

Determination of the Best Quality of Sappan Bark Kombucha Drink Based on Its Sensory Characteristic

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Abstract. Kombucha secang is a fermented drink of *Acetobacter xylinum* and *Saccharomyces cerevisiae* with the addition of sappan bark. The purpose is to get the best quality of kombucha secang drink based on sensory characteristics with differences in the amount of sugar and fermentation time. The research was conducted using a factorial completely randomized design method. The factors were the addition of sugar concentration (G = 10%, 20% and 30%) and the fermentation time (F = 4, 7, 10 and 13 days). The parameters observed were raw material characteristics, sensory tests in the form of color, aroma, taste, viscosity, general acceptance, and the best drink quality with further tests of antioxidant activity, alcohol content, and total plate number. The best quality characteristic of the kombucha secang drink was the addition of 20% sugar concentration and 10 days of fermentation time with antioxidant activity IC₅₀ of 31.9744 ppm, the alcohol content of 0.1967%, and total plate count (TPC) of 7.6 x 10⁵ CFU/ml.

Keywords: fermentation time, kombucha, secang bark, sugar concentration

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1. Introduction

The majority of people favor fast meals and drinks that appear great but do not consider the beneficial and harmful consequences on the body as lifestyles change with the times [1]. Consuming healthy drinks is very important to petrify the body to stay healthy [2] such as yogurt from buffalo milk [3] and kombucha. Kombucha is made by fermented of bacteria *Acetobacter xylinum* and the yeast *Saccharomyces cerevisiae* in the fermentation process that takes place converting glucose into various types of acids, and alcohol. Yeast and *Acetobacter xylinum* produce ethanol and nata, respectively. Acetic acid bacteria convert glucose to gluconic acid via the pentose phosphate route, while the majority of fructose is transformed into organic acids [4], fermented glucose and fructose produce ethanol by yeast, which is then oxidized by acetic acid bacteria to acetic acid [5]. People know secang as a spice with a local name known in Indonesia, such as the Aceh (seupeng), the Batak (sopang), and the Sundanese (secang) [6]. Secang has a

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chemical compound brazilin (C₁₆H₁₄O₅) which contains a red pigment. The pigment has a level of stability at pH were at pH 6-7 (high) purplish red color at pH 2-5 (low) yellow color in brazilin compounds [7]. The purpose is to get the best quality of kombucha secang drink based on sensory characteristics with differences in the amount of sugar and fermentation time.

2. Materials and Methods

2.1. Material

The materials used in the study were 100 g of secang wood, 500 ml of water, 10%, 20%, and 30% of concentration granulated sugar, and 10% kombucha starter. Prepare the sappan bark after sorting and cleaning with running water. Boil 100 g of secang into a pot of 500 ml stirring until the water turns red. Then filtered the wood of the secang to separate the wood from the juice of the secang. Secang juice was added with sugar with a sugar concentration (G = 10%, 20%, and 30%) of the amount of juice and then stirred until homogeneous. Add 10% kombucha starter solution into a glass jar and kombucha mushrooms. The kombucha secang was fermented for (F = 4, 7, 10, and 13 days). After the fermentation process, secang kombucha was filtered to separate the remaining fermentation residue. The kombucha cup was heated at a temperature of 65oC for 15 minutes then cooled to room temperature and packed in bottles.

2.2. Methods

The study used a factorial complete randomized design (RAL) method, the study was carried out 3 times to obtain a sample of 36 units. Parameters observed were raw materials characteristics of sappan bark and secang juice, Sensory analysis on this panel used a hedonic rating test [8]. Untrained panelists totaling 80 participants from Medan, North Sumatra, were used in this study. The antioxidant activity of the substance was measured using the DPPH free radical technique in a subsequent product acceptance test [9]. The alcohol content was assayed using the method pignometer. The total plate count (TPC) test is carried out with the pour plate method [10] and carried out data analysis using statistical analysis.

3. Results and Discussion

The results of the analysis of the physicochemical composition of sappan bark and the analysis of raw materials in sappan juice can be seen in Tables 1 and 2.

Table 1. Physico-chemical Composition of Sappan Bark

| Test Parameters | Secang Bark |
|---------------------|----------------|
| Average Length (cm) | 7.9528 ± 0.10 |
| Average Weight (g) | 0.2227 ± 0.00 |
| Water content (%) | 6.4331 ± 0.48 |
| Color value (°Hue) | 49.8691 ± 0.14 |

Table 1 shows the findings of the physicochemical study of sappan bark. To determine the average in sappan bark packing, tests of cm/pack length and g/pack weight were performed. Secang farmers market sappan bark alone by reducing its size without further processing. *Simplicia* is a natural material that has undergone no processing alterations other than drying. Moisture content is a drying process with multiple approaches, one of which is oven drying. According to the results, the sappan bark's hue is red (R). This is since the L value acquired from the analysis spans from 40-59, the a* value obtained ranges from 39-46, and the b* value ranges from 43-59. Based on this, the color value of the sappan bark was obtained by showing the dark red color of the product.

Table 2. Analysis of Raw Materials in Secang Juice

| Test Parameters | Secang Juice |
|---------------------------------|------------------------------|
| pH | 5.1570 ± 0.16 |
| Total Acid (%) | 0.6970 ± 0.01 |
| Antioxidant activity IC50 (ppm) | 20.0367 ± 0.34 |
| Color value (Hue) | 49.8680 ± 0.14 |
| ALT Starter Kombucha (CFU/ml) | 4.9 x 10 ⁶ ± 4.96 |

Table 2 shows the findings of the Analysis of raw materials in secang juice. The pH level and color of secang juice are connected. This is because secang creates a red color at a pH of 6-7, and the color value of secang juice ranges between 180-540, hence the product is Red (R). The antioxidant activity contained in secang juice obtained an IC50 value of 20.03 ppm and [11] the antioxidant activity of dried secang extract, an IC50 value of 15.69 ppm was obtained. The difference in antioxidant activity that arises as a result of employing water as a solvent in the process of creating secang juice and the separation process carried out using a manual filtering approach using a filter cloth. While the extraction procedure is used with a tool, the extracted extract is more concentrated, and the antioxidant activity gained is more active.

Kombucha secang is a fermented beverage innovation that is expected to have a good effect on the body in the end. Consumer acceptance of secang kombucha drinks can be seen in Table 3.

Table 3. Consumer Acceptance of the Observed Parameters

| Treatment | Observed Parameters | | | | |
|-----------|---------------------|-------------|-------------|-------------|-------------------|
| | Color | Flavor | Taste | Viscosity | General Admission |
| G1F1 | 4.1875±0.02 | 4.5958±0.12 | 3.6208±0.10 | 5.1417±0.14 | 4.1583±0.06 |
| G2F1 | 4.2292±0.03 | 4.9458±0.01 | 4.4583±0.06 | 5.4625±0.05 | 4.6000±0.10 |
| G3F1 | 4.1875±0.04 | 4.8833±0.05 | 4.6625±0.06 | 5.5125±0.12 | 4.4042±0.12 |
| G1F2 | 4.9583±0.06 | 4.9833±0.06 | 4.9583±0.06 | 5.3792±0.08 | 4.8833±0.09 |
| G2F2 | 5.3000±0.05 | 5.0583±0.08 | 5.2167±0.08 | 5.4250±0.07 | 5.3333±0.07 |
| G3F2 | 5.2458±0.12 | 5.0833±0.07 | 5.4458±0.08 | 5.5167±0.06 | 5.3458±0.08 |
| G1F3 | 6.1208±0.07 | 5.1708±0.12 | 5.6250±0.16 | 5.5042±0.12 | 5.2708±0.14 |
| G2F3 | 6.2833±0.01 | 5.2125±0.14 | 6.2458±0.05 | 5.4792±0.04 | 5.5667±0.07 |
| G3F3 | 6.2083±0.13 | 5.1792±0.15 | 5.7083±0.11 | 5.5458±0.03 | 5.4167±0.10 |
| G1F4 | 5.8625±0.08 | 5.1917±0.02 | 5.4833±0.01 | 5.5750±0.11 | 5.3583±0.03 |
| G2F4 | 5.8292±0.17 | 5.1833±0.05 | 5.7667±0.04 | 5.6292±0.01 | 5.3500±0.10 |
| G3F4 | 5.9583±0.03 | 5.1792±0.07 | 5.7083±0.05 | 5.7417±0.03 | 5.2458±0.14 |

Note: Concentration of sugar (G1= 10%; G2= 20%; G3= 30%),
 Fermentation time (F1= 4 days; F2= 7 days; F3= 10 days; F4 = 13 days)

3.1. Color Hedonic

The analysis of variance revealed that participant acceptability of the kombucha secang drink was significantly different ($P < 0.05$). According to Figure 1A, the highest hedonic color was found in the G2F3 treatment of 6.2833, indicating that the panelists liked the color of kombucha secang, and the lowest hedonic color was found in the G1F1 and G3F1 treatments of 4.1875, indicating that the panelists chose neutral to the color of kombucha secang. G2F3 had the highest panelist acceptability because the kombucha secang was reddish yellow, which drew the panelists' attention. The panelists' preference level in G1F1 and G3F1 was low due to the product's color. The results of color hedonic can be seen in Figure 3.1.

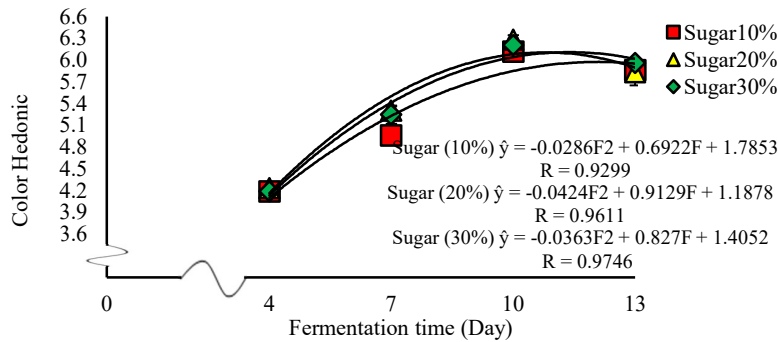


Figure 1. Color Hedonic

3.2. Hedonic Flavor

The analysis of variance revealed that participant acceptability of the kombucha secang drink was significantly different ($P < 0.05$). According to Figure 1B, the largest effect on the G2F3 treatment is 5.2125, indicating that the panelists prefer the scent of kombucha secang, and the lowest hedonic flavor is 4.5958, indicating that the panelists choose neutral to the aroma of kombucha secang. Panelist acceptance is highest in G2F3 because the flavor created is sufficient to pique the panelists' interest, and the aroma is not too dense to be accepted by smell. The lowest level is seen on G1F1. [12] The rearrangement of sugar into organic acids that occurs throughout the microbial fermentation process results in an acidic solution, according to the statement. The flavor in kombucha is caused by an acid solution that oxidizes, resulting in the characteristic sour fragrance in kombucha. The results of hedonic flavor can be seen in Figure 3.2.

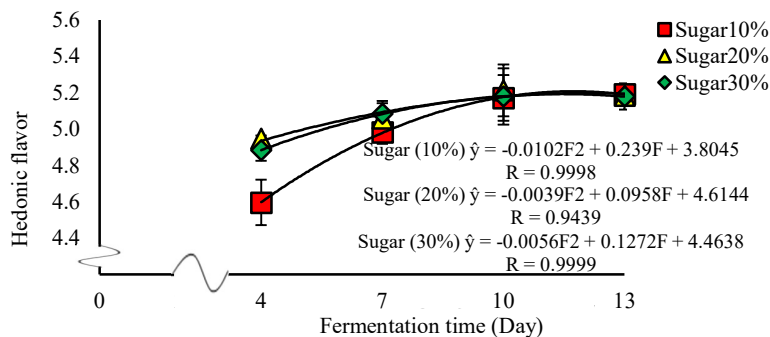


Figure 2. Hedonic Flavor

3.3. Hedonic Taste

The analysis of variance revealed that participant acceptability of the kombucha secang drinks was significantly different ($P < 0.01$). According to Figure 1C, the maximum impact on the G2F3 treatment is 6.2458, indicating that the researcher enjoys the taste of the Secang kombucha drink, while the lowest effect on the G1F1 treatment is 3.6208, indicating that the panelists dislike the taste of the Secang kombucha drink. Acceptance of panelists the highest in G2F3 was also loved by the panelists because it generated a slightly sweet-sour kombucha taste and a sour taste that was not too thick, so the panelists enjoyed it and did not dislike it. The results of hedonic taste can be seen in Figure 3.3.

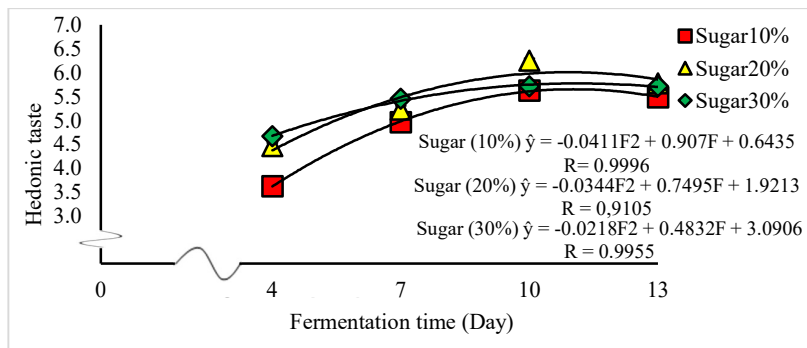


Figure 3. Hedonic Taste

3.4. Hedonic Viscosity

The analysis of variance revealed that participant approval of the kombucha secang drinks was significantly different ($P < 0.05$). According to Figure 1D, the largest effect on treatment G3F4 is 5.7417, while the lowest hedonic viscosity of 5.1417 was discovered in the G1F1 treatment, indicating that the panelists enjoyed the viscosity of the secang kombucha drink. Panelist approval in G3F4 is the highest because the resulting viscosity is not too thick, and when the fermentation process begins, the microbes have reached the optimal point, and the fermentation results run smoothly and produce a liquid viscosity level. Because the sugar level in the solution had not been reduced, G1F1 attained a low hedonic viscosity. The results of hedonic viscosity can be seen in Figure 3.4.

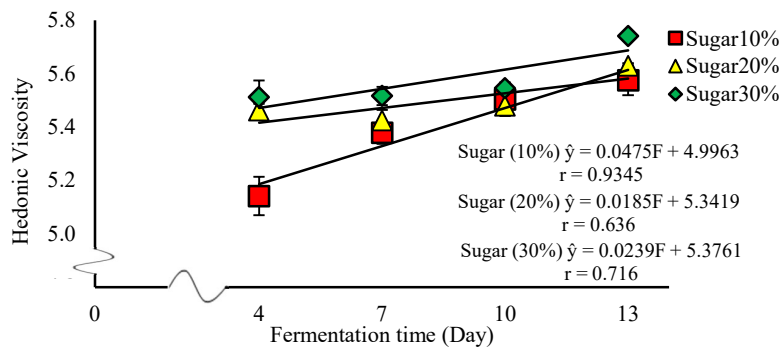


Figure 4. Hedonic Viscosity

3.5. General Admission

The analysis of variance revealed that participant acceptance was substantially different ($P < 0.01$). According to Figure 1E, the best acceptance is in the G2F3 treatment of 5.5667, indicating that panelists prefer the general acceptance of secang kombucha drinks, while the lowest general acceptance hedonic is in the G1F1 treatment of 4.1583, indicating that panelists prefer neutral to the general acceptance of secang kombucha drinks. The researcher did not like the neutral option of kombucha secang, and the general acceptance of the product for color, taste, scent, and viscosity was not satisfactory. The popularity of kombucha secang drinks with consumers alters the market. The results of general admission can be seen in Figure 3.5.

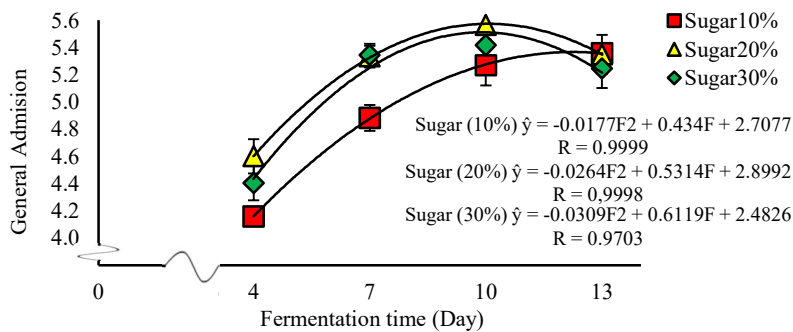


Figure 5. General Admission

3.6. Determination of the Best Quality in Secang Kombucha Drinks

The de-Garmo approach was used to determine the optimum treatment for kombucha secang. The DPPH technique was used to determine antioxidant activity (2,2-diphenyl-1-picrihydrazil). This study was conducted to investigate the antioxidant activity of the optimum treatment, G2F3, which has a 20% sugar concentration and a 10 day fermentation duration. The IC50 of the test was found to be 31.9744 ppm. This is in line with research, which claims that antioxidant activity is active if the IC50 ranges from 10-100 g/ml [13]. The outcomes of microbial metabolism in kombucha during the fermentation process create an increase in antioxidant activity the increase is due to the free phenol produced during fermentation the higher the phenol content produced, the higher the antioxidant activity. [14].

The alcohol content was measured using a pycnometer. The test results obtained an alcohol content of 0.1967%. This is by the Ugandan standard. The kombucha category is without alcohol by 0.5% and for kombucha containing alcohol, the alcohol content in kombucha is 0.5-15%. The increase in the amount of alcohol content in kombucha is due to the long fermentation time, the longer the fermentation time the levels will increase. The formation of alcohol during fermentation is also influenced by the availability of nutrients in the substrate where if the nutrient content in the substrate decreases, the yeast stops breeding, and as the alcohol content decreases it will turn into organic acids [15].

The total plate count (TPC) was the test result obtained with a total plate count (TPC) of 7.6×10^5 CFU/ml. In kombucha products, after the fermentation process, the kombucha solution is taken and then heated to stop the rate of fermentation that occurs. The heating process can reduce the number of fermenting bacteria and inhibit the sustainable formation of SCOBAY biofilms [16]. The highest acceptance of products can be seen in Table 4.

Table 4. The Determination of the Best Quality in Secang Kombucha Drinks

| Test Parameters | Analysis |
|---------------------------------|-----------------------------|
| Antioxidant activity IC50 (ppm) | $31.9744 \pm 0,76$ |
| Alcohol content (%) | $0.1967 \pm 0,06$ |
| Total aerobic count (CFU/ml) | $7.6 \times 10^5 \pm 11.64$ |

4. Conclusion

Based on consumer acceptance of the sensory characteristics of fermented kombucha drink, the best quality obtained is the sample code with a value of G2F3 sugar concentration of 20% and fermentation time of 10 days. The best quality value is obtained by looking at the result of the general acceptance of respondents 5.5667 and product ratings based on the color, flavor, taste, and viscosity of the secang kombucha drink. The test results obtained were the results on the antioxidant activity test, the IC50 value was 31.9744 ppm, the alcohol content test was 0.1967% and the total plate count (TPC) test was obtained at 7.6×10^5 CFU/ml.

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