CHAPTER I

INTRODUCTION

1.1 Background

One of the issue in food industry is food shelf life. There are even some foods that can only last within days. Edible film technique has been found to overcome with this issue (Maftoonazad and Badii, 2009). Edible film is a thin layer edible material applied on food surface to extend the shelf life of food, without altering the characteristic of the food product itself. Edible film is efficient and environmental friendly as it is consumed together with the food (Zambrano-Zaragoza, *et al.*, 2018). Starch based edible film is the most promising raw material as starch is inexpensive, abundant, biodegradable and edible (Wittaya, 2012).

Edible film is also considered as an effective carrier of bioactive compounds with antimicrobial and antioxidant properties that might enhance its function in prolonging the shelf life of food (Wu *et al*., 2012). Essential oil from clove bud (*Syzygium aromaticum*) is natural substance that has biological activities such as antibacterial, antifungal, insecticidal and antioxidant properties (Nunez and D'Aquino, 2012). Edible film incorporated with essential oil has been reported to show a great potential effect in increasing the shelf life of perishable food products like fresh-cut fruits (Antunes, *et al*., 2012). However, the incorporation of essential oil to edible film has some limitation as essential oil has low solubility and high volatility (Galus and Kadzinska, 2015). This can cause phase separation to occur in the incorporated edible film due to the high surface areas between the immiscible

constituents, resulting to a non-homogenous film (Abbas, *et al*., 2013). Double emulsion emerges as an alternative to this limitation. Double emulsion (W/O/W) or water in oil in water is defined as an emulsion of emulsion, where it is composed of small sized water droplets (W_1) contained within larger oil droplets (O) that are dispersed within an aqueous continuous phase (W_2). The functional food component in clove essential oil that act as antimicrobial could be encapsulated using double emulsion. With this kind of structure, it is easier for essential oil to be inserted subsequently to the edible film (Murillo, *et al*., 2011) and masking the strong odor from the clove oil (Hu, 2010).

1.2 Research Problem

Starch based edible film is the most commonly used and there are many types of starch available in the market with different amylose and amylopectin content that might influencing the physical, mechanical characteristic or antimicrobial activity of the film. Besides, edible film is an effective method for inserting a natural ingredient that has a beneficial property to the food product (Wu, *et al.*, 2012). Clove oil has been known to have antimicrobial properties (Nunez and D'Aquino, 2012). However, the incorporation of clove oil to edible film might produce a non-homogenous film. Double emulsion emerge as an alternative of this limitation as the double emulsion will encapsulate the clove oil making it suitable to be incorporated into edible film. Therefore, in this research different types of starch and concentration of double emulsion added were done to observe their suitability in the edible film and in terms of their antimicrobial activity.

1.3 Objectives

The objective of this thesis was divided into two, consisting of:

1.3.1 General Objectives

The general objective of this research was to produce tapioca (low amylose) and corn (high amylose) starch based edible film with double emulsion of clove oil as antimicrobial.

1.3.2 Specific Objectives

The specific objectives of this research were:

1. To extract clove oil from clove bud with distillation method and analyze its antimicrobial activity based on the minimum inhibitory concentration (MIC) towards *Escherichia coli, Staphylococcus aureus, Rhizopus stolonifer* and *Aspergillus niger.*
2. To study characteristics of clove oil double emulsion (W/O/W) by analyzing the droplet size, stability and viscosity.
3. To determine effect of type of starch and concentration of clove oil double emulsion on characteristics of edible film produced.