CHAPTER 1

INTRODUCTION

1.1 Background Research

There are two popular varieties in Indonesia, i.e., *ijo panjang* (*Persea gratissima Gaertn*) and *ijo bundar* (*Persea americana Mill*.; Manaf et al., 2018). *Ijo bundar* variety belongs to the West Indian race and is better known as *alpukat mentega* due to its thick and greenish or yellow flesh like butter (Anova, I., & Kamsina, K., 2013; Ayala Silva & Ledesma, 2014). Avocado pulp could be consumed directly or indirectly, while avocado seed and leaf are mostly used as ingredients for medicine (Wang et al., 2020).

In the avocado industry, the pulp is widely used while the seed and peel are discarded as wastes. In comparison to peel and pulp, avocado seed (AS) has higher total phenolic compound and total antioxidant capacities (TAC; Wang et al., 2010). Therefore, AS, a by-product of avocado, has been extracted to be used as preservatives and sources of phenolic nutraceuticals due to its high level of polyphenols that contribute to the antioxidant, antiradical, and antimicrobial power of avocado.

In AS, most of the polyphenols which mainly consist of chlorogenic acid, and protocatechuic acid, both of those are highly water-soluble (Gómez et al., 2014). Polyphenols are considered as a chain-breaking antioxidant that works by competing with the propagation reactions of autoxidation (Amorati & Valgimigli, 2015; Segovia et al., 2018). However, polyphenols are sensitive to oxygen, light, and heat as well as possess an unpleasant flavor (Calderón-Oliver et al., 2017; Macías-Cortés et al., 2019). In order to maintain the antioxidant activity of polyphenol in AS throughout food processing, these polyphenols need to be encapsulated.

A promising and currently unexplored encapsulation method for AS is coacervation. There are two types of coacervation including complex coacervation and simple coacervation. Simple coacervation involves only one macromolecule or encapsulating agent to generate matrix-wall,

while complex coacervation uses the combination of encapsulating agents (commonly protein with polysaccharide) through electrostatic interaction that would form a matrix-wall around the active compound (Astoricchio et al., 2020; Calderón-Oliver et al., 2017; Rutz et al., 2017).The objective of this study is to do a preliminary study to determine the feasibility of simple and complex coacervation as an encapsulation method to preserve the antioxidant activity of AS by investigating their stages (i.e., emulsification, coacervation and gelation, drying).

This study will focus on determining the effect of the freeze-drying process, the presence of ASP (core), the encapsulation process, and the combination of type and ratio of encapsulating agents to generate wall to the TAC of the sample. TAC is analyzed due to a large diversity of antioxidant compounds present in the product to characterize the antioxidant properties of the product (Csepregi et al., 2016). In this study, TAC was measured using DPPH (2,2-diphenyl-1-picryl-hydrazyl-hydrate) assay and was represented by a percentage of antioxidant activity (AA%) calculated from the absorbance of each sample as a result of DPPH assay.

1.2 Problem Formulation

The research problems are formulated as follows:

- What is the effect of the freeze-drying process on the TAC of samples?
- What is the effect of the presence of ASP (core) on the TAC of samples?
- What is the effect of the encapsulation process on the TAC of samples?
- What is the effect of the combination of type and ratio of encapsulating agents to generate wall on the TAC of samples?

1.3 Research Objectives

The objectives of this study are formulated as follows:

- To do a preliminary study to determine the feasibility of simple and complex coacervation as an encapsulation method to preserve the antioxidant activity of AS

- To observe the effect of the freeze-drying process of sample on the TAC of samples
- To observe the effect of the presence of ASP (core) on the TAC of samples
- To observe the effect of the encapsulation process on the TAC of samples
- To observe the effect of the combination of type and ratio of encapsulating agents for generating wall on the TAC to samples.

1.4 Research Hypothesis

- Null hypothesis (H0): there are no significant differences between samples at any experimental design steps of the statistical analysis in this study (step 1, step 2, step 3, step 4, step 5, step 6)
- Alternative hypothesis (H1): there are significant differences between samples at any experimental design steps of the statistical analysis in this study (step 1, step 2, step 3, step 4, step 5, step 6)

1.5 Expected Result

- The freeze-dried powder sample is expected to have a higher TAC value than the liquid sample
- The sample containing ASP (core) is expected to have a higher TAC value than the sample containing no ASP (core)
- The complex coacervated sample with core in the form of freeze-dried powder is expected to have a similar or higher TAC value with the ASP
- The complex coacervated sample with core in the form of freeze-dried powder sample made of HC-LMP with a ratio of 4:1 (TA) is expected to have the highest TAC among other samples.

1.6 Importance of Research

The importance of this research is to explore the possibility of reducing food waste resulting from consumption of avocado by investigating the application of simple coacervation, complex coacervation to AS in order to produce an antioxidant-rich sample.

1.7 Scope of Research

This research will include the simple and complex coacervation process (i.e., dissolution, emulsion, gelation, freeze-drying), the extraction method of samples for DPPH assay, and the analysis of TAC using DPPH assay. However, there are several things that are not included in the study, i.e., the comparison of TAC between the AS and ASP, the difference of TAC in the seed between variety of avocado cultivars, the identification of chemical composition in ASP and wall material as well as their concentration, the safety and toxicity of any samples containing ASP, the physical characteristic of any encapsulated sample, the controlled-release properties of any encapsulated sample, the application of the encapsulated sample to the food product.