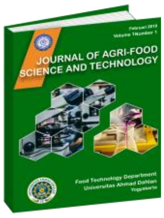
Journal of Agri-Food Science and Technology (JAFoST)
Vol 4(1) 2023: 37 – 48

P-ISSN 2686-0716
E-ISSN 2746-5519

Journal of Agri-Food Science and Technology (JAFoST)

Journal homepage http://journal2.uad.ac.id/index.php/jafost
Journal email jafost@tp.uad.ac.id



Physico-chemical Characteristics of Jelly Drink with Variation of Red Dragon Fruit Peel (*Hylocereus polyrhizus*) and Additional Sappan Wood (*Caesalpinia sappan*)

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ARTICLE INFO

Article history

Received 17/12/22
Revised 05/03/23
Accepted 10/04/23

Keywords

Jelly drink;
Red dragon fruit peel;
Sappan wood;

10.12928/jafost.v4i1.7069

ABSTRACT

Red dragon fruit peel can be developed into a jelly drink because it naturally contains pectin which can be used as a thickening agent. Sappan wood contains bioactive substances including antioxidants of 15.69 ppm, anthocyanin 2.43%, and brazilin which can increase the red color in jelly drinks. This study contributes to determining the physicochemical characteristics of the red dragon fruit peel jelly drink with the addition of sappan wood. This study consisted of three formulations and a control. The concentrations of red dragon fruit peel and sappan wood were F1=1.5:0.5, F2=1.7:0.3, F3=1.9:0.1, and control (F4=2 :0). The product evaluation consists of pH, gel strength, viscosity, crude fiber, and moisture content. This study showed that the physical properties of jelly drink had a pH value between 6.49-6.67, a gel strength between 0.20-0.22, and a viscosity between 372-583 mPa.s. The chemical properties of jelly drinks have 1.29-2.13% crude fiber and 71.27-76.69% moisture content. This study showed that the higher the red dragon fruit peel concentration and the lower the sappan wood used, the higher the gel strength, viscosity, and crude fiber content, and lowered the pH value and moisture content.

1. INTRODUCTION

Dragon fruit has 30-35% peel of the fruit flesh. The utilization of dragon fruit peel is not maximized so it usually only becomes waste even though dragon fruit peel has a high polyphenol content and is a good source of antioxidants (Faadlilah & Ardiaria, 2017). The antioxidant content of dragon fruit peel is higher than its flesh (Handayani & Rahmawati, 2012). Hatuwe's research (2020) states that red dragon fruit peel has a higher fiber content of 49.7% compared to 22% pears, 18.4% oranges, and 29% peaches.

Red dragon fruit peel contains several compounds such as 13.9% vitamin C, 2.09% protein, 0.10% fat, 6.20% carbohydrates, 4.15% glucose, and 1.1% total sugar which are good for health (Oktaviani, 2014). Dragon fruit peel antioxidant compounds include total phenols

39.7 mg/100g, total flavonoids 8.33 mg/100g, anthocyanins 30.05 mg/100g, and betacyanins 13.8 mg (Faadilah, 2016). According to Nazaruddin et al., (2011) the peel of red dragon fruit contains quite high pectin, namely 20.1%. This pectin can be used as a gelling agent, thickener, and stabilizer in fruit juices (Yati et al., 2017).

The pectin content contained in red dragon fruit peel can be used as a thickener in making jelly. The jelly drink is a functional drink in the form of a gel made from pectin, carrageenan, agar, or hydrocolloid compounds with the addition of sugar, acid, or other additional ingredients (Vania et al., 2017). Jelly drinks can be made from fruit extracts or not from fruits that contain pectin in them (Febriyanti & Yunianta, 2015). Jelly drink has the characteristics of being transparent, has a taste like real fruit, and is in the form of a gel with a low concentration so that the gel is easily destroyed when sucked, besides being a drink, it also has properties such as food because it can be used as a hunger delay (Vania et al., 2017).

Red dragon fruit peel has a slightly unpleasant taste so if it is applied to a product, it can affect the taste (Shofiati et al., 2014). Therefore, to reduce the unpleasant taste of red dragon fruit peel in jelly drink, sappan wood is added to improve the flavor and increase the color of the jelly drink. Sappan wood has a slightly sweet taste and is almost odorless (Hidayat et al., 2015). In addition to the taste and color of sappan wood, it also contains components that have high antioxidant activity so that it can increase the value of antioxidant activity in jelly drink.

Sappan wood has been used since ancient times as a traditional drink in the form of wedang secang which gives a warm feeling to the body. In addition, sappan wood is one of the plants used as a natural red pigment (Hidayat et al., 2015). Sappan wood has active compounds in the form of flavonoids, saponins, tannins, phenols, alkaloids, and brazilin which can function as antioxidants. One of the flavonoids in sappan wood is anthocyanin, anthocyanin is a compound that is good for health because it has antioxidant activity value (Widowati, 2011).

Sappan wood in the manufacture of jelly drinks is used in powder form in order to make it easier to mix with other constituent materials and to maintain the oxidative compounds contained in sappan wood (Neswati & Ismanto, 2018). Sappan wood extract is stored and used in powder form in order to maintain its antioxidant content. Utilization of red dragon fruit peel in this study was used in the form of flour. This was done to maintain the pectin and fiber content in the red dragon fruit peel so that it could help form a gel in jelly drinks. In addition, the study of Daniel et al., (2014) stated that the anthocyanin content of red dragon fruit peel flour was greater than that of fresh red dragon fruit peel, namely 1.27 ppm and that of fresh red dragon fruit peel, which was 0.56 ppm. The high bioactive content of red dragon fruit peel and sappan wood can increase the utilization of jelly drinks as an antibacterial alternative. This study contributes to determining the physicochemical characteristics of the red dragon fruit peel jelly drink with the addition of sappan wood.

2. MATERIALS AND METHODS

2.1. Materials

The tools used in making the samples were a 40×30×3 baking dish, cutting board, knife, strainer, spoon, ohaus analytical scale, Rinnai gas stove, Philips blender, stainless steel pot, stopwatch, 250 mL iwaki beaker, and jelly drink cup. Meanwhile, the tools used in the test were an Ohaus analytical balance, water bath, Maspion electric stove, 80 mesh sieve, desiccator, funnel, tongs, spatula, NDJ-5S digital rotary viscometer, test tube, dropper pipette, 40 ml crucible cup, and some analytical glasses.

The ingredients used in the manufacture of this jelly drink are red dragon fruit peel obtained at the Giwangan Main Market, sappan wood obtained at Bina Agro Mandiri, granulated sugar with the Pamela brand, water, and carrageenan. While the materials used in the analytical methods were 96% ethanol, ascorbic acid, distilled water, methanol, aluminum foil, and Whatman No. 1 paper.

2.2. Research Methods

2.2.1. Stages of Red Dragon Fruit Peel Preparation Red

Dragon fruit peel in this study was obtained from whole fruit that had been separated. The characteristics of this dragon fruit peel are red with green fins, the fruit is not wilted or fresh and the fruit picking rate ranges from 3-5 days.

2.2.2. Red Dragon Fruit Peel Flour Method

The stages of making red dragon fruit peel flour are based on Rochmawati (2009) with slight modifications. The peel of red dragon fruit is peeled and scales. After that, wash using running water and cut into small pieces of red dragon fruit peel up to 2-3 cm. Then arranged on a baking sheet and dried in an oven at 65°C for 20 hours to maintain the antioxidant and fiber content in dragon fruit peel. The dried red dragon fruit peel was then mashed using a blender and sifted through an 80-mesh sieve. The granules that pass through the sieve are red dragon fruit peel flour.

2.2.3. Sappan Wood Powder Method

The stages of making sappan wood powder are based on Rismayanti (2016) with slight modifications. It begins with drying the sappan wood in the sun to dry. The dry sappan wood is ground coarsely using a milling machine. Next, grind it using a blender so that the powder size is finer and smaller. Sappan wood powder was sifted using a 60-mesh sieve. The fine grains that pass through the sieve are sappan wood powder.

2.2.4. Jelly Drink

The jelly drink was produced based on Gani et al. (2014) with slight modifications. It begins by dissolving 0.5 grams of carrageenan in 50 ml of water in a separate container of sugar in 100 ml of water is put into a saucepan and cooked over medium heat at 70-80°C for 3 minutes. During the cooking process, the dissolved carrageenan is added and stirred. After that, red dragon fruit peel flour and sappan wood powder were added according to the formulation. Cook until it boils for about 2-3 minutes after cooking, the solution is filtered into a cup then the jelly drink is cooled in the refrigerator until it is semi-solid. The formulation of jelly drinks is the ratio between red dragon fruit peel concentration and sappan wood. They are F1=1.5:0.5, F2=1.7:0.3, F3=1.9:0.1, and control (F4=2 :0).

2.2.5. pH value

pH testing is carried out using an Ohaus pH meter. Before being tested on the sample, the cathode tip of the indicator is washed with distilled water and then dried with a tissue. After that, it is calibrated using a buffer pH 4 and 7. The sample to be tested is dipped into the cathode tip and waited 3-4 minutes until the number stabilizes.

2.2.6. Gel Strength

The gel strength test in this study used the Universal Testing Machine (UTM) because the jelly drink is in the form of semi-solid or semi-gel. This measurement begins by pressing the power on the tool then adjusting the test standard (Compression, Tensile Strength, Penetration) and filling in the data according to the sample. The sample to be tested is cut and placed on the upper and lower clamps and then pierced with a UTM needle. After that, it is locked by turning the hand wheel and waiting for the testing process to finish. The working principle of this test is that the clamp will exert a pull on the test material until it breaks in order to obtain the maximum strength required by the UTM needle to penetrate the sample (Gerungan et al., 2019).

2.2.7. Viscosity

A viscosity test was carried out using a Brookfield viscometer. The sample is put in a 250 ml beaker glass and then the spindle needle is attached to the viscometer and the spindle rotation speed and spindle number to be used are set. This study uses rotor 3 with a speed of 60 rpm (Kartikasari & Nisa, 2014).

2.2.8. Crude Fiber

The sample is weighed as much as 3 grams then put into a 250 ml beaker and added 50 ml of 0.3 N H_2SO_4 solution. After that, it is put into a water bath with a temperature of 70°C and a speed of 10 rpm for 30 minutes. The sample was added 25 ml of 1.5 N NaOH and reheated for 30 minutes. Filter with a funnel containing filter paper that has been dried and the weight is known. The precipitate on the filter paper was washed successively using 20 ml of hot distilled water, 20 ml of 0.3 N H_2SO_4, and 10 ml of 90% ethanol. The filter paper containing the precipitate was removed and put in a porcelain cup and then dried at 105°C for 30 minutes (Yovani, 2022). After that, put it in the desiccator for 15 minutes and weigh it. The crude fiber calculation formula can be seen as follows:

$$Crude\ Fiber\ \% = \frac{b - a}{x}\ x\ 100\%$$

b : filter paper + dried sample (g)
a : weight of filter paper (g)
x : sample weight

2.2.9. Moisture Content

The weighing bottle to be used is marked and baked for 1 hour at 105°C to stabilize the weight, then put in a desiccator for 15 minutes and weighed. The sample is put as much as 2 grams into a weighing bottle whose weight is known and dried in an oven with a temperature of 105°C for 5-6 hours. The weighing bottle was removed and cooled in a desiccator for 15 minutes after which it was weighed. Drying was continued every hour until a constant weight was obtained (Yovani, 2022). The water content calculation formula can be seen as follows:

$$Moisture\ Content = \frac{w - (w1 - w2)}{w}\ x\ 100\%$$

W : sample weight (g)
W1: Sample weight + cup after baking (g)
W2: Empty cup weight (g)

3. RESULT AND DISCUSSION

3.1. pH value

pH is the sum of the concentration of hydrogen ions (H^+) in a solution which expresses the level of acidity and alkalinity it has with a measuring value on a scale of 0 to 14 (Astria et al., 2017). The pH test was carried out to determine whether or not there was an effect of variations in the red dragon fruit peel and the addition of sappan wood on the degree of acidity of the jelly drink. The pH test was carried out using a pH meter and the results were obtained in Table 1.

Data Table 1. shows the lowest level of acidity shown in treatment F4 with a value of 6.49 and the highest level of acidity is shown in treatment F1 with a value of 6.67. Statistical analysis One Way ANOVA showed that the variation of red dragon fruit peel with the addition of sappan wood gave a significant difference to the value of the jelly drink. This can be seen from the P value < α with a significance value of 0.00 ($p < 0.05$). The analysis was continued with the DMRT (Duncan) test which showed a significant difference in each formulation.

Table 1. Jelly Drink pH Results

Formulation	pH
F1	6.67±0.01[c]
F2	6.57±0.02[b]
F3	6.49±0.02[a]
F4	6.49±0.01[a]

Different letter notations (a,b,c) indicate significant differences based on Duncan's test results with a significance level of 0.05.

The pH value decreased with increasing concentration of red dragon fruit peel, this is in accordance with the research of Hardita et al., (2019) which stated that red dragon fruit peel is acidic, close to neutral, with a pH value of 6.4. The addition of red dragon fruit peel to water will result in an increase in hydrogen ions (H^+) and a decrease in hydroxide ions (OH^-) causing the pH value to decrease (Yowandita, 2018).

Extraction of sappan wood using distilled water has a pH value of 6.2-7.0 which is acidic to neutral (Regina et al., 2015). Sari's research (2017) stated that the pH of a cup of jelly drink with the addition of 0% ginger juice was 8.02. Therefore, the increasing concentration of sappan wood causes a higher pH value in the resulting jelly drink because sappan wood is acidic to neutral. Research by Bumi et al., (2015) states that the pH of red dragon fruit jam and red dragon fruit peel ranges from 5.06-5.22. The redder dragon fruit peels used, the lower the pH value produced, this is because the pectin contained in red dragon fruit peels will hydrolyze into pectic acid and pectin acid so that the pH value becomes low or acidic. Sari's research (2017) states that the addition of carrageenan and ginger extract to a cup of jelly drink can increase the pH value of the jelly drink.

SNI 8897: 2020 concerning the quality requirements for jelly drinks states that the maximum jelly pH value is 4.6. This indicates that the pH value of jelly drink red dragon fruit peel with the addition of sappan wood is not in accordance with the SNI quality requirements. Research by Zega & Prangdimurti (2010) states that commercial jelly drink products use the addition of benzoic acid as a preservative so that it can lower the pH value. Benzoic acid is an ingredient used to prevent the growth of yeast and bacteria, benzoic acid will work optimally as an antimicrobial at a pH of 2.5-4.5 (Nasution, 2013). Therefore, the high pH value of jelly drink red dragon fruit peel and sappan wood is one of the reasons it is not added with benzoic acid so it produces a pH value above 6.

3.2. Gel Strength

Texture is an important characteristic of food products that can affect consumer acceptance. The texture is usually related to organoleptic tests on food ingredients (Sari, 2017). Testing the gel strength of jelly drink from red dragon fruit peel with the addition of sappan wood using the Universal Testing Machine (UTM) with the aim of determining the formation of gel texture (Pamungkas et al., 2014). The results of the gel strength test can be seen in Table 2.

Table 2. shows the value of strength gel shown in the F1 treatment with a value of 0.20 and the gel strength was shown in the F3 and F4 treatments with the same value of 0.22. Statistical analysis One Way ANOVA showed that variations in red dragon fruit peel with

the addition of sappan wood did not make a significant difference to the texture value of jelly drink. This can be seen from P value>α with a significance value of 0.272 (p>0.05) so there is no effect significantly to the treatment of F1, F2, F3, and F4.

Table 2. Results of Strength Gel Jelly Drink

Formulation	Gel Strength
F1	0.20±0.002
F2	0.21±0.021
F3	0.22±0.01
F4	0.22±0.009

Different letter notations (a,b,c) indicate significant differences based on Duncan's test results with a significance level of 0.05.

The gel strength value increased with increasing concentration of red dragon fruit peel, this is in accordance with research by Waladi et al., (2015) which stated that red dragon fruit peel contains a high enough dietary fiber of 46.7%. The level of gel strength is affected by the amount of water contained in the food. The fiber found in red dragon fruit peel causes the free water content in the material to decrease because water will be absorbed into the molecular structure of the fiber so that it can improve the gel structure and increase the resulting gel strength (Suptijah et al., 2013).

Red dragon fruit peel also contains 20.1% pectin (Nazarudin et al., 2011). The pectin content found in red dragon fruit peel can increase the viscosity value and as a gel formation in the manufacture of jelly drinks so that the value of gel strength increases with increasing concentration of red dragon fruit peel (Yati et al., 2017). The addition of sappan wood in this study caused the gel strength to decrease so that the resulting gel was easier to suck, this is in line with Pradanasari's research (2021) which stated that sappan drink jelly with a concentration of sappan wood and carrageenan (3%: 0.3%) is the most preferred. by the panelists with the suction power parameter, this is because the addition of a 3% concentration of sappan wood produces a jelly that is easy to suck, and the resulting gel is felt when consumed. The addition of sappan wood powder to the jelly drink also makes the jelly drink have a slightly fibrous texture and adds a red color to the jelly drink.

Gel formation is a process of crosslinking polymer chains to form a three-dimensional cobweb that is connected. The resulting net can capture or mobilize water to form a strong structure (Santika et al., 2014). Research by Anova & Kamsina (2013) states that factors that can influence gel formation include temperature, pH, the addition of sugar, and the addition of other hydrocolloid concentrations. Characteristics of the texture of the jelly drink the main thing is the strength of the gel. Gel power (gel strength) is the magnitude of the compressive force to solve solid products, increasingly the greater the style used, the higher the gel strength value of the product (Kristantria et al., 2022). SNI (8897:2020) regarding requirements for the quality of jelly drinks, jelly drinks semi-solid form which crumbles easily when sucked. Jelly drink red dragon fruit peel and sappan wood complies with SNI because it is semi-solid form and easily crushed when sucked.

3.3. Viscosity

Viscosity is a measure to express the thickness of a liquid or fluid. The greater the viscosity, the lower the flow rate. Viscosity in liquids creates cohesive forces in liquids so that the stronger the cohesive forces the greater the resulting. Viscosity testing was carried out to determine the level of viscosity of the jelly drink using the NDJ-5S Digital Rotary Viscometer viscometer. This study uses rotor 3 with a speed of 60 rpm. The results of the viscosity test can be seen in Table 3.

The results showed that the viscosity value increased with increasing concentration of red dragon fruit peel, this was because the red dragon fruit peel contained quite high pectin, namely 20.1% (Nazarudin et al., 2011). The pectin content in the red dragon fruit peel results in the hydrolysis of the pectin polysaccharide bonds in the jelly drink so that the solution becomes thicker to a solid state and causes the viscosity value to increase (Tiara, 2016).

Table 3. Jelly Drink Viscosity Results

Formulation	Viskositas (mPa.s)
F1	372±25.4[a]
F2	388±47.3[a]
F3	482±76.3[ab]
F4	583±26.8[b]

Different letter notations (a,b,c) indicate significant differences based on Duncan's test results with a significance level of 0.05.

Research by Hardita et al., (2019) states that the viscosity of red dragon fruit peel jam and red dragon fruit flesh (90%:10%) is 0.08 cm/sec while the treatment of red dragon fruit peel and red dragon fruit flesh (10%: 90%) of 0.03 cm/second, this is due to the gelatinization process, so the higher the use of red dragon fruit peel, the greater the gel that is formed so that the resulting jam is thicker. Gelatinization is a process in which starch granules are heated with sufficient water so that starch granules expand and produce a viscous liquid to provide the desired product quality (Rohaya et al., 2013).

Viscosity is also affected by the amount of material and the kinds of materials added to the solution. The increasing addition of sappan wood causes a decrease in the viscosity value of jelly drink, this is in accordance with Pradanasari's research (2021) which states that the viscosity value of sappan jelly with a ratio of sappan and carrageenan (3%: 0.3%) is 900 mPa.s while the ratio of sappan and carrageenan (9%:0.3%) decreased by 775 mPa.s. In addition, Mulyani's research (2017) stated that the addition of sappan wood extract with the highest concentration of 8% to goat's milk resulted in a lower viscosity value compared to 0% and 4% sappan wood extract concentrations. The level of viscosity of the jelly drink is inversely proportional to the water content produced. The low viscosity of the material causes a high-water content in the material. Low viscosity indicates that the strength in binding water becomes weak so the gel that is formed is prone to syneresis (Sari, 2018).

3.4. Crude Fiber

Fiber has two types, namely dietary fiber and crude fiber. Crude fiber is a part of food that cannot be hydrolyzed by strong acids and strong bases, but crude fiber can be determined with sulfuric acid and sodium hydroxide (Hardiyanti & Nisah, 2021; Yovani et al., 2022). The results of the crude fiber test on the dragon fruit peel and sappan wood jelly drink samples can be seen in Table 4.

Table 4. shows the lowest value of crude fiber content shown in treatment F1 which is 1.29% and the highest value of crude fiber content is shown in treatment F4 which is 2.13%. One Way ANOVA statistical analysis showed that the variation of red dragon fruit peel with the addition of sappan wood gave a significant difference to the jelly drink crude fiber content. This can be seen from the P value $<\alpha$ with a significance value of 0.006 ($p < 0.05$). The analysis was continued with the DMRT (Duncan) test which showed a significant difference in each formulation. The value of crude fiber content increased along with the increasing concentration of red dragon fruit peel, this is because dragon fruit peel

has a crude fiber component in the form of 9.25% cellulose and 37.15% lignin (Nilawati et al., 2019). Research by Daniel et al., (2014) states that the crude fiber content of red dragon fruit peel flour is 25.56%. The fiber content of red dragon fruit peel flour is higher than that of the fruit flesh, which is 2.8-5.3%. So that the more concentration of red dragon fruit peel, the higher the value of crude fiber content.

Table 4. Jelly Drink Crude Fiber Results

Formulation	Crude Fiber (%)
F1	1.29±0.22[a]
F2	1.47±0.07[a]
F3	1.62±0.14[a]
F4	2.13±0.18[b]

Different letter notations (a,b,c) indicate significant differences based on Duncan's test results with a significance level of 0.05.

The research that has been carried out is in line with the research of Wardani et al., (2018) which states that the fiber content of artificial grass jelly in red dragon fruit peel is 1.63% and the fiber content in red dragon fruit peel is 3.60%. The value of the fiber content of the red dragon fruit peel and the artificial grass jelly produced was different. In the process of making grass jelly, only the inner part of the dragon fruit peel is used, while the outer red dragon fruit peel contains a crude fiber component, namely cellulose. The making of jelly drink in this study used red dragon fruit peels on the outside and inside so that there were components of crude fiber in the form of cellulose and lignin.

The addition of sappan wood in this study can reduce the value of crude fiber content. This is in accordance with the research of Nurlisa et al., (2015) which states that the higher the concentration of sappan wood added to the meat for tanning the peel causes the resulting fiber value to decrease. Fiber in food has a role to bind water, cellulose and pectin. In addition, fiber can also help speed up leftovers through the digestive tract to be secreted out. Fiber can bind free water in food, this free water is very influential in the taste and texture of food. The less bound free water, the weaker the gel formation process, resulting in a liquid jelly drink texture (Sharma & Joshi, 2014).

3.5. Moisture Content

Moisture content is an important component in food ingredients because water can affect appearance and determine the durability and freshness of a food ingredient (Gita & Danuji, 2018; Fitriani et al., 2021). The high-moisture content will result in food spoilage because bacteria, mold, and yeast can multiply which can accelerate spoilage (Pratama et al., 2014). Testing the water content in jelly drink red dragon fruit peel and sappan wood using the oven method. The test results can be seen in Table 5.

Data Table 5. shows the lowest value of moisture content shown in treatment F4 which is 71.28% and the highest value of moisture content is shown in treatment F1 which is 76.64%. One Way ANOVA statistical analysis showed that variations in red dragon fruit peel with the addition of sappan wood gave a significant difference to the value of the moisture content of the jelly drink. This can be seen from the P value $<\alpha$ with a significance value of 0.00 ($p < 0.05$). The analysis was continued with the DMRT (Duncan) test which showed a significant difference in each formulation.

Table 5. Results of Jelly Drink Moisture Content

Formulation	Moisture Content (%)
F1	76.64±0.234[c]
F2	73.64±0.064[b]
F3	73.20±0.591[b]
F4	71.28±0.208[a]

Different letter notations (a,b,c) indicate significant differences based on Duncan's test results with a significance level of 0.05.

The water content value decreased with increasing concentration of red dragon fruit peel. This is because red dragon fruit peel contains quite high pectin (Nazarudin et al., 2011). The pectin contained in red dragon fruit peel is a type of hydrocolloid (Herawati, 2013). Hydrocolloids can be used as additives that function to improve the quality of food products because hydrocolloids can absorb water easily and form gels, so they are often used in the manufacture of food and non-food products (Herawati, 2013).

Selviana's research (2016) states that the greater the hydrocolloid concentration added, the thicker the sample will be, this viscous nature indicates that the solution has a small moisture content because the number of dissolved solids is greater. Research by Karismawati et al., (2015) stated that the moisture content of jelly drinks from red dragon fruit peel and roselle with various concentrations of carrageenan and glucomannan resulted in a moisture content ranging from 93.70 to 94.66%. The results obtained indicated that the more carrageenan added, the moisture content of the jelly drink increased.

The addition of sappan wood is able to increase the moisture content of jelly drink because sappan wood has hygroscopic properties, hygroscopic is a substance that can absorb and release moisture content due to changes in humidity and air temperature around it (Zelin, 2018). In the process of heating the jelly drink solution, the added sappan wood will release water due to the high temperature which can cause the moisture content to increase (Marwita et al., 2022).

4. CONCLUSIONS

Based on the research that has been done, it can be concluded that variations in red dragon fruit peel and sappan wood have a significant effect on the parameters of pH, moisture content, and crude fiber content of jelly drinks. However, it did not have a significant effect on the gel strength parameter.

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