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Variation of Pectin and Sugar Concentration on The Characteristic of Passion Fruit Gummy Candy

Tri Adelti Nabilah[1], Meysin Anjliany[1#], Merynda Indriyani Syafutri[1]

[1]Department of Agricultural Product Technology, Sriwijaya University, Palembang, Palembang, 30862, Indonesia
[#]*Corresponding author* : E-mail: meya629@gmail.com

***Abstract* — Gummy candy is a type of soft candy who made from juice and gel-forming materials. The objective of this research was to determine the effect of variation of pectin and sugar concentration on physical and chemical characteristics of passion fruit (*Passiflora edulis*) gummy candies. The research using factorial completely randomized design with two factors, namely concentration variation of pectin (1%, 1,5%, 2%) and concentration variation of sugar (30%, 40%, 50%). The observed parameters included physical characteristics (color, elasticity) and chemical characteristics (water content, ash content, pH, vitamin C, reducing sugar content, total acid). The result showed that concentration of pectin significantly affected on color (lightness, redness, yellowness), elasticity, water, ash, vitamin C, reducing sugar content, and total acid content, where as concentration of sugar significantly affected on color (lightness, yellowness), elasticity, water, ash, pH, vitamin C, reducing sugar content, and total acid content. The interaction affected significantly on elasticity, water, reducing sugar content, and total acid content. A3B2 treatment (pectin concentration 2% and sugar concentration 40%) was the best treatment based on parameters of water content (17.41%), ash content (1.06%), and reducing sugar content (8.28%).**

***Keywords*— Extraction; Gummy Candy; Passion Fruit; Pectin**

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I. INTRODUCTION

Passion fruit is one type of horticultural commodity developed in Indonesia. According to [10] passion fruit producing regions in Indonesia are Lampung, West Sumatra, and South Sulawesi. People's plantations are capable of producing 5 to 10 tons of passion fruit per year. [3] stated that passion fruit plants produce fruit consisting of 45% of fruit skin and 55% of the edible part of the weight of fresh fruit.

Passion fruit (*Passiflora edulis*) produces juice that has a sour and thick taste with a strong distinctive aroma. Passion fruit is a natural source of antioxidants, this can be seen from the orange flesh. Antioxidants protect the body from free radical contamination. Phenols, vitamin C, and carotenoids are antioxidants are widely found in passion fruit [9]. Phenol content in passion fruit is 435 mg/L, while the carotenoid content in passion fruit is 9.32 mg/L consisting of -carotene, lycopene, -carotene, and –cryptoxanthin.

Passion fruit can be processed into a variety of food products such as juice, syrup, ice cream, fruit leather, and powdered drinks. Passion fruit can also be processed into gummy candy. Gummy candy has a chewy texture and is included in the type of soft candy. The conditions for gel formation in the gummy candy manufacturing process are the presence of sugar, pectin, and acid [7].

Sugar is a sweetener which is generally in the form of white crystals obtained from the processing of sugarcane juice. The sugar used in this research is granulated sugar. Granulated sugar is a sweetener that is most easily found in the market and is commonly used daily to sweeten foods and beverages. [4] stated that sugar can affect the balance of water and pectin so that it can maintain the firmness and elasticity of gummy because sugar is a dehydrating agent that can attract water molecules bound to pectin molecules. The concentration of added sugar will affect the gel formation process. If the addition of too much sugar can cause crystallization on the surface of the gel, but if it is too little then the resulting gel will be too soft. Addition of sugar should not exceed 65% so that the formation of crystals on the surface of the gel can be prevented. According to [18], the best treatment for sugar concentration in the process of making sugar apple gummy candy is 60%, while in the study of [32] the best treatment of

sugar concentration in the process of making soursop gummy candy is 30%.

Carrageenan, gelatin, pectin, and agar are gelling agents that are often used in the process of making gummy candy. The gel-forming material that is often used in the manufacture of gummy candy is pectin which is reversible, meaning that the gel will form a liquid when heated and can form a gel again when cooled. This reversible property makes pectin different from other gelling materials. Gummy candy manufacturers often use pectin as a gelling agent compared to other gelling agents because pectin has a distinctive elasticity [20]. Pectin is a D-galacturonic acid linked by -1,4 glycosidic bonds and forms a polysaccharide polymer. Pectin can convert liquids into elastic solids, improve the shape and texture of gummy candy and can inhibit sugar crystallization in the process of making gummy candy [20] According to some previous research, the best treatment for adding pectin concentration in the ginger gummy candy manufacturing process is 1%, while in [19] the best treatment for adding pectin concentration in the red beetroot gummy candy manufacturing process is 2%. Therefore, further research is needed on the concentration of pectin in the manufacture of passion fruit gummy candy. Passion fruit gummy candy is also made by adding sugar as a sweetener. This study examines the effect of pectin and sugar concentrations on passion fruit gummy candy.

II. Material and Methods

A. Material

Passion fruit used in this research were Berastagi Passion Fruit (*Passiflora edulis* f. *edulis sims*) with purple skin, purchased at Danau Ranau Market. Sucrose "Gulaku", Pectin "CP Kelco Company" and Carrageenan "Kappa" were purchased from online retail market Sobat Keto. Chemical ingredients such as Iodine, Pb-acetic, $(NH_4)_2HPO_4$, Luff Schoorl reagent, H_2SO_4, KI, phenolphtalein, and NaOH were purchased from Agricultural Product Technology Laboratory, Department of Agricultural Product Technology, Sriwijaya University, Palembang.

B. Methods

This research used Completely Randomized Factorial Design with two treatment factors namely (A) pectin concentration (1%, 1.5% and 2%) and (B) sugar concentration (30%, 40% and 50%). The treatment repeated three times.

A1B1 = 1% pectin concentration, 30% sugar concentration

A1B2 = 1% pectin concentration, 40% sugar concentration

A1B3 = 1% pectin concentration, 50% sugar concentration

A2B1 = 1.5% pectin concentration, 30% sugar concentration

A2B2 = 1.5% pectin concentration, 40% sugar concentration

A2B3 = 1.5% pectin concentration, 50% sugar concentration

A3B1 = 2% pectin concentration, 30% sugar concentration

A3B2 = 2% pectin concentration, 40% sugar concentration

A3B3 = 2% pectin concentration, 50% sugar concentration

The parameters observed were physical characteristics (color and elasticity) and chemical characteristics (water concent, ash concent, pH, vitamin C, sugar concent and total acid). The data obtained were processed using ANOVA. The treatment that had a significant difference was further tested using Honestly Significant Difference test at 5% level.

Passion Fruit Extraction

The passion fruit was washed with water to remove dirts. The passion fruit was then peeled. Then the flesh and seeds were taken. The passion fruit flesh and seeds were then filtered through an 80 mesh sieve to separate the seeds and juice. The passion fruit juice was added to water in a ratio of 1:5 so that it was not too sour and thick [34].

Gummy Candy Making

A total of 200 ml of passion fruit juice was put in a saucepan and heated on the stove over low heat. While heated, 6 grams of carrageenan and sugar were added according to the treatment. Then added pectin according to the treatment. The ingredients were cooked until it boiled so that it formed a gel. Next, the candy dough was poured into a 18 cm x 5 cm x 3 cm tin and allowed to stand for 30 minutes at room temperature. The passion fruit gummy candies was then cooled in the refrigerator for 24 hours. The passion fruit gummy candies was then cut into cubes with a size of 2 cm x 2 cm x 1.5 cm.

Color Analysis

The Color Reader was calibrated using a standard white plate. The sample was put into PE plastic and measured by attaching the optical head. The L*, a*, and b* reading scale menu was selected, then the START button was pressed until the L*, a*, and b* values were read [23].

The Analysis of Elasticity

The blade-type brook was mounted on the texture analyzer just above the sample. The sample probe (probe) was installed and positioned until it was close to the sample. Previously, make sure that the value on the monitor was zero, then selected the start test menu on the computer so that the probe move until it pierced the gummy candy sample. The test was completed when the probe returned to its original position. Then the test results seen in the form of graphs or values (numbers) [11].

The Analysis of Water Content

The crucible was pre-baked for 30 minutes, then cooled using a desiccator for 10 minutes and then weighed. Gummy candies samples were crushed and weighed as much as 2 g. Then put it in a cup of known weight. The cup containing the sample was

placed in an oven at 105˚C for 3 hours. The cup was removed from the oven and the sample was cooled in a desiccator and then weighed. The cup was dried again and weighed to a constant weight (not more than 0.0002 mg) [5].

The Analysis of Ash Content

The mashed sample was weighed as much as 2 g and put into a porcelain dish whose weight was known. The sample was burned until the smoke runs out. The cup containing the sample was put into the muffle furnace at 550ºC until a white to gray color was formed for 10 hours. The sample was then cooled in a desiccator for 30 minutes and then weighed [5].

pH Analysis

A sample of 5 mL was prepared. The pH meter was calibrated using pH 4 and 7 buffers. The cathode was inserted into the sample and left until the number indicated on the digital measurement no longer changed. Each time the measurement, the cathode of the pH meter was rinsed with distilled water and then dried before being used again [5].

Vitamin C Analysis

A sample of 10 g was crushed until smooth and 50 ml of distilled water was added. Samples were taken as much as 10 ml and put into an Erlenmeyer flask and added 2 ml of 1% starch. The solution is titrated with 0.01 N standard iodine [29].

The Analysis of Total Acid

Samples of gummy candy were taken as much as 10 g and mashed then diluted with aquadest using a 50 ml volumetric flask. The solution was taken as much as 10 ml, then put into an Erlenmeyer and added 3 drops of PP indicator. Titrated with 0.1 N standard NaOH until pink [29].

III. Result and Discussion

Passion fruit gummy candy with 2% pectin concentration and 30% sugar concentration had the highest value of vitamin C. It also has the highest value of elasticity. The physical and chemical characteristics of passion fruit gummy candy respectively were shown in **Table 1** and **Table 2**.

TABLE 1
PHYSICAL CHARACTERISTICS OF PASSION FRUIT GUMMY CANDIES

Physical Characteristics	A1B1	A1B2	A1B3	A2B1	A2B2	A2B3	A3B1	A3B2	A3B3
Lightness (L*)	34.61± 1.12[a]	33.31± 0.72[a]	32.02± 0.69[a]	33.90± 0.59[a]	32.64± 0.89[a]	30.98± 1.09[a]	33.04± 1.45[a]	31.61± 1.37[a]	31.03± 1.28[a]
Redness (a*)	2.68± 0.34[a]	2.97± 0.44[a]	3.08± 0.19[a]	2.96± 0.15[a]	3.04± 0.42[a]	3.18± 0.61[a]	3.64± 0.31[a]	3.79± 0.39[a]	4.23± 0.38[a]
Yellowness (b*)	12.51± 0.48[a]	11.79± 0.53[a]	10.13± 0.59[a]	12.15± 0.72[a]	11.04± 0.71[a]	9.44± 0.49[a]	10.63± 0.36[a]	9.74± 0.33[a]	9.06± 0.33[a]
Elasticity (gf)	286.40± 4.69[de]	246.33± 3.21[c]	191.87± 6.56[a]	282.10± 8.56[d]	250.73± 2.80[c]	215.67± 3.39[b]	291.57± 13.45[e]	281.60± 8.40[d]	218.77± 6.01[b]

*Data shown is average value ± deviation standard
*Values which are followed by different superscript alphabet in the same column issignificantly different at level of 5% according to Honestly Significant Difference (P<0.05)

A. Color

Color is one of the assessment factors in a product. Color is also a determining factor in consumer acceptance of food products [25].

Lightness

The lightness value consists of 0 (black) to 100 (white). The lightness value is expressed in percent (%) and denoted by L. The results showed that the average lightness (L*) of passion fruit gummy candy ranged from 31.03% - 34.61%. The highest mean value was found in the A1B1 treatment (1% pectin and 30% sugar), while the lowest mean value was found in the A3B3 treatment (2% pectin and 50% sugar).

The higher the pectin concentration, the lower the lightness value. According to [8], the more pectin added, the lower the lightness value due to the non-enzymatic browning reaction, namely the Maillard reaction. Maillard reaction is a browning reaction that occurs between carbohydrates in the pectin group and proteins in passion fruit juice. According to [17], passion fruit juice especially purple passion fruit contains 6.53 grams of protein per 100 grams of passion fruit juice. The final stage of the Maillard reaction will produce melanoidin, a brown polymer containing nitrogen.

According to [6] the addition of sugar will increase the non-enzymatic browning reaction, namely the browning reaction due to the oxidation of vitamin C. Vitamin C is more

stable in acidic conditions while sugar has acid-neutralizing properties so that the oxidation of vitamin C increases. Ascorbic acid (vitamin C) will be oxidized to dehydro-L-ascorbic acid which will then be hydrolyzed to 2,3 diketogulonic acid. 2,3 diketogulonic acid can then be decomposed to form furfural which produces a brown pigment. Previous researches also reported that an increase in sugar concentration will cause the solution to be more concentrated due to the browning reaction that occurs during the cooking process, resulting in a darker color (decreased brightness). Therefore, the higher the concentration of added sugar, the lower the lightness value (L*) produced.

Redness

The results showed that the average redness value (a*) of passion fruit gummy candy ranged from 2.68 to 4.23. The higher the pectin concentration, the higher the redness value (a*) of the passion fruit gummy candy. According to [15], pectin can increase the browning reaction, namely the Maillard reaction. At first the reducing sugar will be condensed with protein to form N-substitute glucosamine through Amadori regulation and the formation of Schiff base. N-substitute glucosamine or commonly called Amadori product will then be degraded and dehydrated to form carbonyl compounds. The carbonyl compound then binds to the amino group and is accompanied by a rearrangement reaction to produce the final product of glycosylation.

[8] reported that the higher the concentration of addition of pectin, the more concentrated the solution and the darker the color, so that the redness value of the dragon fruit gummy candy increased.

Yellowness

The results showed that the average yellowness (b*) value of passion fruit gummy candy ranged from 9.06 to 12.51. The yellow color of gummy candy is caused by the presence of carotenoid pigments contained in passion fruit juice. According to [17], passion fruit juice especially purple passion fruit juice contains 288.56 g of total carotenoids. The higher the pectin concentration, the lower the yellowness (b*) value. The decrease in yellowness value was caused by the breakdown of carotenoid pigments during the cooking process. The addition of more pectin can increase acidity so that carotenoid pigments will be damaged more quickly.

The higher the sugar concentration, the lower the yellowness (b*) value. This is because the sugar will undergo a non-enzymatic browning reaction during the cooking process, namely the Maillard reaction and the browning reaction due to the oxidation of vitamin C. The most dominant browning reaction between the two browning reactions is the Maillard reaction because the Maillard reaction is a browning reaction involving proteins while the browning reaction due to the oxidation of vitamin C involves vitamin C. The protein content is higher than the content of vitamin C. The protein in passion fruit juice is 6.53 grams per 100 grams of passion fruit juice while vitamin C of passion fruit is 30 mg per 100 grams of passion fruit juice [17]. Therefore, the most dominant browning reaction is the Maillard reaction.

B. Elasticity

The results showed that the average elasticity of the passion fruit gummy candy ranged from 191.87gf – 291.57gf. The level of elasticity of the gummy candy is related to syneresis, namely the process of removing water from the gel due to the formation of new bonds between polymers in the gel structure. High syneresis values can damage the gel in the product. Hydrocolloid materials such as pectin are able to reduce the level of syneresis in the gel because it can help bind water to the product [16]. Therefore, the higher the concentration of pectin addition, the lower the syneresis value so that the higher the level of elasticity in the gummy candy. The addition of sugar concentration can increase the pH value which affects the gel formation process and the resulting texture. The higher the pH value (more alkaline) can cause the breakdown of pectin by the methyl esterase enzyme, resulting in fruit juice consistency and viscosity decreasing and becoming unstable. Therefore, the higher the concentration of added sugar, the higher the pH value so that the elasticity of the gummy candy decreases.

According to [27], gummy candy texture is influenced by several factors, namely sugar concentration, pH, and water content. [24] added that the texture of gummy candy can also be affected by temperature and cooking time because the higher the temperature and the longer the cooking process, the more water will evaporate from the ingredients and make the gummy candy stiffer. The reduced water content will make the proportion of sugar content in the material increase, whereas if the sugar content in the material increases it will make the texture of the product harder.

TABLE 2
CHEMICAL CHARACTERISTICS OF PASSION FRUIT GUMMY CANDIES

Chemical Characteristics	A1B1	A1B2	A1B3	A2B1	A2B2	A2B3	A3B1	A3B2	A3B3
Water Content (%)	26.67± 1.06 ^{e}	23.03± 0.94 ^{d}	17.92± 0.99 ^{b}	25.89± 0.98 ^{e}	21.30± 1.03 ^{c}	16.65± 1.24 ^{ab}	21.67± 1.39 ^{c}	17.41± 0.74 ^{b}	15.86± 0.90 ^{a}
Ash Content (%)	0.76± 0.06 ^{a}	0.82± 0.07 ^{a}	0.92± 0.10 ^{a}	0.91± 0.04 ^{a}	0.95± 0.12 ^{a}	0.94± 0.05 ^{a}	0.98± 0.03 ^{a}	1.06± 0.04 ^{a}	1.10± 0.08 ^{a}
pH	4.09± 0.22 ^{a}	4.15± 0.06 ^{a}	4.24± 0.06 ^{a}	4.15± 0.08 ^{a}	4.19± 0.07 ^{a}	4.33± 0.06 ^{a}	4.17± 0.06 ^{a}	4.22± 0.07 ^{a}	4.42± 0.04 ^{a}
Vitamin C (%)	20.33± 2.45 ^{a}	18.85± 2.57 ^{a}	17.46± 0.10 ^{a}	24.57± 2.60 ^{a}	20.34± 2.46 ^{a}	18.79± 2.48 ^{a}	28.99± 2.36 ^{a}	26.06± 0.15 ^{a}	20.29± 2.38 ^{a}
Reducing Sugar Content (%)	6.28± 0.52 ^{a}	8.11± 0.61 ^{c}	8.23± 0.72 ^{cd}	7.33± 0.47 ^{b}	8.15± 0.45 ^{c}	8.58± 0.40 ^{d}	8.80± 0.32 ^{d}	8.28± 0.40 ^{cd}	9.35± 0.38 ^{e}
Total Acid (%)	5.48± 0.39 ^{cd}	4.86± 0.39 ^{b}	3.38± 0.37 ^{a}	5.70± 0.62 ^{d}	5.06± 0.61 ^{bc}	5.29± 0.37 ^{c}	6.34± 0.62 ^{e}	6.53± 0.34 ^{e}	5.83± 0.23 ^{d}

*Data shown is average value ± deviation standard
*Values which are followed by different superscript alphabet in the same column issignificantly different at level of 5% according to Honestly Significant Difference ($P<0.05$)

C. Water Content

The results showed that the average water content of passion fruit gummy candy ranged from 15.86% - 26.67%. The treatments A1B3, A2B3, A3B2, and A3B3 were in accordance with the quality requirements of gummy candy in SNI 3574-2-2008, namely a maximum of 20%, while other treatments had an average water content value exceeding 20%. This high water content can be caused by a low total dissolved solids (TPT) content or the substance of the gummy candy making material contains too much water.

According to [31], pectin is hygroscopic because it is able to bind water molecules through hydrogen bonds or OH-groups on pectin molecules with H atoms on water molecules so that pectin is able to reduce water content in gummy candy. Pectin is commonly used as a stabilizer, emulsifier, and thickener because pectin can homogenize the dispersion system in foodstuffs and increase viscosity.

The 50% sugar addition (B3) treatment resulted in the lowest average water content value, while the 30% sugar addition treatment (B1) resulted in the highest average water content value. According to [12], sugar or sucrose when heated will turn into fructose and glucose. Fructose and glucose are monosaccharides that have polar or hydrophilic properties so that they easily bind to water. Therefore, the more sugar added, the lower the water content of the gummy candy. In addition, the increase in sugar concentration also resulted in an increase in total dissolved solids (TPT) so that the water content in gummy candy decreased. The value of the average water content of gummy candy is influenced by the concentration of added pectin and sugar. Pectin and sugar bind with free water content to form bound water content so that the free water content in gummy candy decreases. The water content bound with pectin and sugar is not volatile compared to the free water content which is more volatile. Therefore, the more the addition of pectin and sugar, the more water content is bound, the less water will evaporate so that the less water content in gummy candy.

D. Ash Content

All treatments resulted in an average ash content value that was in accordance with the quality requirements of gummy candy in SNI 3574-2-2008, namely the ash content value was below 3%. According to [28], the amount of ash content is influenced by the type of material, temperature, and heating time. When the material is processed at high temperatures, the ash content will increase because more water comes out of the material due to the heating process. The highest ash content value was found in the treatment of 2% pectin concentration (A3). According to [19], pectin can bind minerals from materials, water, and dissolved solids so that the higher the concentration of pectin added, the higher the value of ash content in passion fruit gummy candy.

The increase in the average ash content value is related to the amount of mineral content [18]. Granulated sugar contains minerals or ash. According to the [14], the mineral content in granulated sugar is about 0.6 grams. Therefore, the more sugar concentration added, the higher the ash content.

E. pH

The degree of acidity or pH is the sum of the concentration of hydrogen ions (H+) [26]. The pH value of the passion fruit gummy candy is below the neutral pH value (7) or is classified as acidic. This can be caused by the high content of citric acid in passion fruit. According to the citric acid content in passion fruit ranges from 2.4 to 4.8%. In addition to functioning as a sweetener, sugar can also function to increase the pH value and viscosity of foodstuffs [21]. Therefore, the higher the concentration of added sugar, the higher the pH value of the passion fruit gummy candy.

F. Vitamin C

Vitamin C can be produced by plants because plants have the microsomal enzyme L-gulonolactone oxidase which functions as a component of the formation of vitamin C or ascorbic acid [22]. The results showed that the average vitamin C value of passion fruit gummy candy ranged from 17.46% - 28.99%. Pectin can bind water and form a gel. This causes vitamin C, which includes dissolved substances in water, to be bound to pectin. Increased levels of vitamin C can also occur due to the withdrawal of colloidal particles resulting in a decrease in free oxygen levels thereby reducing the oxidation reaction. Therefore, the higher the concentration of pectin addition, the higher the vitamin C content [13].

The results of the 5% BNJ follow-up test are in Table 4.16. showed that all sugar concentration treatments were significantly different to the value of the average vitamin C content of other passion fruit gummy candy. According to [30], sucrose has properties that can neutralize acids or increase pH, while vitamin C is more stable in acidic conditions so that the higher the sugar concentration, the lower the value of vitamin C levels. In addition, according to [18], the presence of high sucrose content accompanied by a heating process can cause L-ascorbic acid (Vitamin C) to be degraded or damaged. During the cooking process at high temperatures, L-ascorbic acid will be oxidized to L-dehydroascorbic acid. The compound L-dehydroascorbic acid still has activity as vitamin C, but this compound is very unstable and can then change to form 2,3-L- diketogulonate (DKG) which no longer has activity as vitamin C [2].

G. Reducing Sugar Content

The reducing sugar content of the passion fruit gummy candy produced has met the SNI requirements for gummy candy, which is a maximum of 20%. . According to [1], pectin is a polysaccharide which will be hydrolyzed into fructose and glucose (reducing sugar) during cooking in the presence of acid so that the higher the concentration of addition of pectin, the higher the reducing sugar content because more pectin will be hydrolyzed into reducing sugar.

[1] reported that the amount of reducing sugar content was related to the sucrose inversion process. The reaction of acid, mineral content, and heat affect the inversion process. Sucrose will be hydrolyzed into fructose and glucose (invert sugar) which are reducing sugars. Therefore, the higher the addition of sugar in the process of making passion fruit gummy candy, the higher the value of reducing sugar content will be.

The higher the concentration of added pectin and sugar, the higher the value of reducing sugar content in the average passion fruit gummy candy. The increase in the value of reducing sugar levels was also caused by the presence of minerals contained in passion fruit juice. According to [19], the mineral content contained in the material can function as a cofactor that can accelerate the sucrose inversion reaction. According to [17], purple passion fruit juice contains 2.10 mg of zinc, 20.00 mg of calcium, 150.00 mg of phosphorus, and 120.00 mg of magnesium per 100 grams of material.

H. Total Acid

The highest total acid content value was found in the treatment with 2% pectin concentration (A3). Heating under acidic conditions will cause pectin to be hydrolyzed into pectinic acid and pectic acid, resulting in an increase in the total acid content. Therefore, the higher the concentration of pectin addition, the higher the total acid content in passion fruit gummy candy.

Sugar or sucrose has a hydroxyl group (OH-) which functions to bind H+ ions in solution. Therefore, the more sugar concentration added, the more hydroxyl groups that bind to H+ ions, resulting in a decrease in total acid levels. The higher the concentration of addition of pectin, the higher the value of the average total acid content, while the higher the concentration of added sugar, the lower the value of the average total acid content. In addition, the factor that affects the total acid content in the passion fruit gummy candy is the type of passion fruit used, namely purple passion fruit. According to [33], the citric acid content of purple passion fruit when compared to yellow passion fruit, purple passion fruit contains more citric acid. Ripe purple passion fruit contains about 2.4-2.7% citric acid, while yellow passion fruit contains 1.6-1.8% citric acid.

IV. CONCLUSION

The interaction between pectin concentration and sugar concentration significantly affected the elasticity, water content, reducing sugar content, and total acid content. A3B2 treatment (2% pectin concentration and 40% sugar) was the best treatment because it met SNI (2008) based on parameters of water content (17.41%), ash content (1.06 %), and reducing sugar content (8.28 %).

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