Chapter 1: Introduction

1.1. Background

Sweet soy sauce is a popular condiment in Indonesia and several other Southeast Asian countries (Syifaa, Jinap, Sanny, & Khatib, 2016). It is also an important component in several Indonesian delicacies. Per capita consumption of soy sauce in Indonesia stayed above 800 grams since 2015, and it was predicted to increase above 900 grams by 2020 (Indonesian Ministry of Agriculture, 2019a). Soy sauce is also a notable export commodity for Indonesia with annual export value above USD 17 million since 2015 (Indonesian Ministry of Agriculture, 2019b).

Liquid products could be converted into powder through spray drying technology. In spray drying process, a feed solution is sprayed into small droplets and evaporated with hot air, thus resulting in particles of the solids contained in the feed solution. This technology has been commonly used since 1970 (Schuck, Jeantet, & Dolivet, 2012). Converting liquid products into powder could improve the shelf-life of the product and reduce distribution costs (Verdurmen & de Jong, 2003). This technology has been applied to Japanese soy sauce (Wang & Zhou, 2012; Wang, Dufour, & Zhou, 2015). Applying spray drying on sweet soy sauce could improve the distribution efficiency of sweet soy sauce, particularly as an export commodity. Aside from reconstitution into sweet soy sauce, the powder itself could also be utilized directly, for example as seasoning for dry snack products.

However, spray drying is a relatively complex process as there are several process parameters to control. One of the most critical spray drying parameters is the inlet air temperature. High inlet air temperature is needed for an adequate drying rate, but it could also damage the product (Patel, Patel, & Suthar, 2009). Therefore, many studies use inlet air temperature as an independent variable to obtain the optimum temperature for the spray-dried products.

Characteristics of feed solution is also important in a spray drying process, particularly for products with high sugar content. Compounds with low molecular weight, such as sugar, will cause high hygroscopicity and low glass transition temperature on the powder, thus resulting in stickiness and low powder yield (Muzaffar, Nayik, & Kumar, 2015). To solve this issue, carrier agent or drying aid

is usually added into the feed solution. The most common carrier agent in a spray drying process is maltodextrin. While maltodextrin could improve the properties of spray-dried products, high maltodextrin concentration might also result in less desirable powder properties, such as pale color (Papadakis, Gardeli, & Tzia, 2006; Tze et al., 2012) and reduced solubility (Mahendran, 2011). The optimal carrier concentration is usually determined through trial-and-error (Shishir & Chen, 2017). Therefore, this study will analyze the effect of inlet air temperature and ratio between carrier agent and product to the properties of sweet soy sauce powder.

1.2. Objective

The objective of this study is to produce sweet soy sauce powder from feed solutions containing different sweet soy sauce solids:maltodextrin ratios, and spray-drying at different inlet air temperatures. The resulting powders will then be analyzed in terms of yield, moisture content, water activity, hygroscopicity, flowability, dissolution time, solubility, and color.

1.3. Problem Formulation

The problems that are going to be solved in this study are as follows:

1. What are the effects of inlet air temperature towards the physical properties of sweet soy sauce powder?
2. What are the effects of sweet soy sauce solids:maltodextrin (S:M) ratio towards the physical properties of sweet soy sauce powder?
3. Which inlet air temperature and sweet soy sauce solids:maltodextrin (S:M) ratio results in sweet soy sauce powder with the best physical properties?

1.4. Scope of the Study

This study uses commercial sweet soy sauce in the formulation. The independent variable is limited to inlet air temperature and sweet soy sauce solids:maltodextrin (S:M) ratio in the feed solution. Other spray drying parameters are determined based on preliminary trials. The analysis is also limited to physical properties of the sweet soy sauce powders (without reconstitution).