CHAPTER I

INTRODUCTION

1.1 Background

Color is one of the important factors in consumer interest in food products. Generally, producers will add colorants to their processed food so that the color of the product can attract consumer tastes. However, most of the dyes commonly used for processed food are artificial or synthetic dyes, which may have adverse health effects, such as toxic and carcinogenic effects (Lestario *et al.*, 2004). Along with increasing public awareness of health, the use of natural dyes is believed to be safer for health. One of the natural pigments that have potential as an alternative to synthetic dyes is anthocyanin. Anthocyanin are pigments belonging to flavonoid compounds, a group of water-soluble plant pigments that can be found in some flowers, fruits and vegetables that are responsible for causing orange, orange, red, purple, or blue colors. (Aishah *et al.*, 2013).

One of the plants known to be rich in anthocyanin is rosella (*Hibiscus sabdariffa*). Rosella is a flower that has been cultivated and widely distributed worldwide, including Indonesia. As stated by Lema *et al.* (2021), the total anthocyanin content of roselle is 1500mg/L. Anthocyanin from roselle calyx can be obtained by extracting the plant using certain solvents to obtain a concentrated extract. However, natural dyes in concentrated form have poor stability because they are easily degraded by several factors such as oxygen, light, temperature, and

pH, and have a relatively short shelf life, thus a method is needed to make dyes in a more stable form.

Palupi *et al.* (2014) stated that microencapsulation method can produce more stable dyes by producing dyes in powder form. Microencapsulation is carried out with a coating material that encloses the core material or active substance to reduce the degradation of the active compound in the material. The type and ratio of coating agent is an important factor to be considered in the microcapsules powder physical and chemical properties. An ideal coating material should have the ability to stabilize the microcapsules, which have high encapsulation efficiency, good solubility, and able to maintain the active substance. However, with all the criteria mentioned before, it is difficult to be achieved by only a single coating agent, therefore most studies used combination of coating agent (Baysan *et al*., 2021). Yinbin *et al.* (2018) stated that a properly combination of coating agent for microencapsulation could compensate the limitation of a single coating agent and improve the product quality and stability.

One of the most commonly used coating material is maltodextrin. Lestari *et al.* (2019) stated that maltodextrin can protect the active compound that is sensitive to oxidation or heat, it can also maintain the stability of the material during the drying process with a spray dryer. A study was done by Nining *et al*. (2017) show that the particle size and hygroscopicity of the roselle extract decrease, water solubility increases, and had an encapsulation efficiency value of 97.73% with the addition of maltodextrin. Research conducted by Ying *et al.* (2013) stated that mixtures of whey protein isolate and starch have been used for probiotics

microencapsulation and incorporated in low pH beverages. Moreover, a study from Chung *et al*. (2015) showed that whey protein isolate can increase the stability of anthocyanin by forming complexes through hydrogen bonding. Based on the research, addition of whey protein isolate conferred better color stability than the pectin after 7 days of storage. Another research by Moser *et al.* (2017) studied the combination of maltodextrin and whey protein isolate on the grape juice. It is stated that the combination of maltodextrin and whey protein resulted in a brighter color of grape juice powders, had good solubility, low water content, high anthocyanin retention, and high encapsulation efficiency. However, combination of maltodextrin and whey protein isolate has not been conducted for microencapsulation of roselle anthocyanin extract. Thus, this research was conducted.

The microencapsulation method that is commonly used is spray drying, in which the material is sprayed onto a drying medium at high temperature to convert the material into a powder or agglomerated product. As stated by Gouin (2004), spray drying is used because it could encapsulate active compounds and protects them, useful for heat sensitive material due to exposure time to elevated temperature is very short (5-30s). By using spray drying, it is possible to obtain powdered microparticles with low water activity, so it can facilitate the handling and storage of the product and ensure the microbiological quality characteristics of product (Gharsallaoui *et al*., 2007). By combining whey protein isolate and maltodextrin in roselle extract encapsulation using spray drying method, it was expected that the microcapsules of extract from roselle calyx could be more stable.

1.2 Research Problem

Food coloring is usually used for food products to enhance the color and make the appearance of the food or drink more attractive. The use of synthetic dyes is relatively more often used for food products because it is more stable. However, the use of synthetic dyes in food products can cause negative effects on human health because they have the potential to be carcinogenic and allergic, which make the synthetic dyes not completely safe for long-term consumption (Sajda, 2021). Along with increasing public awareness about health, natural dyes are believed to be safer for consumption. Roselle is a plant that has the potential as a natural dye because it contains high anthocyanin. However, natural dyes are usually less stable and have a relatively shorter shelf life in liquid media, and are more easily degraded due to several factors such as pH and temperature, so a method is needed to improve the stability of the dye. Microencapsulation is one of methods which can be used to stabilize the anthocyanin pigment in powder form. An ideal coating material should have the ability to stabilize the microcapsules, which have high encapsulation efficiency, good solubility, and able to maintain the active substance. However, with all the criteria mentioned before, it is difficult to be achieved by only a single coating agent, therefore most studies used combination of coating agent. Maltodextrin is one of the most common coating materials to produce microcapsules and whey protein isolate is an emulsifier that can be used for microencapsulation because it can help to stabilize the anthocyanin pigment. However, there was no research conducted on forming microcapsules from roselle calyx by using combination of maltodextrin and whey protein isolate.

1.3 Objectives

1.3.1 General Objectives

The general objective of this research was to determine the stability of microencapsulated roselle extract.

1.3.2 Specific Objectives

The specific objectives of this research were:

1. To determine the preferred ratio of coating agent based on physical and chemical characteristics of microcapsules produced.
2. To determine the effect of pH and temperature towards the stability of microcapsules of roselle calyx extract.