Jurnal Ilmiah Berkala: Sains dan Terapan Kimia
Vol. 17 No. 2, July 2023

Pretreatment of Aloe Vera and Its Effect on the Properties of Flour and Vermicelli Produced

Pretreatment Lidah Buaya dan Efeknya pada Sifat Tepung dan Bihun yang Dihasilkan

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ABSTRACT

The color of aloe vera powder is dull due to the browning reaction. Pretreatment was carried out to improve the quality of aloe vera flour. Aloe vera flour can be utilized to produce several food items, including vermicelli. This study aimed to investigate the impact of several pretreatment methods, including blanching, immersion in sodium metabisulfite, immersion in sodium bisulfite, and steam blanching, on the properties of aloe vera flour and its application in vermicelli production. The research steps included aloe vera pretreatment and aloe vera flour production, vermicelli production with aloe vera flour substitution, and analysis. The findings indicated that the pretreatment procedure yielded aloe vera and vermicelli flour exhibiting enhanced brightness in color. The mositure content, water-holding capacity, oil-holding capacity, and cooking qualities are all influenced by pretreatment. However, the sensory characteristics of vermicelli remained unaffected by the treatments.

Keywords : vermicelli, aloe vera, flour, pretreatment, color.

Received: November 30, 2022; **Accepted**: September 11, 2023: **Available online**: October 23, 2023

1. INTRODUCTION

The aloe vera plant exhibits the highest concentration of dietary fiber, specifically 62.34% in the skin and 57.64% in the flesh. According to Siregar *et al*. (2014), the dietary fiber found in aloe vera consists of cellulose, pectic compounds, lignin, and mannan. Aloe vera flour is a mixed component widely used in food and beverage products (Latifah & Apriliawan, 2019). Extraction is carried out by taking liquid or gel from the midrib of aloe vera. This liquid or gel is easily damaged when exposed to heat, light, and air, which can cause oxidation due to oxidase enzymes. Hence, the presence of air (specifically oxygen) can accelerate the oxidation process.

Contact oxidation induces a noticeable alteration in the color of aloe vera gel, resulting in a brown hue, referred to as a browning reaction. Browning reactions can occur through enzymatic and non-enzymatic processes. In order to minimize the browning reactions, it is necessary to subject the aloe vera gel to pretreatment prior to its conversion into flour. Several pretreatment methods that can be employed include blanching, metabisulfite soaking, bisulfite soaking, and steam blanching. Pretreatment is conducted to produce flour with a brighter color.

Aloe vera flour can be processed into finished products, including vermicelli. The shelf life of aloe vera gel is notably short, primarily due to its nutritional composition and enzyme concentration, making it susceptible to spoilage. Aloe vera flour can be used as an additional ingredient, which is expected to help increase the elasticity of tapioca or cornstarch and increase

the fiber content of vermicelli food. According to Jumanah *et al*. (2017), vermicelli can be produced from flour substituted with canna flour, green bean flour, and additional tapioca flour, which can produce vermicelli with a brownish color. This color change is caused by phenol compounds and the activity of the phenolase enzyme contained in canna flour. This research aims to determine the effect of different pretreatments (blanching, sodium metabisulfite soaking, sodium bisulfite soaking, and steam blanching) on the characteristics of aloe vera flour and its application to the vermicelli produced.

2. MATERIALS AND METHOD

2.1. Material and Tools

The material used were aloe vera from the West Semarang, maltodextrin, rice flour, tapioca flour, CMC, gelatin, distilled water, sodium metabisulfite, sodium bisulfite, aluminum foil, oil, distilled water, filter paper, paper tissue, and descriptive test equipment.

The equipment employed were a cabinet dryer, 60 mesh sieve, blender, stainless steel knife, cutting board, plastic container, pan, baking sheet, desiccator, analytical balance, colorimeter, sieve, aluminum cup, glass bottle, oven, mortar, 100 mL measuring cup, beaker 100 mL, pipette, centrifuge tube, centrifuge, stove, pan, and hot plate.

2.2. Pretreatment and production of aloe vera flour

Fresh aloe vera was cut. The outer skin was peeled and then weighed 500 grams. Clean aloe vera was given preliminary treatment consisting of control (without treatment), blanching, sodium metabisulfite soaking, sodium bisulfite soaking, and steam blanching. The pretreatment results were further pulverized using a blender, supplemented with a 15% maltodextrin, underwent homogenization, filtered, and subjected to a temperature of 60ºC for 48 hours in a cabinet dryer. The dried aloe vera underwent a secondary grinding process using a blender and was sieved using a 60-mesh sieve (Siregar *et al*., 2014).

2.3. Vermicelli Production

Ten grams of aloe vera flour mixed with 48 grams of rice flour, 10 grams of tapioca flour, 1.5 grams of CMC, and 0.5 grams of gelatin. A total of 30 mL of heated water was incorporated into the dough and kneaded until achieving a smooth consistency. The dough undergoes a molding process utilizing an extruder, followed by a steaming duration of 45 minutes. Subsequently, it was subjected to a drying period of 24 hours within a cabinet drier.

2.4. Analysis

The analyses on aloe vera flour were moisture content (AOAC, 1995) and color (chromameter WR-10). Analyses on vermicelli were moisture content (AOAC, 1995), water holding capacity, oil holding capacity, rehydration power, cooking time, cooking loss, development ratio, color (chromameter WR-10), and descriptive organoleptic tests.

3. RESULTS AND DISCUSSION

3.1. Analysis of the moisture content of aloe vera flour and vermicelli

Moisture content is used to determine the content or amount of water contained in a material by drying the material in an oven/heater.

Table 1. Moisture content of aloe vera flour and vermicelli

Treatment	Condition	Moisture content of aloe vera flour (%)	Mositure of vermicelli (%)
K	Control	7.72±0.98b	5.45±0.32a
P1	Blanching	8.64±0.23b	6.51±0.27b
P2	Metabisulfite soaking	7.92±0.14b	6.34±0.31b
P3	Bisulfite soaking	5.44±0.3a	6.73±0.06bc
P4	Steam blanching	5.53±0.34a	7.15±0.41c

Note: Different notations in the same column indicate significant differences at the α=5% level using the Duncan test.

The moisture content of aloe vera flour, following various pretreatments, exhibited a range of 5.44-8.64%. The preliminary blanching process yielded the highest moisture content of 8.64%.

In a study conducted by Masuku (2014), it was shown that cashew flour subjected to bisulfite soaking pretreatment exhibited a reduced moisture content compared to flour treated with blanching pretreatment. This is because sodium bisulfite has the ability to bind water, causing the moisture content to decrease.

3.2. Analysis of water holding capacity and oil holding capacity

Water holding capacity is expressed as expressible moisture or water from the food system due to external pressure. Oil Holding Capacity (OHC) is the product's ability to absorb and hold oil without heating conditions (Nafi *et al*., 2007).

Table 2. Data analysis of water holding capacity and oil holding capacity

Treatment	Condition	WHC (%)	OHC (%)
K	Control	347.96d	154.82a
P1	Blanching	137.06a	167.56ab
P2	Metabisulfite soaking	248.21b	161.3ab
P3	Bisulfite soaking	266.65b	167.72ab
P4	Steam blanching	306.73c	178.5b

Note: Different notations in the same column indicate significant differences at the α=5% level using the Duncan test.

According to Table 2, the Water Holding Capacity (WHC) of vermicelli substituted with aloe vera flour and subjected to various pretreatments ranged from 137.06m - 347.96%. The WHC value of vermicelli substituted with aloe vera flour without pretreatment was the lowest (137.06%). The control flour exhibited a higher WHC compared to the flour subjected to blanching pretreatment. This disparity can be attributed to the utilization of room temperature water during the production of the control flour, while the blanching treatment involved hot water or boiling. The findings of Muhamad *et al*. (2015) align with the present study, as they observed that the utilization of room temperature water during pineapple fiber pretreatment led to increased WHC compared to the utilization of hot water.

3.3. Analysis of Cooking Properties

The concept of rehydration power refers to the capacity of a substance to absorb water. This test aims to measure the capacity of the material to undergo water reabsorption subsequent to the drying process (Asgar & Musaddad, 2006). Cooking loss is the process of losing solids due to cooking, which shows the large amount of solids that come out of the vermicelli strands during cooking (Husna *et al*., 2017). Cooking time is the time needed to turn raw vermicelli into cooked vermicelli. The higher the amylose content, the faster the product's cooking time. This is caused by the high amylose content, which causes the product to be easily retrograded (Mayasti *et al*., 2018). The swelling ratio is the ratio of the expansion of the length and width of vermicelli when dry and after cooking (Interpares & Cahyanto, 2015).

Table 3. Data analysis of cooking properties

Treatment	Condition	Rehydration power (%)	Cooking loss (%)	Cooking time (minute)	Swelling ratio (mm)
K	Control	210.68±14.61a	0.59±0.13a	2.29±0.05c	17.49±0.42b
P1	Blanching	265.87±13.81bc	1.29±0.46b	2.34±0.06c	18.72±0.56c
P2	Metabisulfite soaking	254.66±15.25b	0.49±0.14a	2.15±0.02b	17.05±0.46b
P3	Bisulfite soaking	265.42±13.05bc	1.37±0.28b	2.03±0.02a	19.39±0.55c
P4	Steam blanching	282.64±8.51c	0.26±0.12a	2.25±0.05c	15.44±0.82a

Note: Different notations in the same column indicate significant differences at the α=5% level using the Duncan test.

Vermicelli substituted with aloe vera flour with steam blanching treatment had the highest rehydration value, 282.64%. This phenomenon occurs due to the dilation of pores, resulting in an increased water inflow. The high rehydration capacity of the substance can be attributed to its

constituents, particularly protein and starch, which have a strong affinity for water (Handayani & Putri, 2020). The highest cooking loss value was found in vermicelli with pretreatment in sodium bisulfite soaking, while the lowest was from steam blanching pretreatment. According to research conducted by Lestari *et al*. (2016) on the properties of soybean sprout flour, the solubility value increases with decreasing moisture content. The low moisture content of the material makes it easily dispersible in water.

The average value of cooking time for vermicelli substituted with aloe vera flour with several pretreatments ranges from 2.03 to 2.34. The vermicelli pretreated with bisulfite soaking yielded the lowest value. The lower the cooking time, the easier the vermicelli to gelatinize. According to Masuku (2014), it was observed that increasing the concentration of sodium bisulfite during the soaking process of cashew flour led to higher values of cooking speed. This phenomenon occurs due to reduced moisture content, increasing the required cooking duration for the product. The reason for this phenomenon can be attributed to the inherent property of sodium bisulfite, which exhibits a high affinity for water absorption. Vermicelli substituted with aloe vera flour with bisulfite soaking treatment produced the highest swelling ratio value. According to research on the scale multiplication of sweet potato dry noodles, the expansion ratio of dry sweet potato flour noodles with sodium bisulfite soaking pretreatment exhibited a higher value compared to the control group. This is because sodium bisulfite is a hygroscopic salt that can absorb water (Dewi *et al*., 2015).

3.4 Color analysis of aloe vera flour and vermicelli

Table 4. Analysis data from flour color

Treatment	Condition	L value	a* value	b* value
K	Control	79.8±0.03a	2.38±0.05d	11.27±0.11e
P1	Blanching	86.35±0.04b	2.98±0.01e	8.41±0.11b
P2	Metabisulfite soaking	89.27±0.23e	0.4±0.005a	6.56±0.03a
P3	Bisulfite soaking	88.76±0.02d	0.56±0.04b	9.63±0.15d
P4	Steam blanching	87.34±0.05c	0.74±0.01c	9.19±0.03c

Note: Different notations in the same column indicate significant differences at the α=5% level using the Duncan test.

The L value of aloe vera flour with blanching treatment was lower than with sodium bisulfite soaking treatment. This observation is consistent with the findings of Ardiansyah *et al*. (2014), who conducted a study investigating several pretreatment methods for producing oyster mushroom flour. The findings indicate that the flour subjected to the blanching treatment exhibited a darker color than those treated with sodium bisulfite soaking. This is because sodium bisulfite can inhibit the browning process. Glucose will form α-hydroxy sulfonate, where sulfite reacts with aldehyde or ketone groups so that the reaction between reducing sugars and amino acids does not occur.

The flour subjected to blanching treatment yielded the highest a* value, whereas the lowest a* value was seen in the flour treated with metabisulfite soaking. The prevention of the browning reaction is attributed to the preservation properties of sodium metabisulfite, which facilitates a reaction with the carbonyl group and subsequent binding of melanoidin (Angelia & Hasan, 2018).

The highest b* value was obtained in aloe vera flour without treatment, while the lowest was in metabisulfite soaking. Metabisulfite can inhibit browning by deactivating enzymes so that the b* value is lower than other pretreatments.

Table 5. Data analysis of vermicelli color

Treatment	Condition	L value	a* value	b* value
K	Control	48.66±0.7a	3.9±0,32c	12.06±1.15b
P1	Blanching	72.26±0.95d	2.83±0,46b	7.78±0.94a
P2	Metabisulfite soaking	70.31±0.56c	1.87±0,48a	7.44±0.55a
P3	Bisulfite soaking	71.35±0.39cd	1.56±0,28a	7.89±0.47a
P4	Steam blanching	68.65±0.41b	1.49±0,16a	7.02±0.40a

Note: Different notations in the same column indicate significant differences at the α=5% level using the Duncan test.

The highest L value was found in vermicelli substituted with aloe vera flour with pre-blanching treatment, while the lowest was in the control. Oxidation occurred in the control aloe vera flour, resulting in a change in the color of the gel to brownish.

The highest a* value was found in vermicelli substituted with aloe vera flour without treatment, while the lowest was in steam blanching pretreatment. An increase in the a* value corresponds to a greater intensity of reddish-brown hue in the product's color. According to Purwanto *et al*. (2013), in the production of pumpkin flour, it was observed that the blanching treatment resulted in a higher a* color value compared to the metabisulfite soaking method. This is because the blanching process has the function of sharpening the color.

The highest b* value was found in vermicelli substituted with aloe vera flour without treatment, while the lowest was in steam blanching pretreatment. The color of the control vermicelli was observed to be more yellow in comparison to the vermicelli that underwent pretreatment.

3.5 Descriptive analysis

Table 6. Descriptive analysis data

Treatment	Parameter							
	Brightness	Aloe vera aroma	Aloe vera taste	Aloe vera flavor	Adhesiveness	Floury	Chewiness	Elasticity
Control	3.31±1.70a	2.38±1.87a	1.21±0.54a	1.8±1.42a	2.89±1.56a	3.48±1.31a	3.57±1.4a	4.46±1.59a
Blanching	5.08±1.88b	2.64±1.89a	1.24±0.62a	1.8±1.69a	3.51±1.57a	3.68±1.42a	3.35±1.62a	3.55±1.83a
Metabisulfite soaking	5.57±1.57b	1.7±1.29a	1.24±0.89a	1.37±0.68a	3.73±1.64a	3.44±1.70a	3.73±2.04a	3.69±1.67a
Bisulfite soaking	5.1±1.38b	2.79±2.33a	1.37±1.04a	1.62±0.91a	3.61±1.56a	3.63±1.49a	3.63±1.44a	3.89±1.06a
Steam blanching	5.91±0.93b	1.83±1.10a	1.35±1.08a	1.47±0.95a	3.68±1.63a	3.78±1.41a	6.05±7.49a	3.54±1.46a

Note: Different notations in the same column indicate significant differences at the α=5% level using the Duncan test.

The evaluation of organoleptic properties is conducted by the utilization of sensory instruments. The sensory organs employed include the ocular, olfactory, gustatory, olfactory, and integumentary systems. The lowest brightness value was found in vermicelli substituted with control aloe vera flour. The control aloe vera flour had experienced a browning reaction due to the preliminary treatment. This finding aligns with the study by Rosiani *et al*. (2015), which investigated the use of aloe vera in the production of crackers. The findings indicated a positive correlation between the quantity of aloe vera used and the brightness of the resulting crackers. The chromatic properties of the material can be attributed to several factors, including inherent pigmentation, caramelization reactions, the Maillard process, and the interaction of organic molecules with atmospheric oxygen. Descriptive analysis of the sensory test for the aroma parameters of aloe vera resulted in values ranging from 1.7 to 2.9. Vermicelli substituted with aloe vera flour with pretreatment of bisulfite soaking had the highest aroma, while the lowest was found in the treatment with metabisulfite soaking. According to the study conducted by Karyantina and Kurniawati (2016), the production of jackfruit seed flour by various pretreatment methods results in the developing of a distinct and potent aroma when the blanching treatment is

employed. Data from the descriptive analysis of the sensory test of aloe vera taste parameters obtained results ranging from 1.21 to 1.37. The experimental results indicated that the vermicelli samples containing aloe vera flour exhibited the lowest recorded values compared to the control treatment. On the other hand, the vermicelli that was substituted with aloe vera flour and underwent bisulfite soaking pretreatment exhibited the highest value.

The data collected from the descriptive analysis of sensory test parameters for adhesiveness yielded scores between 2.89 and 3.73. Vermicelli substituted with aloe vera flour without treatment produced the lowest value, with metabisulfite soaking pretreatment obtaining the highest value. The acquired results for the floury (have flour-like characteristics) parameter in the sensory test ranged from 3.44 to 3.78, as indicated by the descriptive analysis of the data. The highest yield was in vermicelli substituted with aloe vera flour with steam blanching pretreatment, while the lowest yield was in sodium metabisulfite soaking pretreatment. Data from the descriptive analysis of the sensory test for elasticity parameters of vermicelli ranged from 3.35 to 6.05. The highest elasticity value was found in control vermicelli substituted with aloe vera flour, while the lowest was found in the steam blanching pretreatment. The steam-blanching treatment of aloe vera flour resulted in a greater increase in heat transfer, causing the hydrogen bonds to become weaker (Wiharto *et al*., 2016).

4. CONCLUSION

The study's findings examining the impact of aloe vera pretreatment on the characteristics of flour and vermicelli indicate that steam blanching pretreatment leads to a decrease in moisture content in the flour while resulting in an increase in moisture content in the vermicelli. Pretreatment will reduce the WHC value. The observed OHC values exhibited minimal variation, except for the steam blanching pretreatment, which showed a notable rise. Pretreatment of aloe vera flour is likely to affect the cooking properties of vermicelli. The application of different pretreatments resulted in an enhanced coloration of both aloe vera flour and vermicelli. Nevertheless, the sensory characteristics of the vermicelli remained unaffected. It can be concluded that different pretreatments will influence the characteristics of the resulting vermicelli.

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