Microencapsulation of annatto seed oil using prebiotic carbohydrates

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Abstract
This work aimed to study the microencapsulation of annatto seed oil using inulins with two degree of polymerization (DP), GR-inulin (DP ≥ 10) and HP-inulin (DP ≥ 23), as wall material. The microparticles obtained by freeze-drying (FD) were characterized with respect to scanning electron microscopy (SEM), confocal scanning laser microscopy (CSLM), encapsulation efficiency (EE) and differential scanning calorimetry (DSC). The DP’s had not influence on the physical-chemical properties of microparticles. However, were produced novel additives for food industry with functional and therapeutic properties.

Key words: Inulin, functional carbohydrate, freeze-drying.

Introduction
Annatto seed oil is rich in δ-tocotrienol and geranylgeraniol, bioactive compounds with antioxidant and anticancer properties, respectively1.

The encapsulation of this oil is a promising alternative for availability and preservation of these valuable compounds. In this sense, using inulin as wall material is an excellent and innovative application, since this is a prebiotic carbohydrate, resulting thus in a fully functional microparticle2. Furthermore, applying different DP’s can lead obtaining products with several technology characteristics.

This work aimed to evaluate the effect of DP, GR-inulin (DP ≥ 10) and HP-inulin (DP ≥ 23), on the encapsulation of annatto seed oil using FD technique for obtaining powders. The microparticles produced were characterized by means of SEM, CSLM, EE, and glass transition temperature (Tg) by DSC.

Results and Discussion
Figure 1 shows the results obtained by CSLM and SEM. The fluorescent green color on the CSLM micrographs refer to δ-tocotrienol distribution in all the structure of the microparticles. The micrographs obtained by SEM confirmed the morphology characteristics of freeze-dried products, broken plaques with irregular aspect.

![GR-FD and HP-FD](image)

GR-FD

HP-FD

20μm

30μm

Figure 1. CSLM e SEM micrographs of annatto seed oil microparticles.

The results of entrapment efficiency showed that DP had not influence on the oil retention in the matrix (p-value = 0.15), resulting 93 ± 2%. Regardless of DP, inulin was not a good encapsulating agent, GR-FD and HP-FD resulted in an EE of 29 ± 1% and 42 ± 1%, respectively. Inulin acted mainly as carrier agent for annatto seed oil.

Figure 2 shows the DSC results. In this analysis was evaluated the conditions which the encapsulating system lost the protector ability due the its melting. The Tg value indicates a phase transition, from the amorphous phase to rubbery phase. The samples were evaluated in natural conditions of moisture and water activity resulting after FD. Were observed Tg’s of 132°C, 157°C, 144°C e 169°C for samples GR, HP, GR-FD e HP-FD, respectively. Results showed that DP and oil presence did not affect the stability of the microparticles.

![DSC curves](image)

Figure 2. DSC curves of GR, HP, GR-FD and HP-FD.

Conclusions
The DP had not affected the physical-chemical characteristics of inulin as a wall material. However, were obtained microparticles fully functional and therapeutic, with the ability to carry lipophilic bioactive compounds.

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