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Analysis of antioxidant formulations of watermelon peel (*Citrullus lanatus*) and secang wood (*Caesalpinia sappan* L.) as jelly candy

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ABSTRACT

Jelly candy made from watermelon rind and sappan wood is a candy with a soft texture that is processed with the addition of gelatin and low-calorie sugar. Based on the literature search that has been carried out. There has been no research regarding the antioxidant activity of jelly candy from watermelon rind and sappan wood. Him this research aims to determine the effect of varying concentrations of watermelon rind and wood extracts sappan in making formulations as jelly candy, the potential of jelly candy as an antioxidant, and to know the SNI 3574.2-2008 standard which includes water content, ash content, reducing sugar content and the condition aroma and taste of jelly candy. The results of the chemical properties test show that the water content in F3 meets SNI namely 19.891995%, and the ash content shows results that meet SNI, namely at F1 0.028%, F2 0.02905% and F3 0.02985%. Meanwhile, the reduced sugar content also shows results that meet SNI, namely F1 0.00219%, F2 0.00144% and F3 0.00048%. The organoleptic test results on the color indicator are 6.72 (somewhat like), the indicator of the aroma is 6.43 (somewhat like) and the taste indicator is 6.54 (somewhat like) and has met SNI with the condition normal. The results of the antioxidant activity test are in the medium category with an inhibition value of 36%.

Keywords: Antioxidant, Jelly Candy, Watermelon Rind, Sappan Wood

I. INTRODUCTION

Indonesia is known as a country with a tropical climate that is rich in natural resources. One of the results is that the watermelon rind (Citrullus lanatus) is one of the many fruit-producing plants found in Indonesia. This fruit is very popular among people because it tastes sweet and fresh. Watermelon rind is waste produced by watermelon fruit. It is known that Indonesia produces 468 tonnes/year of watermelon rind waste (BPS Indonesia Riasman, 2012).

The white layer of watermelon, usually called albedo, contains substances that are important for health and are really needed by the body, one of which is citrulline. Citrulline is an antioxidant that is beneficial for skin health (Rochmatika et al., 2012). Watermelon rind also contains secondary metabolites, namely alkaloids, flavonoids, phenols, tannins and steroids (Alwi et al., 2021). According to Alamsyah et al (2016), the antioxidant activity of watermelon rind extract is 300.12 ppm.

One food product that can be produced by using watermelon rinds is making jelly candy. Currently, jelly candy circulating among the public can harm health and provide no nutritional value to the human body. Making jelly candy from watermelon rinds does not make it attractive for consumption, so natural coloring is added which is safe and can add nutritional value. The natural dye used is a solution of sappan wood (Caesalpinia sappan L.). Apart from acting as a coloring agent, sappan wood will also increase the antioxidant activity of watermelon rind jelly candy. Research by Agustina (2013), reported that the antioxidant activity of sappan wood (Caesalpinia sappan L.) is relatively high. The IC50 results obtained were 74.44 □g/mL.

Currently, the formulation of watermelon rind and sappan wood into jelly candy which has antioxidant activity has not yet been reported. Therefore, researchers are interested in conducting research on "antioxidant analysis of watermelon rind and sappan wood formulations as jelly candy with the aim of being able to produce jelly candy that is healthy and rich in antioxidants and of course liked by consumers and standardized to SNI 3574.2-2008.

II. METHODS

A. Time and Place of Research

This research was carried out from December 2022 to June 2023 at the Chemistry Laboratory at Muhammadiyah University Bulukumba and at the Analytical Chemistry Laboratory at UIN Alauddin Makassar. Antioxidant activity was carried out at the Biochemistry Laboratory, Hasanuddin University, Makassar.

B. Tools and materials

The tools used are a UV-Vis spectrophotometer (PGI T60, United Kingdom), an electric furnace, a set of reflux tools, an analytical balance (Kern), an oven, a water bath, a desiccator, a thermometer, clamps and stands, a bulb, a funnel, a stove, a blender, a saucepan, filters, knives, molds/pans, cups, and glassware.

The materials used are watermelon rind, sappan wood, HILWA liquid sugar, agar powder, DPPH reagent, methanol (CH3OH), lead (II) acetate (Pb(C2H3O2)2), disodium phosphate (Na2HPO4) 10%, potassium iodide (KI) 30%, sulfuric acid (H2SO4) 25%, sodium thiosulfate (Na2S2O3) 0.1 N, luff school solution, starch solution 0.5% and distilled water (H2O).

C. Research procedure

1. Sample Collection

The watermelon rinds used came from Bukit Harapan Village, Kec. Gantarang, Kab. Bulukumba, South Sulawesi, while the second wood comes from the Dampang Village market, Kec. Gantarang, Kab. Bulukumba, South Sulawesi.

2. Watermelon Rind Sample Preparation Process

The process of preparing watermelon rind samples is to prepare 300 grams of watermelon rind, and then clean the watermelon rind. Cut into small pieces and puree with a blender. Then the results are collected into a beaker.

3. Process for Making Secang Wood Extract

Sappan wood extract is made by boiling 10 gr, 20 gr, and 30 gr each using 100 mL of water. The heating process is carried out until it boils and changes color to red, then cooled.

4. Jelly Candy Making Process

In this research, 3 variations of the formulation were made with different concentrations of watermelon rind and sappan wood. The formulation of ingredients for making jelly candy is presented in Table 3.1.

Table 3.1 Formulation of ingredients for making jelly candy:

Formulas	Watermelon rind	Sappan Wood Extract	Hilwa Liquid sugar	Jelly
F1	90 gr	10 gr	50 gr	3 gr
F2	80 gr	20 gr	50 gr	3 gr
F3	70 gr	30 gr	50 gr	3 gr

(Erwan, 2018)

At this stage, first, mix each formulation until homogeneous. Then heat it on the stove until it boils. Next, let it sit until it hardens. Then cut it into squares like candy or according to taste. Then leave it for 3-5 days until the water content reduces and the sugar comes out.

5. Chemical Properties Test

a. Gravimetric Method Water Content Test

Weigh 2 grams of jelly candy and place it in a porcelain cup that has been dried in the oven for 45 minutes. After that, cool it in a desiccator. Then put it in the oven at a temperature range of 100ºC-105ºC for 10 hours. Then cool in a desiccator, then weigh again and put back in the oven for 30 minutes. Then cool it back into the desiccator, then weigh it again to obtain a constant weight.

% water content :

b. Ash Content Test Furnace Method

Put 2 grams of sample into a porcelain cup of known weight. Then place the cup containing the sample over the burner flame, then ash it in an electric furnace at a maximum temperature of 550˚C for 5 hours. Then cool the cup in a desiccator, then weigh it.

% kadar abu :

c. Reducing Sugar Content Test (Luff Schoorl)

1. Sample Preparation

A total of 5 grams of sample was weighed. Place in a 250 mL measuring flask. Then press it using distilled water until it reaches the tera mark, then shake it. The filtrate was filtered and then pipetted 50 mL. After that, put it into a 250 mL measuring flask. Add 10 mL of semi-basic (Pb(C2H3O2)2) solution while shaking. Check whether the addition of (Pb(C2H3O2)2) is sufficient or not by dropping a drop of 10% Na2HPO4 solution. If a white precipitate appears, it means that's enough. Add 10% Na2HPO4 until enough to precipitate the excess (Pb(C2H3O2)2) (15 mL), namely testing by dropping 1 to 2 drops of Na2HPO4 solution. This drip is carried out until no sediment appears. Add distilled water until the mark is indicated, then shake and leave for about 30 minutes. After that, it is filtered.

2. Determination of Sugar Content Before Inversion

From the sample preparation, 10 mL of filtrate is obtained which will be pipetted into a 500 mL Erlenmeyer flask while closed. Add 15 mL of water, boiling stones, and 25 mL of luff school solution. Heat for about 2 minutes until it boils, then boil continuously for 10 minutes in a water bath. Remove then cool as quickly as possible using ice cubes. After cooling, 10 mL of 30% KI solution and 25 mL of 25% H2SO4 solution were added slowly. Titrate immediately using 0.1 N Na2S2O3 solution and 0.5% starch solution as indicators. New starch is added when the color changes to yellow. This is also done on a blank by replacing the sample solution or filtrate with water.

Kadar gula sebelum inversi (%) =

6. Physical Properties Test

   a. Organoleptic Test

   Organoleptic tests were carried out with results from formulations that had the highest antioxidants, involving 30 untrained panelists with an age range of 20-60 years. Each panelist was given a questionnaire containing a test scale for color, taste, and aroma. The organoleptic test in this study used a hedonic scale: (1) Dislike very much, (2) Dislike very much, (3) Dislike, (4) Somewhat dislike, (5) Neutral, (6) Somewhat like, (7)) Like, (8) Very like, (9) Very, very like. The data obtained is then processed to calculate hedonic tests including color, aroma, and taste (Abubakar and Khaerah, 2021).

7. Antioxidant Activity Test

   Test the antioxidant activity of F3 jelly candy from watermelon rind and sappan wood using the DPPH method. The sample was diluted using methanol solvent, then pipetted 1.6 mL into a test tube, and added 1 mL of DPPH reagent. Then the volume of the solution was increased to 5 mL using methanol. Next, homogenize and leave in a dark place for 30 minutes. After that, the absorbance was measured with a spectrophotometer at the maximum wavelength (515 nm). Antioxidant activity was calculated using the following equation:

   Antioxidant activity (%) :

III. RESULTS AND DISCUSSION

A. Test Results of Chemical Properties of Jelly Candy from Watermelon Peel and Sappan Wood

1. Water content

   The shelf life of the food product produced is closely related to the water content obtained and can affect the texture of the jelly candy. (Wijana, et al., 2014). The results of the water content test in jelly candy with 3 different formulations can be seen in table 4.1:

   Table 4.1 Water content of jelly candy from watermelon rind and sappan wood

Treatment	Water content(%)
F1	23,254225%
F2	22,40005%
F3	19,891995%

   Based on Table 4.1, the water content obtained in jelly candy from watermelon rind and sappan wood shows a significant difference in results. In F1, the

highest water content was obtained, namely 23.254225%, while in F3, the lowest water content was obtained, namely 19.891995%. This is due to the difference in concentration added to the jelly candy which can have a significant impact on each treatment of the water content produced. According to Puspitasari (2014), the more watermelon albedo added to a food product, the water content will increase, because the water content of watermelon albedo (92.86%) is higher than the water content of second wood (63.32%) (Sa'ati et al., 2016). At F3, it is 19.891995% by SNI 3574.2-2008, namely a maximum of 20%. This is in line with research by Haryati et al (2020) on watermelon candy with various carrageenan concentrations producing water content that meets SNI 3574.2-2008, namely 16.12%.

2. Ash Content

Ash content is one of the treatments to determine the total minerals contained in a food ingredient (Maulana, 2016). The results of the ash content test in jelly candy from watermelon rind and sappan wood can be seen in table 4.2.

Table 4.2 Ash content of jelly candy from watermelon rind and sappan wood

Treatment	Ash Content(%)
F1	0,028%
F2	0,02905%
F3	0,02985%

Based on table 4.2, the ash content in jelly candy from watermelon rind and sappan wood has different results. The average ash content produced is 0.028%% -0.02985%. From the test results, the ash content in jelly candy from watermelon rind and sappan wood meets SNI 3574.2-2008, namely a maximum of 3%. This is in line with research by Diandra et al (2021) on making jelly candy from watermelon rind juice, namely 0.81% and 1.92%. The results of the ash content are in contrast to the water content that has been produced. This is because the ash content and water content have a relationship where the water content is inversely proportional to the ash content (Wulan, 2020).

3. Reduced Sugar Levels

Reducing sugar is the amount of reducing sugar contained in a food ingredient (Sari, et al., 2022). The test results for reducing sugar content in jelly candy from watermelon rind and sappan wood can be seen in table 4.3.

Table 4.3 Reducing sugar content of jelly candy from watermelon rind and sappan wood

Treatment	Reduced Sugar Levels(%)

F1	0,00219%
F2	0,00144%
F3	0,00048%

Based on the results of the reducing sugar content test obtained, starting from F1 it produces 0.0219%, F2 is 0.00144% and F3 is 0.00048%. The three different treatments have fulfilled SNI 3574.2-2008 with a maximum reducing sugar content of 25%. The results obtained were influenced by differences in the concentration of each treatment. This is by research by Megawati et al (2017) which states that if the amount of watermelon rind is less, the reduced sugar will also be lower.

B. Test Results of Physical Properties of Jelly Candy from Watermelon Rind and Sappan Wood

1. Organoleptic Test

Organoleptic testing is an assessment that will be carried out to observe the color, aroma, and taste of a food product (Sulistiana, 2020). Organoleptic tests on jelly candy from watermelon rind and sappan wood involving 30 untrained panelists can be seen in table 4.4.

Table 4.4 Organoleptic test results on jelly candy from watermelon rind and sappan wood

Treatment	**Average Results**
Warna	6,72
Aroma	6,43
Rasa	6,54

In table 4.4 it can be seen that the results of the organoleptic test on jelly candy from watermelon rind and sappan wood, namely the color obtained was 6.72 (rather liked), aroma 6.43 (rather liked) and taste 6.54 (rather liked) and had met SNI 3574.2-2008, namely with an average value of 6-9 (normal).

C. Results of Antioxidant Activity Tests for Jelly Candy from Watermelon Rind and Sappan Wood

Testing antioxidant activity obtained the best formulation which had been carried out in 3 previous tests, namely water content test, ash content test, and reducing sugar content test. Based on this, F3 is the best formulation because F3 has results that are closer to SNI 3574.2-2008 compared to F1 and F2. The results of the antioxidant activity test with the best formulation, namely F3, can be seen in table 4.5.

Table 4.5 Antioxidant activity of jelly candy from watermelon rind and sappan wood

Sample	Deuteronomy 1	Deuteronomy 2	Deuteronomy 3	Average	% inhibition
Blanko	0,471	0,471	0,471	0,471	
F3	0,303	0,304	0,301	0,303	36%

Based on the results of antioxidant activity tests on jelly candy from watermelon rind and sappan wood, it shows that the antioxidant activity in F3 is 36%, which is in the medium category. Antioxidant activity in jelly candy comes from secondary metabolites of watermelon rind and sappan wood. Based on research by Sadiq et al (2021), watermelon rind contains saponins, terpenoids, and alkaloids which have the potential to act as antioxidants. Likewise with sappan wood, according to Prabawa et al (2019), sappan wood contains flavonoids, terpenoids, and phenolics and has strong antioxidant activity.

IV. CONCLUSION

Varying concentrations of watermelon rind and sappan wood extracts in making jelly candy from watermelon rind and sappan wood greatly influence the water content, ash content, and reducing sugar content and the formulation of jelly candy from watermelon rind and sappan wood has potential as an antioxidant with an inhibition value of 36% including The antioxidant activity is in the medium category, and the jelly candy from watermelon rind and sappan wood in the F3 formulation meets SNI 3574.2-2008 which includes water content, ash content, reduced sugar content and aroma and taste conditions.

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