Chapter 1

Introduction

1.1 Background

Flavor enhancers are food additives that improve the taste and flavor of food, where they can either exist as synthetic and natural (Vasilaki et al., 2021). Natural flavor enhancers or seasonings are made with natural ingredients (Mitchell et al., 2013). The formulation of natural seasonings may consist of a combination of herbs and spices, along with flavor-enhancing ingredients such as salt, sugar, vegetables, meat, poultry, seafood, and more (Tahmaz et al., 2022; Fauziah et al., 2023). The addition of bioactive compounds in seasoning powder has also garnered attention as a possible way to provide added benefits. For instance, previous studies have incorporated antioxidant-rich plants such as mushroom (Bahri et al., 2017) and butternut squash (Ahn & Kim, 2021) to seasoning powder, where they stated the addition of such plants increased antioxidant activity and total phenolic contents of the final product, however it caused color darkening (Ahn & Kim, 2021; Bahri et al., 2017).

Another plant source that is known for its secondary metabolites availability is rice (*Oryza sativa L.*). Rice is frequently used in its grain form as a source of food for humans, straw for animal feeds, and husk for soil fertilizer (Wei & Huang, 2019). On the other hand, the leaf part of rice is often discarded during harvesting. Even so, previous research acknowledged that rice leaf usage is possible for functional foods due to its existing secondary metabolites (Khanthapok et al., 2015). It is reported that rice leaves contain 110 out of 276 bioactive compounds found in rice (Wang et al., 2018). It is also found that rice leaf, in particular the young ones, is predominantly composed of phenolic acids and flavonoids (Dong et al., 2014; Sakulnarmrat et al., 2018). Compared to other bioactive-rich plants, rice has a total phenolic contents of 31.3 mg GAE/g DW, while green tea leaf has 142.7 mg GAE/g DW, and pandan leaf has 54.46 mg GAE/g DW (Sakulnarmrat et al., 2018; Yongkhamca, 2020). Considering

these findings, incorporating rice leaf into seasoning powder is a possible way to provide added health benefits for human consumption.

Plant phytochemicals are unstable to external factors including light, heat, and oxygen which leads to degradation and loss of functional properties (Ramakrishnan et al., 2018). Therefore, to fully achieve and preserve the bioactive compounds of rice leaf during processing as much as possible, Microwave-Assisted Extraction (MAE) and spray drying with a carrier agent of maltodextrin are employed. The utilization of the two techniques have been reported for their positive impacts. MAE is a faster, more efficient, and cost-effective method of extracting polyphenols compared to other methods (Chimsook, 2017; Pérez-Serradilla & Luque de Castro, 2011). Meanwhile, spray drying is a versatile and cost-effective technique that helps to recover bioactive compounds and improve powder properties (Krishnaiah et al., 2014; Sosnik & Seremeta, 2015).

Physicochemical tests to evaluate the two treatments of rice leaf—encapsulated and non-encapsulated—to be incorporated into plant-based seasoning powder are conducted. The test includes analyzing its solubility, hygroscopicity, color, moisture content, water activity, flowability, cohesiveness, Total Phenolic Content (TPC), and antioxidant activity. Furthermore, stability tests (water activity, moisture content, flowability, cohesiveness, TPC, and antioxidant activity) are conducted to evaluate changes in the product over time. The results of these tests are important to ensure the product is safe and able to maintain its quality during prolonged storage. Factors such as moisture content and water activity need to be monitored to prevent microbial growth, while flowability and cohesiveness are indicators of the powder's tendency to cake over time (Chang et al., 2018). In addition, TPC and antioxidant activity are observed for their antioxidant capacity change over time, which may lead to unpreferable product quality degradation as well (Lin et al., 2020). The purpose of this study is to evaluate plant-based seasoning powder that is incorporated with raw and encapsulated rice leaf extract powder.

1.2 Objective

This study's aims are as follows:

1. To evaluate the effect of extraction and spray drying to the Total Phenolic Content (TPC) of rice leaf powder.
2. To evaluate the effect adding non-encapsulated/raw and encapsulated rice leaf powder to the physicochemical properties of the seasoning powder.
3. To evaluate the physicochemical stability of seasoning powder added with non-encapsulated/raw and encapsulated rice leaf powder throughout 4-weeks of storage.

1.3 Hypothesis

H_0 = Extraction and spray drying do not significantly affect the Total Phenolic Content (TPC) of rice leaf powder.

H_1 = Extraction and spray drying do significantly affect the Total Phenolic Content (TPC) of rice leaf powder.

H_0 = Addition of non-encapsulated/raw and encapsulated rice leaf powder does not significantly affect the physicochemical of the seasoning powder.

H_1 = Addition of non-encapsulated/raw and encapsulated rice leaf powder does significantly affect the physicochemical of the seasoning powder.

H_0 = The physicochemical stability of seasoning powder added with non-encapsulated/raw and encapsulated rice leaf powder does not significantly differ throughout the storage period.

H_1 = The physicochemical stability of seasoning powder added with non-encapsulated/raw and encapsulated rice leaf powder does significantly differ throughout the storage period.