JRIFST

www.journals.rifst.ac.ir
Journal of Research and Innovation
in Food Science and Technology

Research Institute of Food Science and Technology

Volume 9, Issue 1, Spring 2020, Pages 57-72
Document Type: Extended Abstract
DOI: 10.22101/JRIFST.2019.09.22.e1071

Extended Abstract

Using Arabic Gum, Maltodextrin and Inulin for Wall Compounds Microencapsulation and Rapid Release of the Bioactive Compounds from Cardamom Essential Oil in Saliva

Mostafa Shahidi Noghabi[1*], Mohammad Molaveisi[2]

1- Associate Professor, Department of Food Chemistry, Research Institute of Food Science and Technology, Mashhad, Iran
* Corresponding author (m.shahidi@rifst.ac.ir)
2- PhD. Student, Department of Food Chemistry, Research Institute of Food Science and Technology, Mashhad, Iran

Received: 2019.05.13; **Accepted**: 2019.09.22

Abstract

In this study, the carbohydrates material include Arabic gum (0-100%), maltodextrin (0-50%) and inulin (0-50%) were used as wall compounds for the microencapsulation of cardamom essential oil. A simple-central mixture design was used to experiment design, to optimize and find the best combination for maximal release in the mouth media. The aim of this study was microencapsulation of cardamom oil active ingredients and the effect comparison of adding maltodextrin and inulin to Arabic gum as coating materials on the responses involve the microencapsulation yield, and release of active ingredients and recovery of powder. In this study, the relationship between glass transition temperature and the release of essential oils of cardamom essential oil was investigated in saliva. The results showed that the optimal combination of Arabic gum, maltodextrin and inulin with ratios of 66.8:33.2:0.0, respectively, under these conditions, the microencapsulation yield of the essential oil, alpha-triphenyl acetate and 1 and 8 cineol were 83.57, 91.79 and 90.87%, the release of the active ingredient was 93.27% and the powder recovery was 67.72%. The glass transition temperature of the optimal combination was 42.9 °C, which was a suitable temperature for preserving the active ingredients at ambient temperature and release in saliva. According to the results of this study, the cardamom essential oil optimal combination can be successfully applied in the products as chocolate, candy, sugar cubes, without the release of active ingredients at ambient temperature and with the rapid and high release in the mouth media.

Keywords: Arabic gum, Cardamom essential oil, Inulin, Microencapsulation, Release

Introduction

Flavor-producing compounds play an important role in the acceptance of food by consumer. Most of these compounds, which are added to foods to improve flavor, are not natural and are made chemically. Most consumers today prefer foods that do not contain chemicals or synthetic ingredients. Essential oils are volatile compounds and therefore unstable in the environment. In the food industry, the major aromatic components utilized are essential oils, synthetic flavoring agents, and natural oleoresin. The key constituents of cardamom essential oil are α-terpinyl acetate and 1,8-cineole (Krishnan, Bhosale, & Singhal, 2005). Cardamom essential oil is often used as a flavoring agent, but its importance as a natural antimicrobial, antioxidant, and antiseptic agent has recently been established (Mathai, 1985). The knowledge of encapsulation techniques allows the control of the bioactive components, the release time, and the dosage of essential oil in the structure of the food (Frascareli, Silva, Tonon, & Hubinger, 2012). Moreover, the encapsulation of essential oils helps to reduce the oxidation of process by exposure to the environment, increasing the shelf life and the solubility (Kubo, Himejima, & Muroi, 1991). The results of this work lead to the use of flavored components for implementation in similar products, thereby improving their flavor. On the other hand, food products must be preserved from production time to consumption for a while, so these compounds used in food formulation need to be properly stabilized and maintained under ambient conditions. Many of these volatile compounds have been microencapsulated into solid walls to increase their storage, release control, evaporation reduction and easier control. The aim of this study was to compare the effect of maltodextrin and inulin than gum Arabic as a coating material and to investigate the properties of the produced microcapsules.

Materials and methods

In this study, gum Arabic (0-100%), maltodextrin (0-50%) and inulin (0-50%) were used as wall compounds for the microencapsulation of cardamom essential oil. A simple-central mixture design was used to experiment design, to optimize and find the best combination for maximal release in the mouth media. The factors including microencapsulation efficiency of cardamom essential oil, release of cardamom essential oil in oral simulated medium and powder recovery were considered for optimizing different wall compounds including gum Arabic, maltodextrin and inulin. The properties of optimal microcapsule produced such as differential scanning calorimetry (DSC) and particles morphology were investigated. Scanning electron microscopy (SEM) was used to observe the microstructure of the prepared microcapsules. In this study, the relationship between glass transition temperature and the release of essential oils of cardamom essential oil was investigated in saliva.

Results and discussion

Based on the results obtained for the microencapsulation efficiency, the release of cardamom essential oil into the oral simulated environment and powder recovery, the composition of gum Arabic, maltodextrin and inulin with 66.8:32.2:0.0 ratio were considered as the optimum composition. The microencapsulation efficiency of the active compounds including the cardamom essential oil, α-terpinyl acetate and 1 and 8 cineol were 83.57, 91.79 and 90.87%, the release of the active ingredient was 93.27% and the powder recovery was 67.72%. The glass transition temperature of the optimal combination was 42.9 °C, which was a suitable temperature for preserving the active ingredients at ambient temperature and release in saliva (Bhandari & Hartel, 2005). The images of scanning electron microscopy showed that optimum composition is spherical and with a slight crack. Also, the results showed that the selected wall materials can be effectively used for the production of cardamom essential oil emulsions with maximum microencapsulation efficiency of cardamom essential oil, α-terpinyl acetate and 1,8-cineole, and release of cardamom essential oil and powder recovery (de Barros Fernandes *et al*., 2016). The suitable release of the active ingredient and particle shape were obtained for optimum composition. In general, the results of this study showed that with using optimum microcapsules produced by spray drying method can increase the release of the active ingredient in cardamom essential oil (Overbosch, Afterof, & Haring, 1991). According to the results of this study, the cardamom essential oil optimal combination can be successfully applied in the products as chocolate, candy, sugar cubes, without the release of active ingredients at ambient temperature and with the rapid and high release in the mouth media.

Conclusions

The results showed that the selected walls can be effectively used for the production of cardamom essential oil emulsions to maximize the microencapsulation efficiency of cardamom essential oil and its effective constituents including α-terpinyl acetate and 1,8-cineole, maximizing the release of the cardamom oil active ingredients in the simulated oral medium, and also maximum powder recovery. A simple-central mixture design is a useful technique for optimizing the ratio of wall components to obtain microcapsules of cardamom essential oil with desired physicochemical properties. The experimental values were also according to the predicted values confirmed by the software for the suitability of the proposed models.

References

Bhandari, B. R., & Hartel, R. W. (2005). Phase transitions during food powder production and powder stability *Encapsulated and powdered foods* (pp. 273-304): CRC Press.

de Barros Fernandes, R. V., Borges, S. V., Silva, E. K., da Silva, Y. F., de Souza, H .J. B., do Carmo, E. L., . . . Botrel, D. A. (2016). Study of ultrasound-assisted emulsions on microencapsulation of ginger essential oil by spray drying. *Industrial crops and products, 94*, 413-423. doi:https://doi.org/10.1016/j.indcrop.2016.09.010

Frascareli, E., Silva, V., Tonon, R., & Hubinger, M. (2012). Effect of process conditions on the microencapsulation of coffee oil by spray drying. *Food and bioproducts processing, 90*(3), 413-424. doi:https://doi.org/10.1016/j.fbp.2011.12.002

Krishnan, S., Bhosale, R., & Singhal, R. S. (2005). Microencapsulation of cardamom oleoresin: Evaluation of blends of gum arabic, maltodextrin and a modified starch as wall materials. *Carbohydrate polymers, 61*(1), 95-102. doi:https://doi.org/10.1016/j.carbpol.2005.02.020

Kubo, I., Himejima, M., & Muroi, H. (1991). Antimicrobial activity of flavor components of cardamom Elettaria cardamomum (Zingiberaceae) seed. *Journal of agricultural and food chemistry, 39*(11), 1984-1986. doi:https://doi.org/10.1021/jf00011a020

Mathai, C. K. (1985). Quality evaluation of the 'agmark'grades of cardamom Elettaria cardamomum. *Journal of the Science of Food and Agriculture, 36*(6), 450-452 .

Overbosch, P., Afterof, W., & Haring, P. (1991). Flavor release in the mouth. *Food reviews international, 7(2),* 137-184.doi:https://doi.org/10.1080/87559129109540906