high NaCl (>200 mM), and at high temperatures (>70 °C). There was slightly effect of pH, salt concentration and temperature on emulsions stabilized by gum arabic (GA) or modified starch (MS). WPI or MS stabilized emulsions were stable to lipid oxidation while GA stabilized emulsion was unstable to lipid oxidation which were attributed to the rate of lipid oxidation increased in the following order GA>>WPI≈MS (pH7, with pro–oxidant). When the characterization of WPI or MS stabilized RBO powder was examined, the results showed that the powder had white color with small particle (<25 μm), contained 2.0–2.7% moisture and 30.3–32.7% total fat. The encapsulation efficiency was 92.6–95.2%. From the sorption isotherm study, it was found that the GAB model (R^2 = 0.99) was suitable for prediction of the equilibrium moisture content values. From the study of kinetic reaction of the chemical deterioration of the RBO powder stored at 25, 35 and 45°C for 80 days showed that the reaction order was different between WPI stabilized rice bran oil powder (n = 1) and MS stabilized rice bran oil powder (n = 0). For the activated energy values of the reaction (E_a), powder stabilized with WPI had $E_a$value higher than powders stabilized with MS. The utilization of rice bran oil powder as a coffee creamer found that the sensory properties of rice bran oil powder including color, odor and favor were needed to be improved to be similar to those of coffee creamer in commercial production. This can be done by adding whitening agent, stabilizing salt, favor and color agents etc.

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