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ORIGINAL PAPER

Physicochemical characterization and oxidation stability of Sacha inchi oil encapsulated by spray drying

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Abstract
In this study, we propose to assess the physicochemical characteristics of the maltodextrin and sodium caseinate capsules used to protect Sacha inchi oil (SIO) and their oxidative stability during storage using a secondary oxidation compound as an indicator. Various indicators of oxidation, including peroxide value (PV), malondialdehyde (MDA), and p-inside (p-AN), were evaluated. Three distinct oil-in-water emulsions were prepared and subsequently subjected to spray drying, utilizing a constant concentration of SIO at 10% v/v. These emulsions were formulated using a combination of maltodextrin and sodium caseinate at three different ratios: 1:1 (T1), 3:1 (T2), and 1.7:0.2 (T3), equivalent to 20% w/v of the emulsion. Fourier transform infrared spectroscopy revealed the absence of chemical interactions between the oil and the capsule materials, and thermogravimetric analysis indicated that all three SIO treatments exhibited notable thermal stability. Our data suggest that the formulation employed in T3 effectively maintained the oxidative stability of the encapsulated oil when contrasted with the other treatments: pansidine values for T1, T2, and T3 were 2.19 ± 0.13; 4.46 ± 0.12 and 1.43 ± 0.11 respectively and TBARS value for T1, T2, and T3 were 6.51 ± 0.41; 4.98 ± 0.16 and 2.62 ± 0.22 respectively, at 15 days storage, highlighting its potential as a superior choice for enhancing the oxidative stability of sacha inchi oil microencapsulation. Since SIO is a rich source of polyunsaturated fatty acids, this study represents a significant advancement in developing strategies to extend its shelf life. By enhancing its stability, the oil can be more effectively incorporated into consumers' diets and utilized to prepare other functional foods.

Keywords Dry emulsions · Vegetable oil · Oil shelf-life · *Plukenetia volubilis* L · Malondyaldehide

Introduction

The growth of the global population and the shift in consumer preferences toward healthier foods that reduce the risk of noncommunicable diseases such as diabetes, cancer, and cardiovascular conditions have driven the search for new food sources or raw materials. These alternatives aim not only to provide essential nutrients and offer functional benefits that positively impact consumers but also to address the challenge of food insecurity outlined in the Sustainable Development Goals. Regarding edible fats and oils, consumption trends now emphasize foods rich in monounsaturated fatty acids (MUFAs) or polyunsaturated fatty acids (PUFAs) [1]. However, MUFAs or PUFAs from animal products tend to be expensive. Meanwhile, vegetable oils are predominantly used for non-food applications such as biodiesel, animal feed, surfactant, and paint and coatings production [2, 3]. This situation has underscored the need to explore new sources of oils rich in MUFAs or PUFAs suitable for the food industry, potentially replacing costly commercial options [4, 5]. Our research on spray drying for microencapsulation of Sacha inchi oil and its impact on oxidative stability directly addresses this need, offering an alternative for the food industry.

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