# CHAPTER I

# INTRODUCTION

## 1.1 Background

Lesser yam (*Dioscorea esculenta* Lour. Burkill) is originated from India, Vietnam, Papua New Guinea and the Philippines. Nowadays, lesser yam has been planted all over the tropical areas and being highly utilized particularly in Southeast Asia. Tropical areas is favorable for the growth of lesser yam, resulting in large and more dormant tubers (Kumar, 2007). Nevertheless, in Indonesia, the limited utilization of lesser yam is not comparable to its abundant supply throughout its season. In rural areas, it is eaten as a source of carbohydrate and the residue is used as animal feed or food reserves (Kay, 1973).

Yam is commonly consumed as boiled slices, fried yam, yam flour but the recent products such as lager beer, chips for snacks can also be made from the tubers (Lim, 2016). Starch in the tuber of lesser yam is found to be more finely grained than other types of yams, with particles which normally less than 0.5 mm diameter (Kumar, 2007). The small granular size of the lesser yam starch makes it suitable as filler in biodegradable plastics, in aerosols and talcum powders (Palaniswami and Peter, 2008). Hence, it is also ideal to use native starch by lesser yam in the making of starch-based edible coating.

Fruit is a living and respiring goods. Shelf life of fruits can be extended by altering its quality (appearance, texture, flavor, and aroma) characteristics such as carbohydrates, organic acids, water content, texture profiles, appearance or by

delaying the postharvest process. Postharvest handling has enabled several fruits to be coated. The basic principle is similar to CA or MA storage where oxygen uptake is reduced and leads to increasing amount of $CO_2$ which can delay the internal oxidation process (Sinha *et al.*, 2012).

Edible coatings can behave as active coating because it can interact with the coated fruit and its environment. The active properties of coating refers to substance such antimicrobials that can inhibit the fruit degradation (Rodrigues and Fernandes, 2012). Direct application of antimicrobial agents on the food surface was observed to be less effective due to rapid diffusion of the active substances into the food. For this reason, the incorporation of antimicrobials into edible films and coatings can enhance the inhibitory effects towards spoilage and pathogenic bacteria (Grau *et al.*, 2009).

Two types of many antimicrobial agents which can be added into edible films are synthetic and natural antimicrobials (Grau *et al.*, 2009). The use of these antimicrobials have been proven to control the postharvest of various fruits and vegetables. When sliced apples and potatoes were dipped in a polysaccharide or protein edible coating containing sodium benzoate as chemical antimicrobial agent, the shelf life was extended by 1 week (Davidson *et. al*, 2005). On the other hand, the application of oregano oil as natural antimicrobial agent in film was found to prolong the shelf life of apples by reducing the amount of inoculated *Listeria innocua* (Grau *et. al*, 2009).

Strawberry is a non-climateric fruits, in which the amount of ethylene and respiration rate will go through a slow decline in respiration during ripening (Brückner and Wyllie, 2008). It has a short postharvest life and is susceptible to

mold such as *Botrytis cinerea*, *Rhizopus* sp. and *Mucor* spp. which produce a gray mycelium, breakdown in fruit juice. Postharvest treatment such as edible coating is able to minimize the quality deterioration and spoilage. (Barkai-Golan, 2001 and Rees *et. al*, 2012).

Research on lesser yam starch as edible coating to strawberry has been conducted in recent years. The research by Putera (2013) has revealed that the shelf life of strawberry can be prolonged for 26 days by using glycerol as the plasticizer. Whereas the research done by Lestari (2014) with a various combination of starch-glycerol and starch-sorbitol edible coating has exhibited a prolonged shelf life for up to 25 days for the combination of starch-sorbitol (6.5%-5.5%), 26 days for the combination of starch-glycerol (4.5%-2.5%) and 28 days for the combination of starch-sorbitol (4.5%-5.5%) when applied to strawberry.

However, these previous studies have not incorporated antimicrobials in the formulation. The addition of synthetic and natural preservatives as antimicrobial agents in this edible coating has the potency to reduce microbial growth and is expected to further extend the shelf life of strawberries. Based on those considerations, this research has concentrated on the investigation of previously formulated edible film but with the incorporation of antimicrobial agents in terms of film characteristic and the extension of strawberries' shelf life.

## 1.2 Research Problem

The utilization of lesser yam is still very less in Indonesia. Strawberry has a short shelf life. Previously, the application of lesser yam as starch-based edible

coating with the addition of glycerol or sorbitol as plasticizer has shown a promising and higher possibility to prolong strawberries' shelf life. However, the previous studies have not incorporated antimicrobial agents into edible coating formulations. Antimicrobials can reduce the number of bacteria and molds, thus, delay the deterioration in strawberry. Therefore in this research, the addition of oregano oil as natural and sodium benzoate as synthetic antimicrobial agent in the edible coating formulation is expected to further prolong the shelf life of strawberry.

## 1.3 Objectives

### 1.3.1 General Objective

The general objective of this research was to investigate characteristics of edible film from lesser yam starch added with antimicrobials, oregano oil or sodium benzoate and its application as edible coating to prolong shelf life of strawberry.

### 1.3.2 Specific Objectives

The specific objectives of this research were:

1. To isolate starch from lesser yam and analyze its yield and chemical characteristics.
2. To determine effect of starch-plasticizer mixture and antimicrobial on edible film physical and mechanical characteristics; and to select best among combinations of edible film to be used as edible coating.
3. To determine effect of the selected edible film formulations used for coating strawberry on shelf life and fruit characteristics including