CHAPTER I

INTRODUCTION

1.1 Background

Papaya (*Carica papaya* L.) is a plant often found in many tropical areas, including Indonesia. Production of papaya in Indonesia itself is up to 851,531 tons during the year of 2015 (BPS, 2015). Papaya is known to be high in antioxidants and has the ability to improve digestion system, as well as other health related problems (Hunter, 2014).

Ripe papaya is most commonly consumed as fresh fruit whereas green papaya as vegetable usually after boiling or cooking (Anuar *et al.*, 2008). Either way, the papaya fruit that is being consumed by society is only the flesh part, leaving the seeds and the peel to be discarded and become a waste. However, beside its juicy flesh, the peel and seeds of papaya are also valuable. Papaya seeds are known to give several health benefits, while papaya peel can be processed into papaya peel powder that can be used for further utilization. Papaya peel contains 47.33% of carbohydrate, 11.67 % of proteins, 2.51% of fat, 32.51% of fiber and also minerals such as calcium, phosphorus, zinc, potassium, magnesium, sodium and iron (Didier *et al*., 2017).

According to the study, papaya peel also contains phenolic substances, flavonoids and tannins that showed antioxidant activity (Didier *et al*., 2017). Other than that, papaya peel also contains pectin, a high molecular weight

polysaccharides that are found as an integral part of the primary cell wall and middle lamella of higher plants. Pectin is used as a thickening agent in the preparation of jams, jellies, marmalades, and also in edible coatings due to its ability to form gels (Normah and Hasnah, 2000). Therefore, edible coating can be one of the alternatives to utilize papaya peel in order to decrease its waste due to increase in consumption of papaya flesh that necessitates the determination of potential papaya waste utilization.

Edible coating is one of the alternatives for food packaging material as it is environmentally friendly, and it acts as a replacement of food's natural layer and prevents moisture loss, while controlling the exchange of critical gases such as carbon dioxide, ethylene and oxygen. It can also act as a sterile surface that has the ability to prevent losses of other vital components within the food system (Embuscado and Hubar, 2009). Edible coatings can be composed of hydrocolloids, which consist of polysaccharides or proteins, or hydrophobic compounds, for example lipids, waxes, and resins (Cerqueira, 2017). Based on previous research, edible coating could be made of starch derived from fruit's seeds such as durian, avocado and jackfruit (Retnowati *et al*., 2015). Several studies have reported the use of starches as one of the raw material for films and coatings that showed improvement on films' barrier to gasses and mechanical property such as increase in elongation (Embuscado and Huber, 2009). Other than starch, edible coatings could also be made of pectin derived from fruit's peel such as banana and orange (Jirukkakul, 2016).

The production and consumption of fresh-cut apples as well as other fresh-

cut fruits are projected to continue growing as more consumers demand fresh, convenient and nutritious foods (Wang *et al*., 2007). However, a challenge for the fresh-cut apple is the darkening of apple flesh due to enzymatic-browning reactions and also tissue softening. Browning damages the appearance, organoleptic properties, and nutritional quality of the fruit. Therefore, several treatments are needed to be applied to extend the shelf-life of fresh-cut apples, for example usage of natural browning inhibitor, salt and chemical treatments, reduced oxygen atmospheres and edible coating agents (Rojas-Grau *et al*., 2007). Application of edible coating in fresh cut apples could reduce moisture and solute migration, gas exchange, respiration, oxidative rates, and other negative effects caused by the loss of protective layers at the surface of the fruits (Quirós-Sauceda *et al*., 2014).

1.2. Research Problem

The utilization of papaya peel is still uncommon despite the high potential for it to be further utilized instead of being discarded as a waste. Papaya peel contains pectin (4-19%) (Yadav *et al*., 2015) that can serve as the raw material to make edible coating. Corn starch was also be added in edible coating making to enhance the properties of the films. Corn starch contains ±25% amylose (Walker and Rapley, 2009), which is higher compared to tapioca starch (±17%) and sago starch (±21%) (Sabate *et al*., 2012). Amylose is associated with the ability to form films and coatings due to its predominant linear nature (Embuscado and Huber, 2009). However the suitable corn starch concentration to be added was still unknown. The utilization of pectin derived from papaya peel as edible coating

material is still very limited. Its application towards food also has not been done yet. Therefore, the research regarding the utilization of papaya peel as the raw material for edible coating and its application towards fruit (fresh-cut apple) was conducted, to assess its effect in extending the shelf life of the fruit.

1.3 Objectives

1.3.1 General Objectives

The general objective of this research was to utilize papaya peel with the addition of corn starch in edible coating making to extend the shelf life of fresh-cut apple.

1.3.2 Specific Objectives

The specific objectives of this research were:

1. To characterize the papaya peel powder and pectin extracted from papaya peel powder
2. To determine the suitable corn starch concentration and pectin concentration to be added in the making of edible coating
3. To observe the effect of papaya peel-based edible coating in extending the shelf life of fresh-cut apple