The Formulation of Aloe Vera (Aloe chinensis Baker) and Calyx of Roselle Flower Petals (Hibiscus sabdariffa L.) For Making Fruit Leather

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Abstract

Fruit leather is a diversification of jam products. The main ingredient of fruit leather is potential agricultural product. West Kalimantan is the largest supplier of aloe vera in Indonesian while rosella calyx contains pectin and acids as important factors in the making of fruit leather. The aim of this research is to find a formulation of fruit leather by aloe vera and roselle calyx which produce the best chemical and sensory characteristics. The research design uses a randomized block design one factor (formulation of aloe vera and rosella calyx) by five levels of treatment (80:20, 70:30, 60:40, 50:50, 40:60) and was repeat 5 times. The data obtained were statistically analyzed using ANOVA (α = 5%) and if followed by BNJ test (α = 5%). The results showed that the best formulation based on effectiveness index was aloe vera: roselle calyx (60:40) with a characteristic water content 35.46%; crude fiber content 0.71%; vitamin C content 75.68 mg / 100 g; pH 3.15; calcium content 28,2712 mg / 100 g; 16.16% sucrose. The sensory level produces a hedonic texture scale of 4.6 (likes), colors 4.7 (likes) and taste 4.43 (likes).

Keywords: fruit leather, aloe vera, roselle calyx

1. Introduction

Aloe vera has spread widely in various countries, including Indonesia, especially West Kalimantan. According to the Pontianak City Food Crops Service, Pontianak is the largest supplier of aloe vera, with a total supply of 37.25% of the total national production. In 2017 the harvested area produced by West Kalimantan Province was 764,792 m², or in 1 year, the results obtained were 76.47 hectares (BPS, 2017). The abundant availability of aloe vera in West Kalimantan has considerable potential for processing aloe vera into a product.

The aloe vera plant has been known for a long time as a hair fertilizer, wound healer, and skin care. Aloe vera gel contains various minerals and vitamins; one mineral substance in aloe vera is calcium. Aloe vera also contains fiber that comes from the carbohydrate content contained in it. It can be beneficial for health, one of which can facilitate digestion. According to the Ministry of Health of the Republic of Indonesia (1992), aloe vera has a relatively high calcium content, namely 85 mg/100 g; when compared to pineapple, which is commonly used as an ingredient in making jam, the calcium content is 19 mg/100 g (Ministry of Health of the Republic of Indonesia). 1998). Aloe vera also contains fiber from the carbohydrate content, which can be beneficial for health and facilitate digestion.

One of the food processing products that can be produced from aloe vera gel is the jam. Jam is one of the preserved fruit products made by cooking crushed fresh fruit and mixing sugar with or without the addition of water. Jam is usually used to complement bread dishes with or without adding butter or margarine. Jam can also be defined as a semi-wet food product which is the processing of fruit pulp and sugar made from a mixture of 45% fruit juice and 55% sugar. The
mixture is then concentrated until the final result is more than 65% dissolved solids (BSN, 2008). In general, aloe vera gel does not have color, taste, and aroma, so in making jam, aloe vera gel requires additional ingredients such as rosella flower petals.

Rosella flower petals have a very attractive red color and sour taste. The red color in rosella contains anthocyanin pigments which are part of flavonoids that act as antioxidants. One of the antioxidant content in rosella flower petals is vitamin C. The sour taste in rosella is caused by the presence of organic acids, one of which is citric acid. In addition, rosella flower petals contain pectin of 3.19% (Muryanti, 2011). Pectin is one of the essential factors in making jam.

Jam in general that circulates in the community is the jam in the form of a spread. The spread of jam is considered less practical, so it is necessary to develop the shape of the spread into sheet jam. Sheet jam as diversification of spread jam products has advantages in the presentation process and packaging concept. Sheet jam has a manufacturing process that is almost the same as the spread, namely fruit peeling, fruit size reduction, fruit crushing, mixing sugar and additional ingredients followed by cooking (Badges, 1979); the difference is that sheet jam is given additional ingredients after the cooking process so that jam becomes stiff and can be cut.

The manufacture of sheet jam products is carried out using the formulation of aloe vera meat and rosella flower petals which have the potential as essential ingredients for making sheet jam. The processed product of aloe vera sheet jam and rosella flower petals is expected to be able to produce sheet jam with the best characteristics and become an alternative for food diversification. This study aimed to obtain a formulation of aloe vera sheet jam and rosella flower petals with the best characteristics.

2. Methods

2.a. Materials and Tools

The raw materials used to manufacture sheet jam include aloe vera and rosella flower petals obtained from the Flamboyan Market, Pontianak City. Additional ingredients include agar (pectin), sugar, CMC, and water. Chemicals for analysis include distilled water, iodine, 0.1 N NaOH, H2SO4, K2SO4, alcohol, and starch.

The tools used in this study were divided into two tools used for processing sheet jam and tools for laboratory analysis. Tools for processing sheet jam are analytical scales, measuring cup, oven, baking sheet, knife, spoon, stirrer, pan, thermometer, and stove. At the same time, the tools used for analysis are sensory test containers, analytical balances, volume pipettes, erlenmeyer, burettes, pH meters, filter paper, stationery, and documentation tools.

2.b. Research Stages

2.b.1. Aloe vera

For making sheet jam, the first thing to do is to prepare the aloe vera meat. The aloe vera used is aloe whose midrib is yellowish and has a thickness of around 1.5 cm. The aloe vera was peeled and then rinsed clean with running water, and after that, it was blanched for about 10 minutes and then cooled using ice cubes. After being blanched, the aloe vera meat was cut into cubes and weighed according to the treatment.

2.b.2. Rosella Petals

The preparation of the rosella petals is the same as the preparation of aloe vera meat. Namely, the rosella flower petals are selected, which have a dark red color, then the petals are separated from the seeds and then washed clean. Furthermore, the rosella petals were weighed according to the treatment.

2.b.3. Jam Sheets Production

Jam sheet is done by mixing pieces of aloe vera and rosella flower petals according to the formulation, then crushing using a blender to get crushed fruit. Then, add other ingredients such as 50 g sugar, 3.5 g gelatin, and 0.5 g CMC and mix until homogeneous. Furthermore, cooking is done until the mixture thickens; after that, the mixture is added as much as 5 g of margarine and
then stirred until evenly distributed. After stirring well, 40 ml of the mixture was spread into a 10 cm x 10 cm baking dish and baked at 65°C for 3 hours. The results of the research products were then analyzed for physicochemical and sensory properties.

2.c. Research Design
This study used a Randomized Block Design (RAK) research method, which consisted of one factor: the concentration of aloe vera and rosella flower petals in the manufacture of sheet jam. The treatments in this study were five levels with five repetitions of each treatment. Each treatment had a total of the main ingredients of aloe vera (%): rosella flower petals (%) which were 100 grams.

- p1 = (80%: 20%)
- p2 = (70%: 30%)
- p3 = (60%: 40%)
- p4 = (50%: 50%)
- p5 = (40%: 60%)

2.d. Data Analysis
The results of observations of chemical and physical parameters were analyzed using analysis of variance (ANOVA) at the 5% test level. If the results had a significant effect, the test was continued with the BNJ method at the 5% level. Sensory test results were analyzed by the Kruskal-Wallis test (Rapengan et al., 1985). To find out the best treatment, all data will be analyzed by using the effectiveness index test (De Garmo et al., 1984).

3. Result and Discussion

3.a. Water Content
The average value of the moisture content of aloe vera and rosella leaf jam in various treatments can be seen in Figure 1. The ANOVA test results show that the formulation of aloe vera and rosella petals significantly affects the moisture content of the sheet jam so that it is continued with the significant difference test (BNJ) 5% level.

![Figure 1. Moisture Content of Aloe Vera Sheets and Rosella Flower Petals (%)](image)

The average moisture content of aloe vera jam and rosella flower petals produced in this study was 33.67-38.39%. Sheet jams of aloe vera and rosella flower petals that met the standards were sheet jams with formulations of 50:50 (34.50%) and 40:60 (33.67%). The moisture content of sheet jam tends to increase with the addition of aloe vera. This is because the water content in aloe vera (99.20%) is higher than in rosella flower petals (90.89%). When compared with the research of Putri et al. (2017) regarding the characteristics of carrot jam which has a water content ranging from 44.42-46.18%, the water content in aloe vera sheet jam and rosella flower petals is closer to the jam quality standard that has been set, with a maximum water content of 35%.
3.b. Crude Fiber Content

The average value of crude fiber content of aloe vera and rosella leaf jam in various treatments can be seen in Figure 2. The ANOVA test results showed that the formulation of aloe vera and rosella petals significantly affected the crude fiber content of sheet jam, so it was continued with the Significant Difference test. Honest (BNJ) level 5%.

The average crude fiber content of aloe vera jam and rosella flower petals produced in this study was 0.37-0.86%. The lowest fiber content was found in the formulation of aloe vera and rosella flower petals at 80:20, and the highest fiber content was found in the formulation at 40:60. This indicates that the more rosella petals were added to the formulation, the higher the crude fiber content value produced. This is because the crude fiber content of rosella flower petals is higher than aloe vera, which is 6.26%, while the crude fiber content of aloe vera is 1.32%, in the study of Manik et al. (2017) regarding the use of ripe bananas a day and flower petals rosella in making jam it was found that the crude fiber content increased with the addition of rosella petals.

3.c. Vitamin C Content

Based on ANOVA analysis with a test level of 5%, the formulation of aloe vera and rosella flower petals significantly affected the sheet jam’s vitamin C levels, so it continued with the Honest Significant Difference (BNJ) test at a 5% level. The average value of vitamin C content of aloe vera leaf jam and rosella flower petals can be seen in Figure 3.
vera and rosella flower petals at 40:60, while the lowest vitamin C levels were found in the 80:20 formulation. The value of vitamin C levels increased with the addition of rosella flower petals. The vitamin C content of rosella flower petals is 79.2 mg/100 g, while aloe vera is 30.8 mg/100 g. The results of this study are also supported by research by Sitanggang et al. (2017) regarding the quality of the fruit leather of rosella flower petals and chrysanthemum flowers which stated that the more rosella petals were given, the higher the vitamin C content.

Compared with the research of Puspitasari et al. (2014) in the manufacture of watermelon albedo sheet jam and super red dragon fruit with vitamin C content ranging from 2.92-9.34%, aloe vera sheet jam, and rosella flower petals have higher vitamin C content. The daily requirement of human vitamin C is 90 mg/100 g (BPOM RI, 2016) so that aloe vera jam and rosella flower petals can meet the human body’s needs.

3.d. pH

Based on the analysis of ANOVA diversity with a test level of 5%, it was found that the formulation of aloe vera and rosella flower petals had a significant effect on the pH of sheet jam, so it was continued with the Honest Significant Difference (BNJ) test at 5% level. The average pH value of aloe vera sheet jam and rosella flower petals can be seen in Figure 4.

![Figure 4. pH of Aloe Vera Sheet Jam and Rosella Flower Petals](image)

**Lidah Buaya : Kelopak Bunga Rosella**

The average pH of aloe vera leaf jam and rosella flower petals produced in this study was 2.822-3.652. Figure 7 shows the lower pH value with the addition of rosella petals. The low pH value of sheet jam is caused by the vitamin C content in rosella flower petals. The higher the value of vitamin C, the lower the pH value. The pH value of rosella flower petals is lower at 2.87, while aloe vera has a pH of 4.96. Low pH is essential in forming gel structure in a jam, where the optimum conditions for gelling are close to pH 3.2-3.4, besides pH affecting a product’s durability (Buckle et al., 2007). When compared with Erdiyus and Usman’s research (2017) on the manufacture of nipah fruit leather and red dragon fruit skin which has a pH ranging from 5.20-5.28, aloe vera sheet jam and rosella flower petals have a lower pH and are close to optimum conditions.

3.e. Calcium Content

Based on the analysis of ANOVA diversity (Appendix 9) with a test level of 5%, it is known that the formulation of aloe vera and rosella flower petals has no significant effect on calcium levels. The average calcium value of aloe vera sheet jam and rosella flower petals can be seen in Figure 5.
Based on the picture above, it can be seen that the highest calcium content is found in the formulation of aloe vera and rosella flower petals at 70:30, namely 316.69. The calcium content of aloe vera is greater than that of rosella petals. The calcium content of aloe vera is 2923.04 mg/100 g, while the calcium content in the rosella flower petals is 391.52 mg/100 g.

3.f. Sucrose Content

Based on the analysis of variance ANOVA with a test level of 5%, it was found that the formulation of aloe vera and rosella flower petals had a significant effect on the sucrose content of sheet jam, so it was continued with the Honest Significant Difference (BNJ) test at 5% level. The average value of sucrose content of aloe vera sheet and rosella petals can be seen in Figure 6.

The average sucrose content of aloe vera leaf jam and rosella flower petals produced in this study was 5.94-21.98%. The average value of the lowest sucrose content was found in the formulation of aloe vera and rosella flower petals at 80:20, while the highest sucrose content was found in the formulation of 40:60. The value of sucrose content in sheet jam increased with the addition of rosella flower petals. This is because the carbohydrate content in rosella flower petals is higher, namely 11.1 g/100 g (Maryani, 2008), while the carbohydrate content in aloe vera is 0.3 g/100g (Morsy, 1991).

3.g. Hedonic Test

Organoleptic test is referred to as sensory assessment or sensory assessment that utilizes the five human senses to observe a product's texture, color, shape, aroma, and taste. The parts of the body that play a role in sensing are the eyes, ears, sense of taste, sense of smell, and sense of touch or touch. Organoleptic testing aims to determine whether a particular commodity or sensory trait can be accepted by the public (Lailiyana, 2012). The organoleptic method used in this study is the hedonic (preferred) method. The organoleptic test was carried out by giving five samples that had been coded with random numbers and then presented to 30 panelists.
Table 1. Hedonic Test of Aloe Vera Sheets and Rosella Flower Petals

<table>
<thead>
<tr>
<th>Aloe Vera: Rosella Flower Petals</th>
<th>Texture</th>
<th>Colour</th>
<th>Flavor</th>
</tr>
</thead>
<tbody>
<tr>
<td>80:20</td>
<td>3.43</td>
<td>3.6</td>
<td>3.63</td>
</tr>
<tr>
<td>70:30</td>
<td>3.56</td>
<td>3.8</td>
<td>3.6</td>
</tr>
<tr>
<td>60:40</td>
<td>4.6</td>
<td>4.7</td>
<td>4.43</td>
</tr>
<tr>
<td>50:50</td>
<td>3.03</td>
<td>3.83</td>
<td>3.3</td>
</tr>
<tr>
<td>40:60</td>
<td>3.06</td>
<td>3.76</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Chi Square 0.05% = 9.4877 Kw=46.2 Kw=30.2 Kw=213.02

Description: If Kw>0.05, has a significant effect; if Kw<0.05, has no significant effect.

3.g.1. Texture

Table 1 shows that the results of the organoleptic test for each treatment of aloe vera and roSELLa petal formulations had a significant effect on the texture of the aloe vera sheet jam and roSELLa flower petals produced. That is 4.6 (like-very much), while the lowest value is found in the treatment with aloe vera and roSELLa 50:50 formulations, which is 3.03 (somewhat like-like). The texture of aloe vera sheet jam and roSELLa flower petals is influenced by the crude fiber and pectin content found in the roSELLa petals. The formation of texture in sheet jam is influenced by crude fiber and pectin content (Anggraini and Handayani, 2016).

3.g.2. Colour

Table 1 shows that the results of the organoleptic test for each treatment of the aloe vera and roSELLa petal formulations had a significant effect on the color of the aloe vera sheet jam and the resulting roSELLa flower petals. The highest value of color was found in the treatment with the formulation of sheet jam and roSELLa flower petals at 60:40, which was 4.7 (like very much). In contrast, the lowest value was found in the treatment with the formulation of aloe vera and roSELLa flower petals 80:20, which was 3.6 (somewhat). The red color in a jam comes from the betacyanin pigment found in roSELLa flower petals; betacyanin is one of the anthocyanin groups that can be used as a food coloring and functions as an antioxidant (Rebecca et al., 2011).

3.g.3. Flavor

Table 1 shows that the results of the organoleptic test for each treatment of the aloe vera and roSELLa petal formulations significantly affected the taste of the aloe vera sheet jam and roSELLa petals produced, i.e., 4.43 (like-very much) while the lowest value was found in the treatment with aloe vera and roSELLa 50:50 formulations, which was 3.3 (slightly like-like). The more the addition of roSELLa petals, the stronger the sour taste in the sheet jam; this is because the roSELLa petals have a lower pH value of 2.87. The sour taste is caused because the ingredients’ content of acids such as vitamin C gives a sour taste sensation on the human tongue (Winarno, 2008). Rosella flower petals contain three dominant acid compound components: ascorbic acid (vitamin C), citric acid, and malic acid (Safitri, 2012).

3.h. Determination of the Best Treatment with Effectiveness Index Test

Based on the calculation of the effectiveness index, the best treatment is indicated by the highest Treatment Value (NP), which can be seen in Table 2.

Table 2. Treatment Value (NP) of Aloe Vera Jam and Rosella Flower Petals

<table>
<thead>
<tr>
<th>Aloe Vera (g) : Rosella Flower Petals (g)</th>
<th>Treatment Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>80:20</td>
<td>0.35</td>
</tr>
<tr>
<td>70:30</td>
<td>0.45</td>
</tr>
<tr>
<td>60:40</td>
<td>0.70</td>
</tr>
</tbody>
</table>

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According to table 2, the best treatment for aloe vera jam and rosella petals was the 60:40 formulation with a value of 0.70, so the hypothesis was accepted. Aloe vera and rosella petals have characteristics that support each other so that the formulation of aloe vera and rosella petals as an ingredient in sheet jam processing produces the right product and can be accepted by the panelists. Aloe vera jam sheet and rosella flower petals with the best treatment (60:40) had the following chemical and physical characteristics; water content 35.46%, crude fiber content 0.71%, vitamin C content 75.68 mg/100 g, pH 3.15, and calcium content 28.2712 mg/100 g.

4. Conclusion

The sheet jam formulation that produces the best characteristics is 60:40, so the hypothesis is accepted. The 60:40 formulation has a water content value of 35.46%, crude fiber content 0.71%, vitamin C content 75.68 mg/100 g, pH 3.15, calcium content 28.2712 mg/100 g, and sucrose content. 16.16% and produces a hedonic value for texture 4.6 (like-very like), 4.7 for color (like-very like), and 4.43 for taste (like).

References


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