# CHAPTER 1

# INTRODUCTION

## 1.1. Background

Avocado (*Persea americana Mill.*) is a climacteric fruit originated from Central America, specifically from Mexico, Guatemala, and West Indie (Dantas *et al.*, 2018). Avocado has some unique characteristics, like its pear-like shape, green rough skin, and a smooth pulp texture. Avocado possesses high nutritional content. It is specifically high monounsaturated fat that is associated with the reduction of cholesterol (Araújo *et al.,* 2018), vitamins, minerals, and phytochemical compounds. The consumption of avocado is often related to immune system improvements and protection against oxidative damage in the organism (Dantas *et al.,* 2018). This high nutritional profile of avocado makes avocado to be an ideal complementary food that could provide adequate nutrients and energy for human body.

Unfortunately, the processing of avocado still generates byproducts, especially the avocado seeds as most industrial applications only utilize the pulp. Although the seeds represent a considerable percentage of the total fruit, they are often under-utilized, discarded and thus become waste (Dabas *et al.,* 2013). Moreover, avocado seed is known to possess many potential health benefits since it contains high phytochemical compounds such as phytosterols, triterpenes, fatty acids, furanoid acids, flavonol dimers, proanthocyanidins, and abscisic acid (Leite *et al.,* 2009). According to Dabas *et al*. (2013), avocado seeds could treat hypercholesterolemia, hypertension and inflammatory conditions. The seed extract could also treat diabetes by decreasing the blood glucose (Alhassan *et al.,* 2012). Avocado seeds also possess fungicidal and antimicrobial activities. Other than that, Geissman & Dittmar (1965) claimed that avocado seeds extract are rich in polyphenolic compounds that exhibit antioxidant properties, including (+)-catechin, (-)-epicatechin, and proanthocyanidin compounds.

According to Araújo *et al. (*2018), the production of avocado reaches 5 million tons per year, which makes avocado the fourth most important tropical fruits worldwide. In Indonesia,

there is an increase of avocado import from 7401 kg to 8251 kg in 2016. In addition to that, the production of avocado keeps increasing from 2010 to 2017, which reaches 363 thousand tons in 2017. This indicates that there is a large increase of avocado production, which also leads to an increase in the waste of avocado seeds. This phenomenon could be a problem because the waste could cause ecological problems and economic losses due to high cost of transporting them to disposal areas (Leite *et al.,* 2009). Therefore, this study aims to investigate the potential utilization for these byproducts; this is very important since it could reduce the waste and increase the value of the avocado seeds at the same time.

The utilization of avocado seeds could be done by using spray drying, where we convert the avocado seed extract into avocado seed powder. Spray drying is a widely used technique used in food industries to convert liquids into solids to increase the shelf life and stability of the end product (Wong, Teoh & Putri, 2017). It works by removing the moisture content and thereby water activity of the food products, hence decreasing the enzymatic reaction, inhibiting microbial growth, and reducing spoilage. Spray drying has been used in various types of food products including fruits such as watermelon (Quek, Chok & Swedlund, 2007), tomato (Goula & Adamopoulos, 2008), pineapple (Jittanit, Nitti-Att & Techanuntachaikul, 2010), blackberry (Ferrari, Germer & de Aguirre, 2011), pomegranate (Thirugnanasambandham & Sivakumar, 2015), banana (Wong, Teoh & Putri, 2017), and even avocado itself (Dantas *et al.*, 2018). However, the study regarding the spray drying of avocado seed extract is still limited. Spray drying for avocado seed extract is expected reduce the waste of the avocado seed by transforming it into avocado seed powder, increase its value by turning it from waste into food product, and to allowing for the potential to incorporate the powder into various products such as instant soups and beverage products.

## 1.2. Objectives

The objectives of this study are:

- To develop avocado seed powder using spray drying technology.
- To investigate the solution stability of avocado seed extract with different avocado seed extract concentration.
- To investigate the effect of inlet temperature and feed flow rate to the physical properties of spray dried avocado powder that consists of powder yield, moisture, water activity, solubility, and color.

## 1.3. Problem formulation

**a.** What is the effect of different avocado extract concentration on the stability of the solution?

**b.** What is the effect of inlet temperature and feed flow rate on the yield and physical properties of avocado powder?

## 1.4. Organization of thesis

This thesis is divided into six chapters that are included as follows:

Chapter I describes about the background of the research (problem statement and solution proposition), objectives of the research, significance of the research, limitation of the research, and the organization of the research.

Chapter II provides the review of literature, which involves the explanation about avocado (characteristics, varieties, nutritional composition and health benefits, and its production in Indonesia), the byproducts of avocado (nutritional and health properties of avocado seed), and spray drying technique (principle, methodology, microencapsulation technology, process parameters and quality parameters for spray drying).

Chapter III explains about the research methodology adopted for this research, starting from the sample preparation, solution preparation and stability test, spray drying process, the analysis of spray dried avocado powder that consists of powder yield, moisture content, water activity, solubility, and color, and statistical analysis.

Chapter IV provides the results (data) obtained from this research, which are statistically analyzed and tabulated in the form of tables, graphs, and figures.

Chapter V provides the interpretation and analysis (discussion) of all the data collected from the study.

Chapter VI summarizes the research work in the form of conclusions and recommendations for future development of related study.