CHAPTER I

INTRODUCTION

1.1 Background

Sweet soy sauces, commonly known as *kecap manis*, is a popular condiment mostly consumed around Indonesia (Apriyantono et al., 1999). Sweet soy sauces are produced in a large range of manufacturing areas, from small backyard producers to large-scale *kecap* factories (Atmoko, 2015). With sweet soy sauces being widely produced, this implies the abundance of sweet soy sauces in Indonesia. In terms of production methods, producing sweet soy sauces differs slightly with salty soy sauces as sweet soy sauces usually add up an amount of coconut sugar and spices to create the distinctive sweet yet *umami* flavor (Apriyantono et al., 1999). A lot of Indonesian citizens utilize sweet soy sauce as a companion for most of their meals. Sweet soy sauces are known to be used as a condiment that adds up flavor and colors to various foods (Atmoko, 2015). People under all socioeconomic status consume it, from high, middle, or low (Ariesman, Prasmatiwi & Indriani, 2015). There has been an increase in soybean demand in Indonesia due to the increase of soy-based products, including sweet soy sauces (Aldillah, 2015). According to the data provided by *Badan Pusat Statistik* (2018), sweet soy sauces take up 61,4% of the quantity from the whole participation rate of consumption in Indonesia in September 2017. It is known that the sweet soy sauce industry is proliferating, primarily supported by culinary innovation and population growth (Atmoko, 2015). Many Indonesian people traveling overseas equip their travel needs with spices or condiments to 'bring a taste of home' along with them, including sweet soy sauces. However, up to now, the available form of sweet soy sauces sold commercially is limited to the thick and viscous liquid. It could be quite inconvenient for a few people due to the bottle size that may take up space and the liquid form that might spill out, which would be undelightful. Transforming the liquid form of sweet soy sauces into a powdered form could benefit convenience and storage. In order to produce powdered sweet soy sauces, spray drying methods could be utilized.

Spray drying is a relatively recent, yet functional drying technology which transforms liquid feed into a dry powder (Selvamuthukumaran, 2019). Compared to other drying methods, spray drying is considered to be able to dry a product more rapidly. It could turn a solution into a powder form in a single step that benefits profit maximization and process simplification (Afoakwah et al., 2012). In the food industry, spray drying has been commonly used towards dairy products such as milk, whey, cheese, buttermilk, and butter. Other foods, such as instant coffee, dry creamers, and instant soups, could also be spray dried (Afoakwah et al., 2012). Spray-dried products possess high functionality, good dispersibility, low moisture content, and high bulk density, known to reduce packaging size and storage costs (Selvamuthukumaran, 2019). Products can look appealing, retaining their nutritional qualities, and are convenient and easy to consume and transported (Chavan, Bhatt & Kaur, 2018). Barbosa-Cánovas et al. (2005) also stated that it is possible and easy to hold a continuous operation and can withstand food materials that are heat-sensitive, heat resistant, corrosive, and abrasive. With all the properties as mentioned earlier from spray drying food products, it could be seen that the spray drying method could benefit consumers as well as producers. Despite spray drying being widely used for a wide array of food products, it may be troublesome for foods with high sugar content, which usually results in the adherence of powder to the drying chamber and agglomeration (Goula & Adamopoulos, 2008).

Processes of spray drying often utilize carrier agents to facilitate the whole process (Tran & Nguyen, 2018). Substances such as starch, modified starch, maltodextrin, solid corn syrup, and gum Arabic are among the called carrier agents (Tran & Nguyen, 2018). Maltodextrin has been the most commonly used drying agent for spray drying due to its beneficial role as a carrier; it has been used to protect heat-sensitive components and increase products' stability (Mishra, Mishra & Mahanta, 2014). It is known to permit an increase of solid contents of emulsions and is low in cost compared to other drying agents known (Anandharamakrishnan & Ishwarya, 2015). However, maltodextrin lacks in emulsifying capacity, thus works better when combined with other drying agents such as gum Arabic which is pH stable (Anandharamakhrishnan & Ishwarya, 2015). Both maltodextrin and gum Arabic are

highly soluble and low in viscosity, which aids the spray drying process in general (Varastegani et al., 2017). Concerning sweet soy sauces, it consists of relatively high sugar, which may be considered as a hurdle for spray drying. Foods with high sugar content tend to stick to the drying chamber. Both maltodextrin and gum Arabic have high solubility and less viscosity. A blend of both is proved to overcome stickiness problems, reduce hygroscopicity, and protect sensitive food components such as phenolics and vitamins (Muzaffar, Nayik & Kumar, 2015). Studies regarding spray dried sweet soy sauces are still minimal; thus, this study aims to apply the spray drying process to sweet soy sauce and observe its physicochemical properties to develop an alternative for the existing liquid product.

1.2 Problem Formulation

a. What is the effect of different gum Arabic concentrations to maltodextrin towards the physicochemical properties of the spray-dried sweet soy sauces?
b. What is the effect of different inlet temperatures on the physicochemical properties of the spray-dried sweet soy sauces?

1.3 Objectives

The objectives of this project include:

a. To develop a spray-dried sweet soy sauce product.
b. To determine the effects of three different ratios of powdered gum Arabic and maltodextrin towards the physicochemical properties of spray-dried sweet soy sauce.
c. To investigate the effect of different inlet temperatures towards the physicochemical properties of spray-dried sweet soy sauces

1.4 Research Scope

This study focuses on developing a powdered sweet soy sauce by utilizing spray-drying methods. The scope of this study is the exposure towards an array of physicochemical properties analysis starting from (1) preparing a mixture of sweet soy sauce with maltodextrin DE 10-12 and a mixture of maltodextrin and gum Arabic with ratios of (GA: MD) 0:8, 1:7, 3:5 (2) spray drying sweet soy

sauces under inlet temperatures of 150°C and 200°C (3) observing the yield of powder by collecting and weighing powdered samples (4) analyzing bulk and tapped density of powder by pouring samples into a graduated cylinder then further tapped to obtain bulk and tapped density, respectively (5) measuring the solubility and dissolution rate of powdered samples by mixing samples with distilled water then stirred using a magnetic stirrer and centrifuged and dried in an oven (6) measuring the moisture content of samples by putting samples inside a crucible then dried in an oven (7) measuring water activity of samples by utilizing the water activity meter, and (8) observing the color of samples using a colorimeter and reading the L*a*b values.