CHAPTER II
LITERARTURE REVIEW

2.1 Ingdredient Review

2.1.1 Purple Sweet Potatoes (Ipomoea Batatas)

Figure 2. 1 Purple Sweet Potato

The tuberous crop known as purple sweet potato, which is primarily grown in hot and humid regions like the South East Asia region, is abundant in a valuable source known as "anthocyanins," but it is also highly perishable (Nevara et al., 2019). Anthocyanins have been regarded as the major biological molecule and are accountable for the deep purple colour of purple sweet potatoes (Li *et al.,* 2019). The purple pigment (anthocyanin) in purple sweet potatoes is useful as an antioxidant because it can interact with free radicals in the body cells to lessen their ability to cause damage. The purple sweet potato contains anthocyanin color pigments and the range of anthocyanin content in purple sweet potatoes is 107.8 mg to 174.7 mg/100 fresh weight. (Kurnianingsih et al., 2019). Several studies have shown that anthocyanins also an important role in maintaining human health and added some colour to food products (Jiang *et al.,* 2019). Due to consumer demand for natural, safer, and healthier food products, the use of natural pigments is being considered as a replacement for synthetic food colorants. The pH condition affects the stability colour

of anthocyanin extract (Ekaputra & Pramitasari, 2020). As the pH of the anthocyanin increases, the colour will shift from red to pink, violet, blue, green, and yellow (Pham *et al.,* 2019). Purple sweet potato that are used in this study can be seen in **Figure 2.1**.

2.1.2 Miana Leaves (Coleus scutellaroides)

Figure 2. 2 Miana Leaves

Miana *(Coleus scutellaroides)* is an ornamental plant with a single leaf that have a purple colour. Anthocyanin pigments from miana leaves can be used as a natural pigment for various staining purposes, particularly in the food industry. Anthocyanin pigment from miana leaves is stable at 100^{o}C for up to 60 minutes of heat exposure and the content of anthocyanin in miana leaves is 0,435 mg/g of leaf wet weight (Ayu *et al.,* 2018; Puspita *et al.,* 2018). The main reason that miana leaves can be another source of anthocyanin other than purple sweet potato is harvesting anthocyanin on miana leaves can be done at any time and does not depend on the season due to its abundant availability in nature (Puspita *et al.,* 2018). Miana *(Coleus scutellariodes [L] Benth)* is a well-known and frequently used traditional herbal remedy that has antibacterial, anti-inflammatory, antioxidant properties, and lowering cholesterol due to its flavonoid, tannin, triterpenoid, steroid, saponins and atsiri oil content (Marlina *et al.,* 2022; Mahata *et al.,* 2022). Flavonoid and tannin compounds that

are found in mania leaves has antibacterial activity because it can denature and coagulate bacterial cell protein (Syamsuri et al., 2018).In Toraja ethnic communities (in the province of South Sulawesi, Indonesia), it is one of the medicinal plants that is frequently used (Yanto *et al.,* 2020). The Southeast Asian ornamental plant known as miana (Coleus atropurpureus, L.) has a wide range of styles, shapes, and colors, but its medicinal properties are found in its brownish red leaves (Fati *et al.,* 2019). The Minister of Agriculture has authorized Color Blaze Dark Star, a variety of P. scutellarioides with brown to black purple leaves and also known as "miana" or "jawer kotok" or "iler" in Indonesia, to be used as a medicinal plant (Astuti *et al.,* 2021). Miana leaves that are used in this study can be seen in **Figure 2.2**.

2.1.3 Tapioca Starch

Tapioca starch is a type of flour made from the starchy roots of the cassava plant. It is commonly used as a thickening agent in cooking and baking, and it is also a popular ingredient in gluten-free and grain-free recipes (S. K. Widyastuti *et al.,* 2022). Cassava starch, known as tapioca, is frequently used as a component or additive in a variety of foods (Kamsiati *et al.,* 2022). Tapioca flour has a neutral taste and a fine texture, making it versatile in various culinary applications. It can be used to make gluten-free bread, cakes, cookies, and other baked goods. It is commonly used in gluten-free products due to its versatility and ability to mimic some of the properties of gluten. (S. K. Widyastuti *et al.,* 2022).

2.1 Product Review

The need for the development of new food manufacturing techniques that will produce convenient, ready-to-eat, safe, and always accessible food products has been prompted by the growing global population and modern consumers' demands. The synergistic effects of micronutrients and

phytochemicals like phenolic acids, sterols, tocols, tannins, and anthocyanins as well as dietary fiber, which are primarily found in the outer bran layer and the germ, may be responsible for the health benefits of whole cereal grain (Saleh *et al.,* 2019). Some used seeds (rice, barley, oats, millet, sorghum, maize), while others are made into flour (wheat, rye, maize), or flakes (barley, oats, maize). Their technological importance is determined by their protein content, which is correlated with the quantity and quality of their proteins (Guerrieri & Cavaletto, 2018). Epidemiological studies have shown that the consumption of whole cereal grains is correlated with a lower risk of developing cardiovascular and chronic diseases such as cancers, diabetes, and obesity. Cereals comprise an essential source in the human diet and a significant part of livestock feed for thousands of years, while their processing represents a substantial asset to the food production chain. (Galanakis, 2022). Cereal grains are energy dense, offering significant amounts of carbohydrates, proteins, fibers, B group vitamins, tocopherols, and trace minerals. Global cereal consumption provides more than 56% of the energy and 50% of the protein consumed globally. Cereal-based products have always formed the foundation of the food pyramid, and their consumption is advised in all dietary guidelines ("Sustainable Recovery and Reutilization of Cereal Processing By-Products," 2018).

2.2 Process Review

2.2.1 Hot Sand Frying

Hot sand frying is a type of frying that can be done with or without oil. With hot sand frying, heat is transferred from the sand to the food through direct contact between the heating plate and the solid. In deep-fat frying, heat is transferred through direct contact between the heating plate and cooking oil as the heat transfer medium. The temperature ranging for hot sand frying is from 120-160ºC and this method is usually done for about 10-25 seconds (Jamaluddin *et al.,* 2019).

Hot sand frying has a number of benefits over deep-fat frying, including the lack of frying oil absorption into the food, which prevents the food from quickly going rancid, the lower cost of sand, and the ease of drying food under the sun at 35 to 45° Celsius if the texture of the food is lost (Jamaluddin *et al.,* 2019). In addition to reducing smoke production during operation, this method can have quick and uniform heat transfer, a larger contact area, controllable fire intensity, high yield, and efficiency (Mei-Yu *et al.,* 2020).

Despite all the advantages, there's also some disadvantage to this method, which is the absence of the savory flavor that results from the use of frying oil. During the hot sand frying process, heat is transferred from the sand to the product, and mass transfer in the form of water or moisture is transferred from the internal part of the product to the surface (or called evaporation), which results in physical and chemical changes to the product (Jamaluddin *et al.,* 2019).

2.2.2 Drying Method

Food drying is an traditional method of food preservation that is a natural process that removes moisture, including water and oil from food. Food dehydrators are used to preserve and extend the shelf life of many foods such as fruits, vegetables, and meats. (Bowornprasittikun *et al.,* 2019). The process of drying involves removing the vegetable's extra humidity. In the drying process, the vegetable was dehumidified by the isothermal process, specific sensors were used in the system to control the temperature for the vegetables, and an ideal temperature was provided to dry the product without burning the vegetables. The portable method is the use of a dehydrator for the removal of water content from the food (Senthilkumar *et al.,* 2020).