CHAPTER 1

INTRODUCTION

1.1. Problem Background

Bananas are predominantly produced in Asia, Latin America, and Africa. The biggest producers are India, which produced 29 million tons, China at 11 million tons, Philippines with an annual average of 7,5 million tons, and Ecuador with Brazil both at an average of 7 million tons per year on average between 2010 and 2017 (FAO, 2019).

Musa Paradisiaca L. banana is a horticulture plant in the form of herbs originating from the Southeast Asia region (including Indonesia). This plant then spread to Africa (Madagascar), South and Central America (Astuti, 1989). Banana fruit is popular with all people, ranging from children to adults. Banana fruit is a source of vitamins, minerals, and fiber that have health benefits. Nutritional content contained in every 100 grams of bananas consists of 88 calories, protein 1.2 grams, 0.2 grams of fat, 23 grams of carbohydrates, 0.7 grams of fiber, 8 milligrams of calcium, 28 milligrams of phosphorus, 0.5 milligrams of iron, 44 milligrams of vitamin A, 0.04 milligrams of vitamin B, 78 milligrams of vitamin C, and 75 grams of water (Mulyati, 2005). Banana fruit can be consumed as fresh fruit or processed into snacks or other products. Banana is the main item in agribusiness as well as being an export commodity in the form of fresh fruits so that it can be used as a foreign exchange resource.

In 2010, banana production in Indonesia reached 5.8 million tons or around 30% of national fruit production. However, since 2000 there has been a significant decrease number in exports, according to the Badan Pusat Statistik (2012), from 70,056 tons in 1999, decrease to 2,105 tons in 2000, even in 2002 only 512 tons.

The cause of the decline in exports is due to the poor quality of bananas in Indonesia, one of the causes of the decline in the quality of bananas is the attack of pests and post-harvest diseases.

One disease that usually attacks post-harvest bananas and deposits is anthracnose disease caused by *Colletotrichum Musae* (Semangun, 1996; Soesanto, 2008; Martoredjo, 1995). Anthracnosis causes infection in the fruit comb through wounds due to the cutting of combs from stems which cause decay on fruit stalks and loose fruit. Damage to the fruit that will quickly affect the physical appearance of the fruit so that it also affects the quality of the fruit and reduce the commercial price.

Banana production is the highest rank in Indonesia. Mostly, all regions of Indonesia are banana producing regions because the appropriate climate supports them. Other than that, from an economic perspective, processed foods derived from banana are quite popular in Indonesia. According to Prabawati, S., & Setyabudi, D. A. (2008), banana is commonly prepared as chips, syrup, and jam. As a solution to reducing the banana fruit waste, the banana can be processed into another form that will make the banana has a longer shelf-life and easier to store.

Nowadays, there are a lot of dried fruit snack varieties. Some dried fruit snacks that commonly found are apple chips, banana chips, jackfruit chips, etc. These types of snack are the most favorite snack for many people, but when consuming this type of snack, have consumer ever wondering whether the nutritional content of these fruit chips snack are still the same as the original fruit or not after they have passed through several processes. Many manufacturers using deep frying methods to achieve the crunchy or crispy texture, but this method is not good for health because it contains too much saturated fat that can be harmful to health by elevating cholesterol levels, contributing heart disease (Ipatenco, 2018). In the case of banana fruit, because of the frying process, the potassium and fiber content in banana chips will decrease compared with a fresh banana. A fresh banana contains around 420-425 milligrams of potassium (Northwestern Memorial Healthcare, 2017; University of Michigan Health System, 2016) and 3 grams of fiber, but a serving of banana chips contains much less (Ipatenco, 2018).

Drying is a complex process accompanied by physical and structural changes. A continuous change will occur in the dimensions during drying as a result of water removal and internal collapse

of the particulates and due to this, resulted in undesirable quality such as browning, leathery texture, losses of nutritive values, etc. (Pieniazek & Messina, 2018).

Freeze drying (lyophilization) is one of the drying technique to preserve product by rapidly freezing it and then subjecting it to a high vacuum which removes ice by sublimation. In several drying cases, the heat will cause a loss of sensory characteristics and nutritional qualities of the product while in freeze drying a similar preservative effect is achieved by the reduction in water activity without heating the food. As a result, this process will reduce the damage of nutritional and sensory qualities of heat-labile foods, such as aroma and texture (porous dried particles having a lower density than the original food). Besides, this process will produce good quality and high values of the final product (Fellows, 2009).

To further increase the quality of chips, pre-treatment can be done before the freeze drying process. Citric acid is an important parameter because it can shorten the drying period during the drying process. Besides, the citric acid pre-treatment will give a significant effect on browning reaction inhibition when it was applied in the banana slice (Doymaz, 2010). Furthermore, ascorbic acid pre-treatment has been proven to prevent fresh-cut products from browning and other oxidative reactions (He & Luo, 2007).

Based on the previous studies, the pre-treatment process gives a significant result in improving the color, and it shortens the drying time of the banana slice product. Currently, there is no study about the ascorbic acid and citric acid pre-treatment can increase the physical and sensorial properties of freeze-dried banana chips product. Therefore, the purpose of this research is to see whether the freeze-dried banana chips product would have increased in terms of physical and sensorial properties.

1.2. Problem Formulation

The focus of this research is to analyze the effect of ascorbic acid and citric acid pre-treatment which can affect the physical and sensorial properties of freeze-dried banana chips

product. According to Washburn & Jensen (2017), ascorbic acid and citric acid commonly used in food manufacturing as a preservative. Ascorbic acid can help maintain the natural color of certain food, especially fruits and vegetables that turn brown after being cut open and exposed to oxygen by using them as a pre-treatment solution. On the other hand, citric acid also has ability in preventing discoloration of fruit as a pre-treatment.

In this research, ascorbic acid and citric acid will be used as the pre-treatment for freeze-dried banana. The pre-treatment resulted in significant improvements on the previous studies. However, both pre-treatments have not been studied simultaneously for the banana product. Thus, the problem formulation of this research is constructed to answer the following questions, which are:

- How many percentages of ascorbic acid and citric acid can be used as a pre-treatment without affecting the physical and sensorial properties of freeze-dried banana chips?
- Is there any physical impact of ascorbic acid and citric acid pre-treatment on freeze-dried banana chips?
- Is there any sensorial impact of ascorbic acid and citric acid pre-treatment on freeze-dried banana chips?

1.3. Research Objective

- To investigate the effect of different acid (ascorbic acid and citric acid) pre-treatment on physical and sensorial properties of freeze-dried banana chips.

1.4. Hypothesis

Based on the problem formulation, the hypothesis in this study elaborated as follow:

- H0: Ascorbic acid and citric acid not affects the quality by improving the physical and sensorial properties of freeze-dried banana chips.

- H1: Ascorbic acid and citric acid affects the quality by improving the physical and sensorial properties of freeze-dried banana chips.

1.5. Importance of the Research

This research will benefit various beneficiaries, including:

- The importance of this research is to provide insight and analysis regarding the crispiness, color analysis, water activity, moisture content of freeze-dried banana chips pre-treated with ascorbic acid and citric acid solution.
- This study can be used to improve the quality of freeze-dried banana chips.