The Addition of Maltodextrin on Characteristics of Red Dragon Fruit Skin (*Hylocereus costaricensis*) Instant Powder Using Freeze Drying Techniques

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Abstract:- The aim of this study was to determine the addition of maltodextrin on pH, total dissolved solids, antioxidant activity, color, organoleptic and the particles size of red dragon fruit skin instant powder using freeze drying technique. Randomized Completely Block Design (RCBD) was used with the addition of maltodextrin 15%, 30%, 45%, 60% and 75% with four replications. The parameters to be observed were pH, total dissolved solids, antioxidant activity, color, organoleptic and particle size. Data were analyzed using Analysis of Variance at 5% significant level and continuied using Duncan's test at the same level. The results showed that the addition of maltodextrin concentration had a significant effect on pH, total dissolved solids, antioxidant activity, color and organoleptic of dragon fruit skin powder. The addition of 75% maltodextrin indicated best value with a pH of 4.89; total dissolved solids 8.22; antioxidant activity 62.84; Hue value 346.75 and organoleptic score for color 3.20; aroma of 2.80 and flavor of 3.13.

Keywords:- *Maltodextrin, Red Dragon Fruit Skin Powder, Freeze Drying.*

I. INTRODUCTION

Shifting lifestyle including diet causes an imbalance between antioxidant and pro-oxidant compounds in the body. This imbalance causes oxidative stress which leads to the occurrence of several degenerative diseases such as diabetes mellitus, atherosclerosis, cancer and cardiovascular [12]. World Health Organization in 2011 shows that various degenerative diseases are included in the top ten causes of human deaths worldwide [4]. One way to prevent degenerative diseases is by balancing antioxidants and pro-oxins in the body by consuming foods containing bioactive compounds including consuming fruits and vegetables.

Nowadays the bioactive components found in fruits are becoming popular because they are good for health. One of the bioactive components is the color component of the fruit itself, one of which is dragon fruit [13]. Dragon fruit is a tropical fruit that is much favored by the community because it has properties and benefits and nutritional value is quite high. The portion of the 30-35% red dragon fruit is the skin of red dragon fruit but is often only disposed of as garbage. It is unfortunate because the benefits of red dragon fruit skin are not used as food additives such as food coloring. Red dragon fruit skin contains natural pigments that can be used as natural food coloring [9]. The red color of dragon fruit skin is caused by anthocyanin content. Anthocyanin is a flavonoid phenolic compound which gives red, purple color to fruits and vegetables that are antioxidants [9]. Anthocyanin pigments are easily damaged if fruits and vegetables are processed at high temperatures, high sugar content, pH and acid can affect the rate of damage [5]. According to Hidayah *et al*. [10], anthocyanin is stable at pH 2-5. Looking at the anthocyanin properties that are unstable and easily degraded, it is very appropriate to use microencapsulation technology, which is expected to protect anthocyanins from the factors that cause degradation [6]. Encapsulation is a technique of entrapment of core material in certain encapsulating materials. Encapsulation is able to protect bioactive components of food such as antioxidants by creating barriers that benefit the encapsulated material [25]. The right technique for the encapsulation process is by using the freeze drying technique.

Freeze drying is an alternative encapsulation process for producing powder with high antioxidant content. The advantage of using freeze drying is seen from its quality which does not cause wrinkled surfaces, more porous, lower density, easily refreshed, normal color, flavor quality and nutritional value can be maintained [17. According to Sembiring [17] research on the quality of dried bitter extract, the method of drying with freeze dryer is better than the oven. Therefore encapsulation using freeze drying is perfect for instant powder drinks. In the encapsulation process, things to consider are the type of encapsulation used. Gum arabic, maltodextrin and whey are encapsulants that are often used because of their ability to dissolve more easily and lower viscosity [23]. Maltodextrin has a very high solubility in water, is slightly soluble in ethanol, and its solubility will increase with increasing DE (Dextrose Equivalent) [5]. Besides that, maltodextrin is cheaper than arab gum and others, so it is recommended to be used for encapsulant materials.

The effect of encapsulation homogenization with ingredients also needs to be considered in the success of encapsulation. According to Sirojuddin et al., [20] about photostability and thermostability of tomato pigments encapsulated using maltodextrin, the optimum speed was obtained at stirring speed of 700 rpm. Meanwhile, Ernawati et al. [6], the characteristics of the natural microencapsules of teak leaves, maltodextrin with a speed of 1000 rpm homogenizer produced microstructure with the best characteristics. Furthermore, Silitonga and Sitorus [19] conducted on the encapsulation of anthocyanin pigment in purple eggplant skin, showing that the optimum encapsulation conditions at 50% maltodextrin concentration and 600 rpm stirring speed with the highest encapsulation efficiency was 63.85%.

Setiawan's [18] study of aloe barbadensis Miller instant powder drink was obtained at a variation of 22.5% maltodextrin using a cabinet dryer with a heating temperature of 90 °C in terms of good physical, chemical and microbiological properties and organoleptic preferred by panelists. Yuliawaty and Susanto's [24] regarding the instant powder drink of Noni leaves, indicated that 18 hours long drying using a cabinet dryer with 10% maltodextrin concentration was the best in terms of taste, color and aroma.

II. MATERIALS AND METHODS

The Experimental Method which consisted of 5 malltodextrin concentrations (15, 30, 45, 60 and 75 %) with four replications [8]. The research consisted of two stages, namely the making of red dragon fruit skin extract and the encapsulation process. The procedure for making red dragon fruit skin extract includes sorting, washing, crushing with the addition of distilled water and filtering. The procedure for the encapsulation process includes the addition of maltodextrin, homogenization, freezing, drying and packaging. The parameters observed included chemical parameters consisting of pH [3], total dissolved solids [3], antioxidant activity of the DPPH method [7], color (Msez User Manual), organoleptic parameters consisting of colors , aroma, taste and thickness of hedonic and scoring test methods and particle size [2].

III. RESULTS AND DISCUSSION

The results showed that the addition of maltodextrin concentration had a significant effect on pH, total dissolved solids, antioxidant activity, color and organoleptic value. The degree of acidity (pH) is the concentration of hydrogen ions contained in a solution.

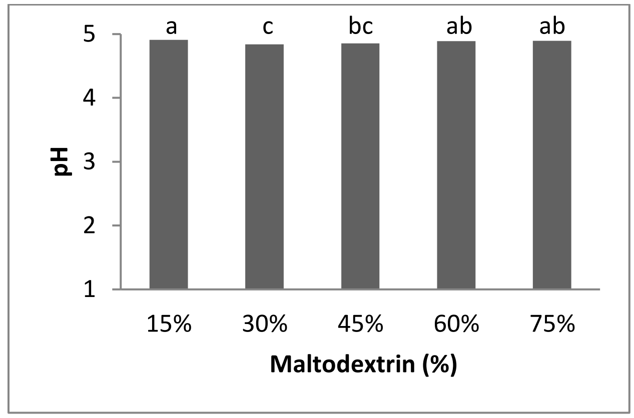

Fig. 1:- pH value of red dragon fruit skin powder instant drink.

The results of the diversity analysis with a confidence level of 5% showed that the addition of 15% maltodextrin concentration had a significantly different effect with the addition of 30% and 45% maltodextrin concentrations but did not give a significantly different effect with the addition of 60% and 75% maltodextrin concentration. It is also seen that dragon fruit skin powder with a 15% maltodextrin concentration has the highest pH with the lowest acidity level, and tends to decrease slightly with the addition of maltodextrin concentration. The pH value of the red dragon fruit skin powder drink shows a low acidity level. This is because dragon fruit skin contains stable anthocyanin compounds at pH 2-5 [10]. The pH value of fresh red dragon fruit skin is 4.08, this indicates that the pH of red dragon fruit skin is still stable under acidic conditions, but after the addition of the concentration of maltodextrin the pH value increases which ranges from 4.89-4.91. an increase in pH in red dragon fruit skin powder drinks was caused by the pH value of the maltodextrin approaching neutral, namely 6.8. According to Yuliawaty et al.,[24] the pH value of maltodextrin ranges from 4-7.

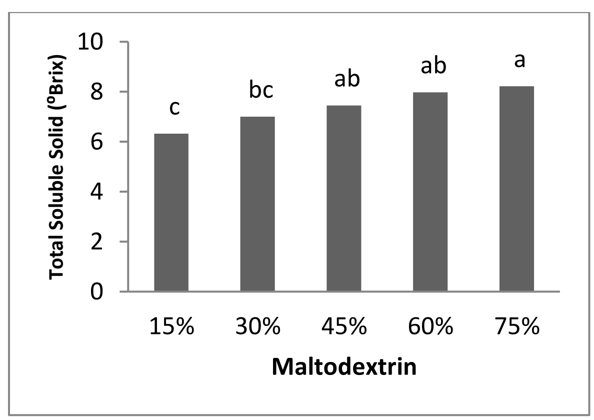

Fig. 2:- Total Value of Dissolved Solids of Dragon Fruit Skin Instant Beverage

The results of diversity analysis with a confidence level of 5% showed that the addition of 15% maltodextrin concentration did not give a significant effect with the addition of 30% maltodextrin concentration but gave a significantly different effect with the addition of 45%, 60% and 75% maltodextrin concentrations. Red dragon fruit skin powder drink with 75% maltodextrin concentration has the highest total soluble solids, while powder drinks with the addition of 15% maltodextrin concentration have the lowest total dissolved solids value. This shows that the increasing concentration of maltodextrin results in a red dragon fruit powder powder with higher total dissolved solids (Fig.2).

Red dragon fruit skin instant drink with the addition of maltodextrin (15%, 30%, 45%, 60% and 75%) has a higher value of total dissolved solids (rixBrix), namely 6.325, 7, 7.45, 7.975 and 8,225. According to Wijana *et al*., [22] the higher the concentration of maltodextrin used, the greater the amount of simple sugars such as glucose, maltose, maltotriosa and saccharide in it, so that the sugars will dissolve in water, which also shows more solid content dissolved in a solution will make the solution thicker and fading and so ^{0}Brix solution that contains a lot of dissolved solids is greater in value than a solution with less dissolved solids [21].

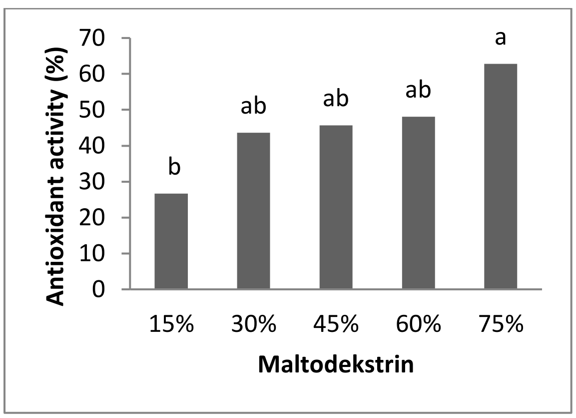

Fig.3:- Antioxidant Activity of Red Dragon Skin Powder Instant Beverage.

Whether or not the antioxidant activity can be analyzed by the DPPH method (2,2-diphenil-1-picrylhydrazil radical). DPPH solution containing sample extracts was measured for light absorption and calculated for antioxidant activity [7]. The results of diversity analysis with a confidence level of 5% showed that the addition of a 15% maltodextrin concentration did not have a significant effect with the addition of 30%, 60%, 45% maltodextrin concentration and yet had a significantly different effect with the addition of 75% maltodextrin concentration. Red dragon fruit skin powder drink with a concentration of 75% maltodextrin has the highest antioxidant activity, while fresh red dragon fruit skin has a low antioxidant activity which is 15.17%. This shows that the addition of maltodextrin can increase the antioxidant activity of the drink of dragon fruit skin powder.

The antioxidant activity in this study was higher as the addition of higher concentration of maltodextrin. According to Silitonga and Sitorus [19], an increase in antioxidant activity caused by maltodextrin can protect the release of nutritional components, protect bioactive compounds such as antioxidant compounds. This is agreed with Rakasiwi *et al*.,[15], that the encapsulation wall of maltodextrin can function to protect sensitive components such as antioxidant components, taste, vitamins, colors and other nutritional components. Antioxidant compounds found in red dragon fruit skin are anthocyanin compounds, where maltodextrin has a strong binding capacity to anthocyanin compounds. The freeze drying process can also protect antioxidant compounds from red dragon fruit skin powder drinks, because the freeze drying device uses freezing temperature and vacuum pressure so that it can retain anthocyanin compounds from its decredited causes.

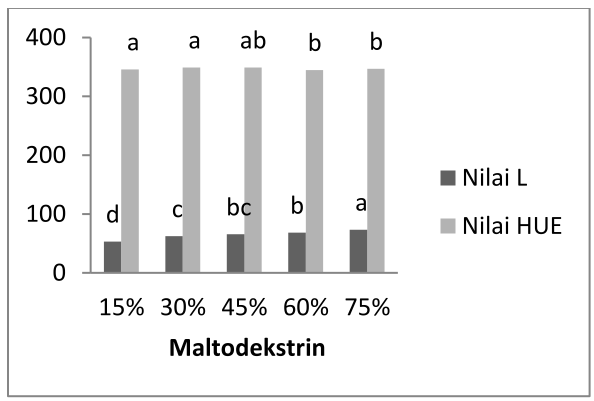

Fig. 4:- L and *Hue* value of of Red Dragon Skin Powder Instant Beverage.

➢ *Color*

The color of a material can be measured using a colorimeter tool. The color quality parameters produced from the colorimeter tool are L (lightness), a (redness) and b (yellowness), after the values a and b are generated then the value of hue is calculated. Where the value of hue represents the dominant wavelength determines whether the color is red, green or yellow [23]. The results of diversity analysis with a confidence level of 5% showed that the addition of a 15% maltodextrin concentration had a significantly different effect with the addition of 30%, 60%, 45% and 75% maltodextrin concentrations (Fig. 4). Red dragon fruit skin powder drink with 75% maltodextrin concentration has the highest L value (brightness), while powder drink with the addition of 15% maltodextrin concentration has the lowest L value (brightness). The L value represents a brightness level of 0 (zero) for black to 100 for white. Increasing the higher concentration causes a higher value of L (brightness). According to Ernawati et al. [6], this was due to the addition of white maltodextrin so that when mixed with dragon fruit skin extract which was purplish red it would give a bright color along with the addition of maltodextrin, the brightness of red dragon fruit skin powder drinks increased. The value of hue is influenced by the values of a and b, showed that the addition of maltodextrin concentration did not have a significant effect on red dragon fruit skin powder drinks. The value of the hue produced ranges between 342-18 values, so the color of the red dragon fruit skin powder drink is included in red purple (Fig.4). According to Winarno [23], the concentration of pigment is also very important in determining the color (hue). At concentrations which are runny anthocyanins are blue, on the contrary in concentrated concentrations are red and ordinary concentrations are purple.

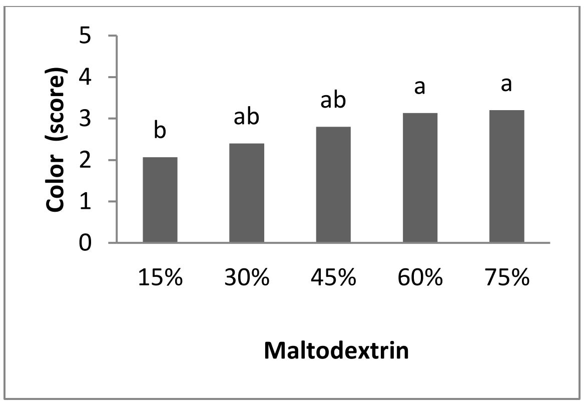

Fig. 5:- Color Test for Red Dragon Fruit Skin Powder Drinking
Scoring Value: 1= Very Red 2 = Red 3 = Slightly Red 4 = Purplish 5 = Purple

The level of panelist scores on the color of drinks of red dragon fruit skin powder had a significantly different effect on the addition of the concentration of maltodextrin. The scale of the panelist score on the color of powder drinks ranges from 2 to 3.2, which is red to slightly red (Fig.5) The red color in red dragon fruit skin powder drinks is caused by the presence of anthocyanin compounds.

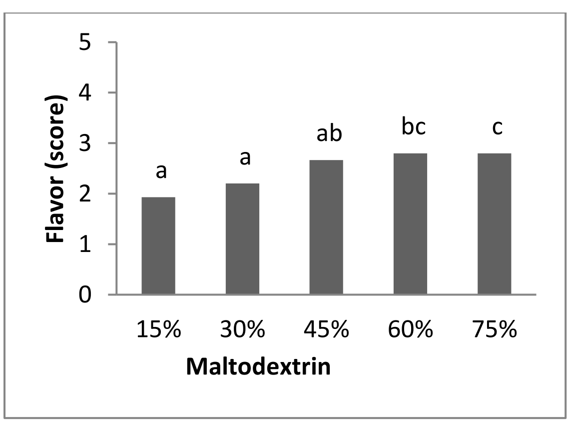

Fig. 6:- Scoring Test for the flavor of Red Dragon Fruit Skin Powder Drinks
Aroma Scoring Value: 1 = Very Scented dragon fruit skin 2 = Scented dragon fruit skin 3 = Slightly scented dragon fruit skin 4 = Not dragon fruit skin scent 5 = Very not scented dragon Fruitskin.

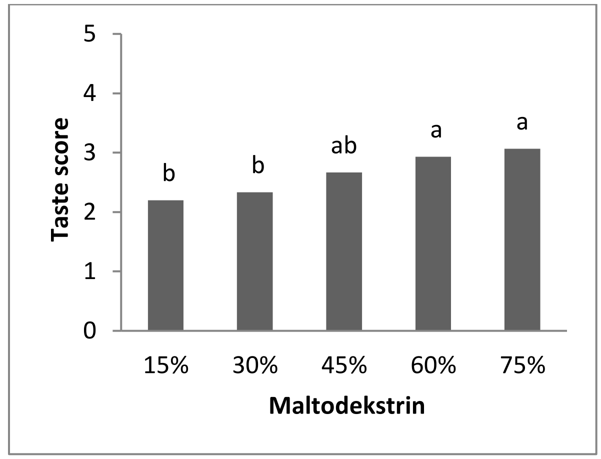

Fig. 7:- Red Dragon Fruit Skin Drink Scoring Test Taste Scoring Value: 1 = Strongly Feel the Skin of a Dragon Fruit 2 = Feel the skin of a dragon fruit 3 = Somewhat Feel the skin of a dragon fruit 4 = Not Feel the skin of a dragon fruit 5 = Very Not Feel the skin of dragon fruit.

Based on Figure 6 the results of diversity analysis with a confidence level of 5% showed that the addition of 15% maltodextrin concentration did not give a significant effect with the addition of 30% and 45% maltodextrin concentrations, but had a significantly different effect with the addition of 60% and 75% maltodextrin concentrations. The panelist score level scale for powder drink color ranged from 1.9 to 2.8, which smelled of dragon fruit skin until it was slightly scented with red dragon fruit skin. This shows that the addition of the concentration of maltodextrin still gives the flavor of dragon fruit skin because the skin of the red dragon fruit has an unpleasant. flavor.

The results of the analysis of diversity with a confidence level of 5% showed that the addition of 15% maltodextrin concentration did not have a significant effect with the addition of 30% and 45% maltodextrin concentrations, but had a significantly different effect with the addition of concentration 60% and 75% maltodextrin (Fig.7).

The scale score of the panelists on the color of powdered drinks ranged from 2.2 to 3.0, which was the taste of dragon fruit skin until it felt somewhat dragon fruit skin. This shows that the addition of the concentration of maltodextrin still gives the taste of red dragon fruit skin, this is presumably due to the absence of sugar and flavor during the process of making powder drinks.

The particle size of red dragon fruit peel powder added the concentration of maltodextrin 15%, 30%, 45%, 60% and

75% determined using an optilab microscope. Observation of the size is done at 40x magnification by drawing a line to determine its diameter. The results of the analysis are presented in Figure 8 to 11.

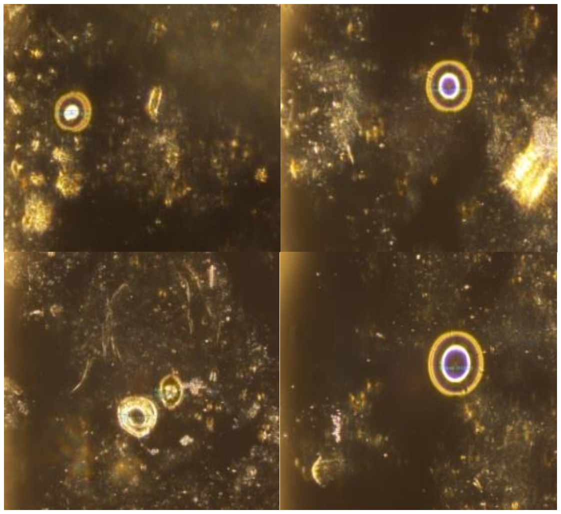

Fig. 8:- Microstructure of of red dragon fruit peel powder added the concentration of maltodextrin 30%, 45%, 60% and 75% with 40x Magnification. Particle Size: 167.8 µm.

Microscope analysis of dragon fruit skin powder, in general has irregular spherical particles, this is because the microscope used is not too clear to see the microstructure of dragon fruit skin powder. The particle size of dragon fruit skin powder tends to increase with the addition of the concentration of maltodextrin namely 107.3 µm, 144.4 µm, 88.01 µm, 167.8 µm and 178.2 µm. This is consistent with the statement of Zuidam and Shimoni [25] that the size of microencapsulated particles has a particle size range of 5-5000 µm. According to Anwar *et al.*, [1] the particle size of maltodextrin ranged from 50-200 µm. The increase in particle size of red dragon fruit powder may be due to the higher homogenisation process of maltodextrin concentration which causes maltodextrin with red dragon fruit skin extract is not completely dissolved so the particle size increases. The smaller the particle size of the dragon fruit peel powder will be more soluble in water.

IV. CONCLUSION

Based on chemical, physical and organoleptic properties, the addition of 75% maltodextrin concentration was the best treatment with a pH value of 4.89; total dissolved solids 8.22; antioxidant activity 62.84; L value 73.33; hue value 346.75 and mean score for color 3.20; aroma of 2.80 and flavor of 3.13.

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