CHAPTER 1: INTRODUCTION

1.1 Project Background

Out of millions of tonnes of food produced everyday, only two-thirds of the total food produced reaches the consumer’s table while the remainder is wasted or lost during transport. In adherence to the increasing consumer demand for food production, the world is now facing a huge food loss and food waste issue. Asia has become the largest continent that contributes to food loss, wasting a total of 21% of foods in 2016 with the increase of number each year. The respective food loss problems are often related specifically towards 2 regions in the Asian continent; Central and Southeast Asia (FAO, 2019). Food loss and waste percentages are lost in the food supply chain, starting from the moment fresh commodities were cultivated. Post-harvest treatments of fresh commodities play a crucial role in determining the shelf life of the food. Improper treatments would eventually lead to foods being wasted. Whilst they passed through the chain, consumers’ acceptance of raw and processed food eventually took part in food waste. Taking into consideration, fruits and vegetables are the second group which accounted for 22% to the world’s food loss and waste. However even with thorough research, these data could not be considered accurate due to the lack of information from the still-developing areas (FAO, 2019).

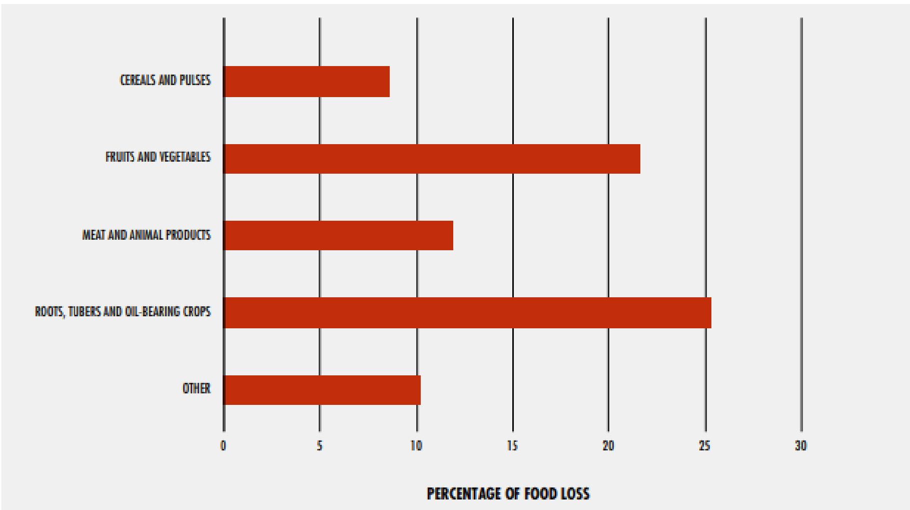

Figure 1. Estimated Food Loss by Weight Difference in 2016 (FAO, 2019)

As a developing country, the amount of research regarding food waste in Indonesia is still insufficient. The same could be said for the food loss problem. Damanhuri and Padmi (2010) found that organic waste contributes to 26.38% of Indonesia's waste composition, second after pulps and chemicals category. One factor that is responsible for the amount of food waste in Indonesia is Indonesian lifestyle and perspective towards food; Indonesian often orders excessive foods when eating out usually ends up with untouched dishes. It is estimated that each person could squander about 300 kg of food per year. Indonesia faced another challenge in the inefficiency of its food supply chain due to poor infrastructure, leading to increasing number of food loss. Subsequently, making Indonesia as the second largest producer of food waste in 2016 (Bisara, 2017). Ironically, food security and malnutrition still remain the bigger concerns in Indonesia, especially in suburban and rural areas (Immanuel et al., 2013; Bisara, 2017).

Breadfruit (Artocarpus altilis (Parkinson) Fosberg) is a staple food native to the Pacific region but widely cultivated in Indonesia for food purposes. Breadfruit has a similar texture to bread due to the sufficient carbohydrate (27.12g/100g) and starch (15.5g/100g) content. Breadfruit can be considered as superfruit as it serves high energy (103kcal/100g) and potassium content (490mg/100g). As a climacteric fruit, breadfruit has a rapid respiration rate in 20°C, reaching spoilage state at 3-5 days (Thompson, 2015). Due to the short shelf life, breadfruit often becomes food waste. Aside from the few efforts in preservation, Fardiana, Ningsih, and Mustapa (2018) also stated that each breadfruit plant produced ±350 kg of waste from the skin to the seed. The lack of knowledge in food preservation piles up more waste of fresh breadfruit.

Realizing the devastating impacts that food loss and food waste had caused, the food and agriculture industries tried to reduce food loss through post-harvest treatment of fruits and vegetables. Fresh fruits and vegetables are highly perishable commodities. They are prone to quality degradation affected by both internal and external factors (e.g. biological processes, storage injury), leading to a shortened shelf life (Gallagher & Mahajan, 2011). Various post-harvest treatments currently available are including heat treatments, chemical agents inclusion, to modified atmosphere packaging (Sandarani, Dasanayaka, & Jayasinghe, 2018). Post-harvest treatments are addressed to minimize the loss from variety of physiological processes of fresh products such as respiration and ethylene production. With the goal mentioned, dehydration process is one of the oldest yet most reliable preservation techniques to extend the shelf life of fruits and vegetables. While most dehydration processes apply heat, osmotic dehydration (OD) uses a high osmotic pressure solution to remove water from the cell (Sandarani, Dasanayaka, & Jayasinghe, 2018).

The driving force of osmotic dehydration relies on the concentration gradient between the osmotic solution and the fluid contained in the cell. Intracellular fluid would diffuse to the hypotonic solution, however the solution would not do to the contrary, creating an equilibrium state to both sides between membranes. Osmotic dehydration is beneficial in nutrients preservation, moreover to the color, aroma, and flavor. The use of sugar and/or salt as the hypotonic solution also offers cost-efficient technology (Yadav & Singh, 2012). Despite these benefits, osmotic dehydration can only achieve up to 50% water removal, depending on the fruit itself. Further processing is still required to lower both moisture content and water activity to avoid microorganism growth (Ramya & Jain, 2016). Conventional dehydration, being one of the most effective options to extend shelf life, is often combined with osmotic process. Food dehydrator has an excellent capability to rotate hot air in a chamber to dry food products, although the period is lengthy. Osmotic dehydration acts as a pre-treatment in shorten the dehydration time (Akharume et al., 2020). With technological ease, the combination of both osmotic and conventional dehydration could be one of the alternative methods to enhance the value of the breadfruit while overcoming food loss and waste problems.

1.2 Research Objective

The objective of this research project is to reduce food waste by the application of osmotic dehydration, combined with conventional dehydration.

1.3 Research Hypothesis

- Osmotic dehydration will cause changes in the physicochemical properties of breadfruit. The expected changes are: lowered water activity and moisture content, increased in weight, and insignificant changes in color.
- Higher sugar concentration will show a more pronounced changes in the physicochemical properties.
- The same trend observed in osmotic dehydration should continue in conventional dehydration

1.4 Research Scope

The project will be focused on the study of osmotic dehydration

- Conduct osmotic dehydration to breadfruit in different sugar solution strength
- Observe physicochemical changes of breadfruit during osmotic dehydration and subsequent conventional dehydration
- Analyze the rate of changes in weight and water activity during the dehydration processes

1.5 Timeline

Activities	April				June				July				August				September				October			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Colloquium presentation																								
Pre-treatment of breadfruit																								

Osmotic dehydration of breadfruit																								
Thesis report writing																								
Thesis defense																								

Table 1. Thesis timeline