

Orange essential oil microencapsulation using inulin as encapsulating agent

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Abstract

Inulin is a storage carbohydrate which naturally occurs many vegetables, including chicory roots. Inulin's chemical structure is composed by a chain of fructose molecules with a terminal glucose molecule, so that it can be classified as a fructooligosaccharide. For food industry, inulin application is mostly related to its ability in substituting sugar or fat, with the advantage of its low calorific contribution, so that it can be applied as an ingredient in several foods. The main goal of this research work was the encapsulation of orange essential oil using inulin extracted from chicory roots as encapsulating agent. The specific goals were: inulin extraction from chicory roots by diffusion in hot water and concentration of extract by evaporation; verification by an experimental design the effect of independent variables (inlet temperature and encapsulating agent concentration) on the process yield; lipid oxidation and evaluate the best point of the operational parameters used on the dryer while to obtain the product in the powder form with the greatest efficiency and biggest microcapsule retention capacity.

Key words:

spray drying, lipid oxidation, microcapsules.

Introduction

Inulin is a fructooligosaccharide¹ which acts in human gastrointestinal system in a similar way to dietary fibers, contributing to improve the benefits of bifidobacterias and, consequently, for the improvement of the overall health of the gastrointestinal system. Due to these properties, it can be applied in food and pharmaceutical industries for the production of functional food, nutritional compounds and medicines.

Physical-chemically, essential oils have instability to light, oxygen, presence of oxidants, reducers, extreme pH media or trace metals that can catalyze decomposition reactions. Spray drying and microencapsulation of these substances increase their stability and shelf life.

This research work mainly intended to verify by central composite experimental design, the effects of operational variables of spray drying process (inlet air temperature and concentration of inulin) on the process yield, moisture content and powder hygroscopicity, pH, water activity and lipid oxidation.

Results and Discussion

In preliminary tests, only inulin as encapsulating agent was not effective for encapsulation of orange essential oil. Thus, it was used a mixture of inulin and gum arabic as encapsulating agent spray drying process.



Image 2. Spray Dryer.

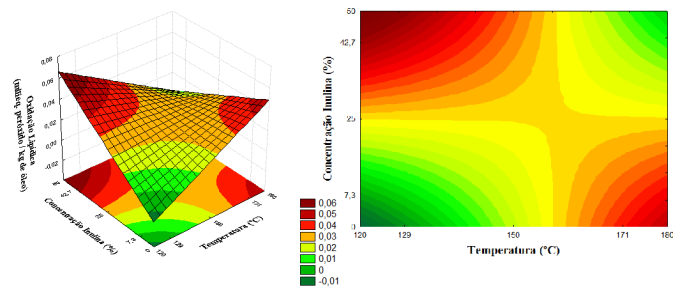


Image 1. Response surface and boundary curves for lipid oxidation of orange essential oil powder.

The low significant variation of moisture content, water activity and hygroscopicity still shows favorable results for many different conditions of inlet temperature and encapsulating material concentration.

Conclusions

Inserting gum arabic in mixture, it was noted that the oil encapsulation was much better, avoiding its grip on glassware and generating dry powder with low moisture content. Also, lower oil concentrations (%) and temperatures (not exceeding 200°C, which was found to be a critical point) were used.

Statistical analysis could not generate coded models and response surfaces, because of low R² values and significant variations for moisture content, water activity, hygroscopicity and process yield.

For lipid oxidation, inlet temperature and encapsulating agent concentration showed opposite effects, ie, low values of lipid oxidation were obtained with low inlet temperatures and high encapsulating agent concentration. The values were similar when compared to the values found in literature.

Acknowledgement



¹ Silva, R.F. Use of inulin as a natural texture modifier. Cereal Foods World. St. Paul. 41 (10), p.792-795, 1996.