

## Microencapsulation of *ciplukan* (*Physalis angulata* L.) extract as food ingredients: Effect of water ratio and maltodextrin concentration variables on product characteristics

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### Article history

Received:

27 September 2022

Received in revised form:

22 December 2022

Accepted:

28 August 2023

### Keywords

*Physalis angulata* L., microencapsulation, spray drying method, water ratio, maltodextrin

### Abstract

The present work evaluated the characteristics of *ciplukan* (*Physalis angulata* L.) microcapsule extracts prepared by spray drying method. Different water ratios namely X<sub>1</sub> (1:2), X<sub>2</sub> (1:5), and X<sub>3</sub> (1:10), and maltodextrin concentrations namely Y<sub>1</sub> (5%) and Y<sub>2</sub> (10%) were applied in a spray drying system to produce microcapsule extracts. Investigations of physical properties (pH, moisture, water activity, total solid, solubility, and colour), as well as morphological characteristics by scanning electron microscopy (SEM) and functional properties (antioxidant, total phenolic, total flavonoid, and quercetin content) were carried out. Results showed that water ratio and maltodextrin gave a significant effect on the physical properties of microcapsule extract with X<sub>1</sub> (1:2) and Y<sub>1</sub> (5%) having significant effect on total phenolic, flavonoid, and quercetin contents, and antioxidant properties of *ciplukan* extract microcapsule. Furthermore, the scanning electron microscopy (SEM) illustrated the morphological structure of microcapsule extract, which showed a spherical structure. All combinations of water ratios and maltodextrin concentrations showed agglomeration, except for X<sub>1</sub>Y<sub>2</sub>. In correlation analysis using partial least square, the antioxidant activity of microcapsule extract was proportional to physicochemical properties, total phenolic, total flavonoid, and quercetin contents of microcapsule extract. The present work revealed that water extraction ratios and maltodextrin concentrations affected microcapsule extract of *ciplukan*. The combination of X<sub>1</sub> (1:2) and Y<sub>1</sub> (5%) retained the functional properties of *ciplukan* microcapsule extract.

### DOI

<https://doi.org/10.47836/ifrj.30.6.12>

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### Introduction

*Physalis* has 75 native species in the United States, and 65 species in Mexico (Martínez *et al.*, 2017). The edible fruits of some *Physalis* species are nutritionally good (Zamora-Tavares *et al.*, 2015; Saavedra *et al.*, 2019). Sweet or sour, these fruits are consumed raw or made into jams, soups, and meals (Vargas-Ponce *et al.*, 2016). *Physalis angulata* L. is a member of the Solanaceae family, and found

throughout tropical and subtropical parts of the world (Ramakrishna Pillai *et al.*, 2022). This plant is commonly referred to as "camapu" in Brazil and "ciplukan" in Indonesia. Its leaves have a variety of pharmacological properties, and its fruits could be consumed as food (Figueiredo *et al.*, 2020). *Physalis angulata* flowers and fruits throughout their vegetative and reproductive cycles, with floral buds emitted shortly after plantlet emergence until senescence. Due to the overlapping timing of

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