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PHYSICOCHEMICAL PROPERTIES OF COLD-SET WPI BIGELS AS VEHICLE FOR CURCUMIN

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Bigels are semisolid systems composed by a mixture of hydrogel and oleogel. Recently, these systems have been studied for food application, mostly working as texture modifiers and as vehicles for bioactive compounds with different polarities. Additionally, curcumin is a lipophilic, widely known to have anti-inflammatory, anticancer and antimicrobial action. Thus, the aim of this work was developing a cold-set bigel with sunflower oil, glyceryl monostearate (GM) 10% (p/v) and whey protein isolate (WPI) 11% (p/v). Bigels were produced by hot-emulsification using a rotor-stator (18000 cm^{-1} / 2 min) with different hydrogel:oleogel ratios (90:10, 50:50 and 10:90). Curcumin (0.03 mg/ml) was added to the oil phase. The mechanical proprieties, microstructure (optic microscopy and FTIR analysis) and controlled release were evaluated. Results showed that the hydrogel:oleogel ratio exerted influence on mechanical properties. In all of them it is possible to observe a rupture point, and an increase in elasticity modulus (EM) proportional to the increase of oleogel. However, the 90:10 and 10:90 formulation had greater stress at the rupture point, while the bigel with equal proportions results in a more fragile structure. This can be explained by the network formed, in which for the 90:10 and 10:90 there is a well-defined disperse and continuous phases, being oil in water (O/W) and water in oil (W/O), respectively, while the 50:50 has the two phases coexisting. Furthermore, it is possible to note that the addition of curcumin provided an improvement in the gel network, that showed an increase in resistance proportional to the amount of curcumin. Temperature sweep showed that at higher temperatures (>85 °C) the bigels with higher oleogel content do

not have a complete structured network, with G' and G'' almost overlapping. However, as the temperature decreases, the gel network became stronger with G' prevailing. The gel point was also dependent on the oleogel proportion and the lowest temperature was observed for 50:50 system (approximately 45°C). Frequency sweep showed that all bigels were slightly frequency dependent, showing variations at low frequencies (<1 Hz), and a gel-like plateau at high frequencies. However, in general, the addition of curcumin did not show great effects on the rheological properties. FTIR results show that the role of the fillers (hydrogel and oleogel) was purely physical, without any chemical interaction. At last, the controlled release data of curcumin from bigels showed a good fitting (R^2 > 0.80), indicating that the release mechanism is governed by both Fickian and Case II transport. Moreover, in relation to the transport mechanisms, it was observed that the relaxation is the governing phenomenon (X_f < 0.5), even the Fick's constant being higher. The release of curcumin from bigels demonstrated that the 90:10 system was the most suitable to describe the release kinetics, which is mainly governed by a relaxation mechanism. So, these results showed that is possible to vehicle curcumin in self-sustainable WPI bigels, and that the mechanical properties can be modulated according to the bigel composition, thus enabling the incorporation into different food matrices.

Keywords: Bigel; WPI; Curcumin

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