CHAPTER 1

INTRODUCTION

1.1. Background

Purple sweet potato (PSP; *Ipomea batatas* L.) is one of the color varieties of sweet potato (white, orange, yellow, red, and pink) from the Convolvulaceae family and grown as tuberous root from underground (Loebenstein & Thottappilly, 2009). According to Food and Agriculture Organization (FAO) statistics in 2019, sweet potato had been grown in a total of 91.8 million tonnes around the world. The highest production of this crop was in the Asia region (64.4%). Indonesia was ranked sixth in the top ten sweet potato-producing nations ("Crops", 2020). However, the rate of sweet potato consumption globally, including in Indonesia, was decreased from 2015 to 2017, although it was slightly increased in 2018 ("New Food Balances", 2020). PSP utilization is still limited as a snack food, which is boiled, steamed, or fried sweet potato, although this crop has been known since a long time ago. PSP flour was commonly produced in the food industry and used as the main ingredient for food product development, such as bread, cookies, cakes, and noodle (Ginting *et al.,* 2011; Rosidah, 2014).

PSP contains anthocyanin (ACN) that is higher than in the other vegetables, such as red cabbage, purple corn, and elderberry. The total PSP ACN concentration is around 110-210 mg/100 g of fresh PSP (Kano *et al*., 2005; He *et al*., 2015; Laga *et al*., 2020). However, Indonesian consumers did not know the benefits of PSP (Zuraida, 2003). In application, PSP ACN is commonly used as a natural colorant in the food industry because of its high stability due to the acylated chemical structure. Thus, the original color may be more stable during food processing (De Aguiar Cipriano *et al*., 2015). However, ACN can be easily degraded due to several factors, such as degrading enzyme, temperature, and light intensity. ACN can be reduced by polyphenol oxidase (PO) as an internal factor (He *et al*., 2015). This enzyme catalyzes the oxidation of phenolic acids into *o*-quinones, which is reacted with ACN (Liu *et al*., 2014; De Aguiar Cipriano *et al*., 2015). Besides, high temperatures could also degrade ACN due to the dissociation of the anthocyanin-copigment complex (He *et al*., 2015). A study by Turker *et al.* (2004) showed that anthocyanin in black carrot was decreased after 24 days of storage at 40°C. Therefore, the optimal temperature should be 20°C or lower during storage. Additionally, light intensity must be avoided to maintain ACN stability during the storage of PSP. Otherwise, the ACN will be decreased by fluorescent and ultraviolet light due to photo-degradation (He *et al*., 2015).

Since PSP ACN could be degraded due to several factors, the color of PSP could also be altered easily because both had a relationship as ACN played as the color pigment in PSP. (Khoo *et al*., 2017). Amoanimaa-Dede *et al.* (2019) stated that PSP had relatively higher ACN than other sweet potato colors. In PO reaction, the color of PSP showed unpleasant brown color which was degraded ACN form. This enzymatic browning reaction began when PSP was cut (Liu *et al*., 2014; De Aguiar Cipriano *et al*., 2015). Meanwhile, processed at high temperature, such as drying, on fresh PSP would have brighter, less red, and less yellow color, which led the ACN concentration to be decreased (Mulyawanti *et al.,* 2018). Chen *et al.* (2019) study showed that the color of PSP extract was not significantly changed after 9 days of storage at 4°C in a dark environment. However, higher temperature storage (>37°C) led to a brighter, less red, and yellower color, which degraded the ACN concentration. In terms of light exposure, dark storage condition had less color change than light storage.

In order to prevent ACN degradation, blanching as a pre-heating treatment is required to inactivate PO. This can be implemented between raw material preparation and prior to application to food processes for various purposes of product development or long-term storage at a cold temperature. Hot water and steam blanching are the most frequently pre-blanching method used in industry and home kitchens. Different type of blanching depends on the goal of quality improvement of each fruit and vegetable. However, several disadvantages of each blanching type may affect the food property, such as nutrient loss and color degradation. Therefore, the time and temperature of blanching have to be set correctly to maintain food properties and prevent harmful enzymes and microorganisms (De Corcuera *et al*., 2004; Fellows, 2009; Xiao *et al*., 2017). Liu *et al*. (2014) showed that the highest ACN concentration in PSP was microwave blanching (78%), followed by steam

(69.78%) and hot water blanching (59.83%). In terms of lightness, microwave blanched PSP had the brightest (L*= 47.43 ± 1.66), followed by hot water (L*= 38.76 ± 1.48) and steam blanching (L*= 33.82 ± 1.40). Meanwhile, steam blanching had reddest color (a*= 20.57 ± 1.41), followed by microwave (a*= 18.60 ± 0.77) and hot water blanching (a*= 14.89 ± 1.59). Microwave blanching had less blue color (b*= -5.12 ± 0.68) than hot water (b*= -5.30 ± 1.16) and steam blanching (b*= -5.12 ± 0.68).

In recent studies by Liu *et al*. (2014) and He *et al*. (2015), the degradation of ACN in blanched PSP during cold storage had not been clearly proven. Liu *et al*. (2014) showed that the comparison between blanching methods was not evident in the statistical difference on ACN concentration and correlation analysis between ACN concentration and color, although the quantification of ACN level was mentioned. Besides, the color of PSP could be affected by blanching treatment, but the colorimetry data in blanching PSP had not been distinctly proved due to raw PSP as control was not measured. Meanwhile, He *et al*. (2015) only focused on the color stability of PSP ACN by showing absorbance value changes from the spectrophotometer without determining ACN concentration. Therefore, further study is needed to validate the effect of different blanching treatments on PSP ACN concentration and origin color retention.

1.2. Objective

This research aimed to investigate different blanching treatments towards the retention of PSP ACN concentration, including the retention of PSP origin color. Additionally, the relationship between PSP ACN concentration and origin color was investigated.

1.3. Research Significance

The benefits of this research are to provide scientifically reliable information on the best choice of blanching method to be applied for retaining PSP ACN concentration and color prior to further food processing in product development. Additionally, their correlation can be used to analyze ACN concentration from color observation efficiently.

1.4. Research Question

The research questions for this research are mentioned as below:

a. How are the colorimetric parameters and ACN concentration of treated PSP changed from control as unblanched PSP at 0 min?

b. How are the colorimetric parameters and ACN concentration of PSP changed between days of cold storage in the same blanching treatment and between blanching treatments on the same day of cold storage?

c. Is there a significant correlation between colorimetric parameters and ACN concentration of each treated PSP in cold storage for 3 days?

1.5. Scope of Work

The scopes of work in this research are PSP blanching and extraction, colorimetry measurement on PSP flesh, ACN measurement on PSP liquid filtrate by using UV spectrophotometer, and correlational analysis.