FORMATION AND STABILIZATION OF NANOSTRUCTURED-LIPID CARRIERS USING BIOSURFACTANTS FOR ENCAPSULATION OF LIPOSOLUBLE VITAMINS

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Introduction – Liposoluble vitamins exhibit poor solubility in aqueous mediums and are very sensitive and unstable when exposed to inadequate conditions (e.g. temperature and pH). With that in mind, it is important to preserve the properties of these molecules and improve their biological efficiency. Nanoencapsulation can be an alternative and the nanostructured-lipid carriers (NLC's) are presented to be a good alternative for vitamins encapsulation due to their unique features (e.g. easy scalability, presence of digestible lipids, possible absence of solvents and the use of food-grade materials during production) [1]. It is also important to find new bio-based and biodegradable food-grade materials with new well-known properties, such as biosurfactants (produced by microorganisms) [2].

Due to physico-chemical properties of biosurfactants (low toxicity, high biodegradability, high selectivity, low micelle concentrations and effectiveness at extreme temperatures, pH's and salinities), they are already used in the food industry to improve, for example, texture, organoleptic properties and creaminess of products [3,4]. Take this account, in this study is investigated the suitability of a biosurfactant produced by *Pseudomonas aeruginosa* (rhamnolipids) to form and stabilize NLC's for encapsulation of liposoluble vitamins.

Experimental - The NLC's were prepared by melt-emulsification, using ultra-homogenization followed by ultrasonication technique. For NLC's productions, Neobee 1053 (liquid lipid) and glycerol monosterate (solid lipid) were used as the lipid phase and rhamnolipids dissolved in ultra-pure water was used as the aqueous phase. A full factorial design was employed for optimization of the process, designing a set of experiments with different ratios of aqueous:lipid phases, solid:liquid lipids and concentration of rhamnolipids. Size and polydispersity (evaluated by dynamic light scattering, DLS) were used as response variables. Morphology of the NLC's system were further evaluated by transmission electron microscopy (TEM) and the structure changes and crystallinity studied by Fourier transform infrared spectroscopy, X-ray spectroscopy and small angle X-ray scattering. The stability over time and in different conditions were also evaluated.

Results and Discussion - Size (124-430 nm) was mainly dependent on the water content of the system, while the aqueous:lipid phase ratio and concentration of rhamnolipids were the main factors affecting the polydispersity, which ranged from 0.227 to 0.945. TEM observations confirmed the size determined by DLS and the spherical morphology of the NLC's. Relatively to stability, the preliminary studies, showed that the NLC's produced with rhamnolipids are stable at least 15 days.

Conclusions - The results represent an important step for the encapsulation of vitamins using NLC's formed and stabilized by rhamnolipids and the consequent production of functional foods.

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