

Effects of wall material ratio and oil concentration on the stability of embedding nanoemulsions in spray drying encapsulation.

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Encapsulations processes ensure the stability of highly sensitive and labile bioactive compounds, such as polyunsaturated fatty acids (PUFAs), in different food systems. However, the effects of the emulsion preparation prior to the encapsulation of products, are often overlooked in spray drying encapsulation. This study presents the manufacturing by high-speed homogenization of nanoemulsions loaded with Sacha Inchi (*Plukenetia volubilis* L.) oil using a DISPERMAT D-51580 (GETZ-MANN GMBH, Germany) at 18000 rpm for 10min. Various oil concentrations (5, 7.5% w/w) and ratios of maltodextrin: sodium caseinate (75:25, 80:20, w/w) were studied for particle size, pH, conductivity, flow behavior, surface tension, cremation index, and Turbiscan Stability Index (TSI). Emulsions with a 5% oil concentration and an 80:20 wall-material ratio exhibited higher stabilities and lower particle sizes. Subsequently, these high stability emulsions were spray-dried using a Mini Spray B-290 (BÜCHI, Switzerland) at 150 °C with its peristaltic pump set at 90% for an aspiration rate and a 10 % for pump rate. The powder was then characterized for encapsulation yield (EY), moisture content, bulk density, solubility rate, and thermal stability, obtaining values of 57.52%, 0.45%, 0.54 g/mL, 64.5 s/g, and 138 °C, respectively. Low humidity powders are more likely to present a lower water activity, which translates into less water available for biological reactions and therefore a lower microbial load. In addition, an encapsulation yield greater than 50% is deemed successful, protecting the PUFAs from oxidation; heat protection is also assured as shown by the thermogravimetric analysis, enhancing not only its shelf life but its capacity to withstand thermal food processing. In conclusion, spray drying encapsulation is a successful process to ensure Sacha Inchi oil stability, elongating the shelf life of the bioactive compounds and protecting them from food processing, increasing its potential applications in functional foods product development.

Keywords: Emulsion; Encapsulation; Spray Drying; Sacha Inchi oil; Bioactive compounds; Physicochemical stability

