A Study on the Physicochemical Properties Alteration of Aloe Saponaria Fermentation

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〈Abstract〉

This research focuses on the physicochemical characteristic of fermentation of Aloe Saponaria. The fermentation process applied in this study had 2 variation, depends on the aloe part as the materials (bottom, middle, and tip) and the initial sugar content (24% and 0%) used. Tests are conducted using uinkin fermented powder, sugar, salt, and distilled water as fermenting agent. The results indicate that change in physicochemical properties of aloe's skin was larger than in aloe's gel as fermentation materials. In contrast, there was no significant change in aloe's leaf during the process. Also, aloes with intial sugar condition of 24% show better results than which without sugar addition in fermentation.

Keywords : Fermentation, Aloe, Saponaria

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1. Introduction

Aloe is a succulent plant widely used in alternative medicine. There are at least 420 species aloe, including in areas that feature the mild temperatures and arid climate that support the growth of these tough plans sucah as Africa and the Arabian Peninsula (McIntosh, 2020)

Aloe in general can be divided into three parts: gel, yellow fluid layer, and cortex. The yellow fluid layer has an anthraquinone and chromium effective ingredients. The gel layer that also called aloe flesh is composed of polysaccharide, glycol-proteins, and minerals (Choi et al. 2011)

Aloe Saponaria has sharp spines on each leaf that rival any cactus with white patches on the leaves. The different of this aloe type from aloe in general, including Aloe vera which cannot stand temperatures below 0℃, Aloe Saponaria is known to thrive in enviroments with a minimum temperature of -7℃. The other important thing that distinguishes Aloe Saponaria from Aloe vera is anthraquinone content (Sampedro et al., 2004).

Nowadays, actually interest in Aloe has also begun to increase, including in Korea. Aloe has widened its range of use on healthy and skin beauty. Several studies also have described product differentiation for aloe usage (Hong et al., 1999; Woo et al., 1995). But, mostly from the studies, the gel layer is the only part that generally used as raw materials, including medicine and cosmetics. Whereas, the cortex part of aloe leaves is also rich in dietary fiber, cellulose, and minerals.

The purpose of this study was to find solutions for the development of aloe gel and cortex utilization, especially Aloe Saponaria. The processing technique chosen in this study was fermentation. Fermentation is the process of decomposition of organic substances by microorganisms or enzymes by converting carbohydrates into alcohols or organic acids (FAO, 1998).

2. Material and Method

2.1 Materials

In this study, the materials used were Aloe Saponaria (Aloe maculata), uinkin fermented powder, sugar, salt, and distilled water. The Aloe Saponaria used in this study can be seen on Figure 1. This material was storage in the refrigerator until the experiment began.

Besides of the materials used, there were some equipments also used in this research; multipurpose fermentor, digital balance (Kg), Small digital balance (g), Digital refractometer, Digital PH meter, Digital alcohol meter and Microplate Spectrophotometer.

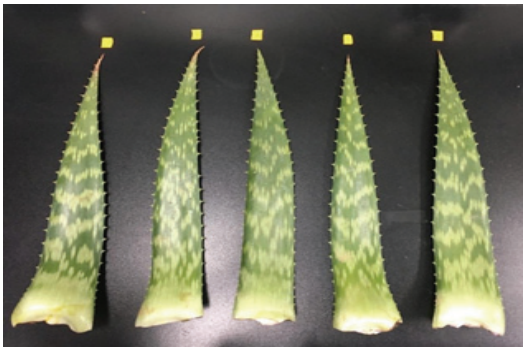


Fig. 1 Aloe Saponaria used in the experiment

2.2 Methods

2.2.1 Preparation of aloe

The aloe used was cleaned by tap water to separate the other materials remain of the leaf. The cleaned aloe was cut into 3 parts: bottom part, middle part, and tip part (Figure 2)

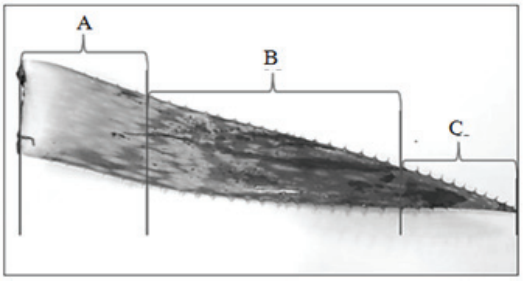


Fig. 2 The surface appearance of Aloe Saponaria leaf: A (bottom part), B (middle part), and C (tip part)

2.2.2 Fermentation

The fermentation process applied in this study had 2 variation, depends on the aloe part as the material and the initial sugar content used. The variation was given also can be seen in Table 1 and 2 below.

Table 1. Tabulation data of samples

Group \ Variation	A (bottom part)	B (middle part)	C (tip part)
1 (Aloe Gel/Flesh)	1A	1B	1C
2 (Aloe Cortex/Skin)	2A	2B	2C

Table 2. Combination of treatments in the samples

Sample \ Treatment	a (24% Brix)	b (No sugar)
1A	1Aa	1Ab
1B	1Ba	1Bb
1C	1Ca	1Cb
2A	2Aa	2Ab
2B	2Ba	2Bb
2C	2Ca	2Cb

On this process. 100g of aloe was used for each variation. The aloe was put into the fermentation jar and added by distilled water in a ratio of 1:3. To make the variation of 24% initial sugar content, sugar was added into the jar. The other ingredients used for this process were slat and starter culture. Salt was added into the sample with ration of 1g/L. While the starter culture (Uinkin, Korea) Used was in a ratio of 2% (v/v). This starter culture was added to accelerate the fermentation process and increase the efficiency of fermentation (Hwang et al. 2017)

3. Result and Discussion

3.1 Physicochemical properties alteration of aloe fermentation in different aloe part

Three variation of aloe part were done in this study, including the bottom part (A), middle part (B), and tip part (C). For each part was then fermented based on the skin and gel part. The parameters of product that analyzed such as TSS content, pH value, and alcohol content. The alteration of these parameter were observed every 3-day for 30 days.

3.1.1 Total soluble solids (TSS) content

In general, the TSS content of samples both on initial sugar conditions were decreased. In initial sugar condition of 24%, the decreasing of TSS from skin-middle part gave the best results compared than the skin-bottom and skin-tip part with reduction from 22.23% to 10.17%. (Figure 3) Meanwhile, in initial sugar condition of 0%, the decreasing of TSS from skin-bottom part gave the best results compared than the skin-middle and skin-tip part with reduction from 0.90% to 0.40% (Figure 4)

On fermentation from gel part, the decreasing of TTS content with initial sugar condition of 24% from middle part also gave the best results compared than the gel-bottom and gel-tip part with reduction from 23.50% to 15.00% (Figure 5). In initial sugar condition of 0%, the decreasing of TSS from gel-middle part also gave the best result compared than the gel-bottom and gel-tip part with reduction from 0.60% to 0.20% (Figure 6)

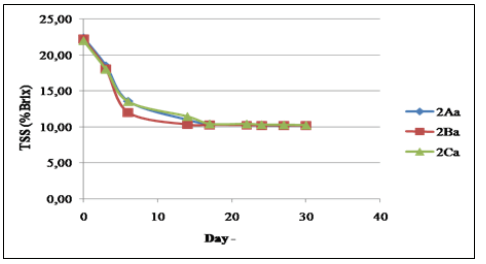


Fig. 3 The alteration of TSS content aloe skin fermentation with initial sugar condition of 24%

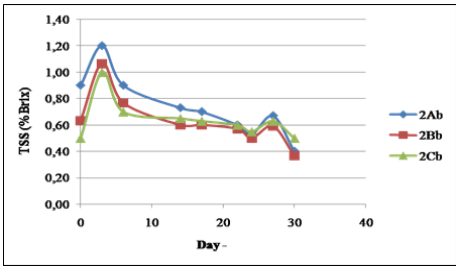


Fig. 4 The alteration of TSS content for aloe skin fermentation without sugar addition (0%)

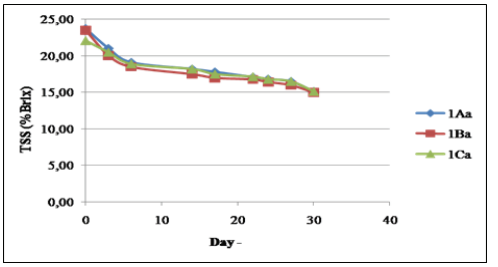


Fig. 5 The alteration of TSS content for aloe gel fermentation with initial sugar condition of 24%

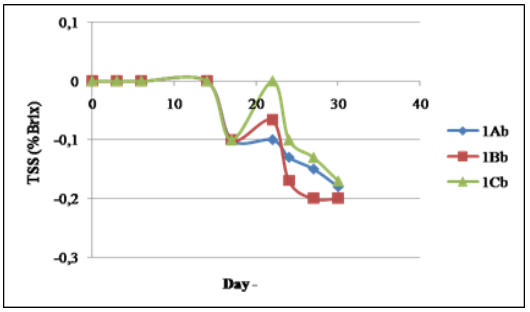


Fig. 6 The alteration of TSS content for aloe gel fermentation without sugar addition (0%)

3.1.2 pH value

Related to the condition of TSS content changes, changes in pH values during the fermentation process will generally also decrease. In initial sugar condition of 24%, the decreasing of pH value from skin-middle part gave the best results compared thant the skin-bottom and skin-tip part with reduction from 5.613 to 4.553 (Figure 7). Meanwhile, at the initial sugar condition of 0%, the TSS changes that occurred actually had increased. When seen as a whole, changes in the pH value of the middle skin also gave better results than the skin-bottom and skin-tip with a change from 5.670 to 7.207 (Figure 8)

On fermentation from gel part, the decreasing of pH value of product with initial sugar condition of 24% from middle part gave the best results compared than the skin-bottom and skin-tip part with reduction from 5.823 to 4.215 (Figure 9).

3.1.3 Alcohol content

The changes of alcohol content during process on the samples can be seen in

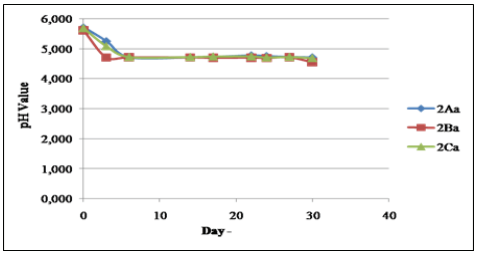


Fig. 7 The alteration of pH for aloe skin fermentation with initial sugar condition of 24%

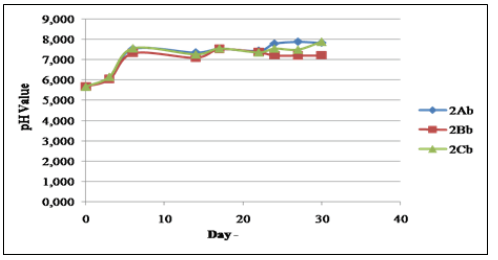


Fig. 8 The alteration of pH for aloe skin fermentation without sugar addition (0%)

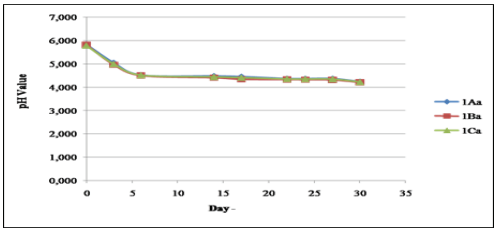


Fig. 9 The alteration of pH for aloe gel fermentation with initial sugar condition of 24%

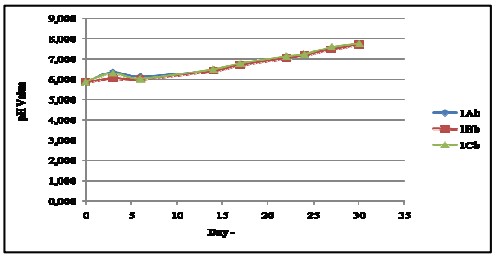


Fig. 10 The alteration of pH for aloe gel fermentation without sugar condition (0%)

Figure 11 – 14 differentiated based on initial sugar conditions. In general, the alcohol content of samples both on initial sugar conditions were increased. In initial sugar condition of 24%, the increasing of alcohol content from skin-middle part gave the best results compared than the skin-bottom and skin-tip part with reduction from 46.433% to 21.400% (Figure 11). In initial sugar condition of 0%, the decreasing of alcohol content from gel-middle part also gave the best results compared than the gel-bottom and gel-tip part with reduction from 1.467% to -0.153%.

On fermentation from gel part, the decreasing of alcohol content of product with initial sugar condition of 24% from middle part still gave the best results compared than the skin-bottom and skin-tip part with reduction from 46.167% to 34.567% (Figure 12). In initial sugar condition of 0%, the decreasing of alcohol content from gel-middle part also gave the best results compared than the gel-bottom and gel-tip part with reduction from 1.533% to -1.167% (Figure 13).

In Figure 11 – 14 were shown that the aloe fermented from middle part still gave the best alteration of alcohol content in all conditions, following by the fermentation from bottom part and tip part, respectively.

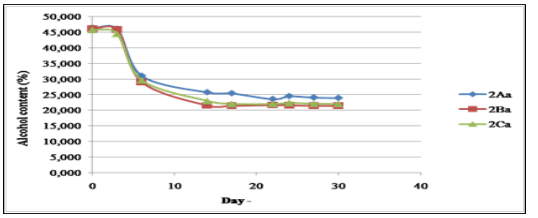


Fig. 11 The alteration of alcohol content for aloe skin fermentation with initial sugar condition of 24%

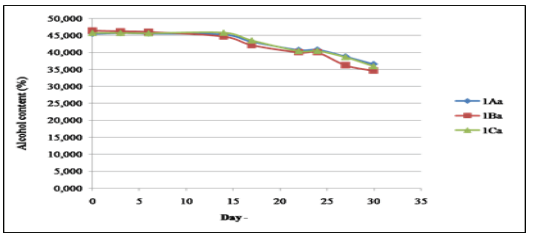


Fig. 12 The alteration of alcohol content for aloe gel fermentation with initial sugar condition of 24%

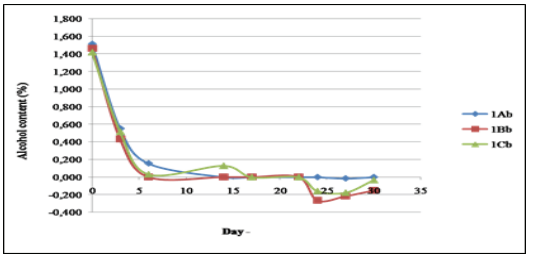


Fig. 13 The alteration of alcohol content for aloe gel fermentation without sugar addition (0%)

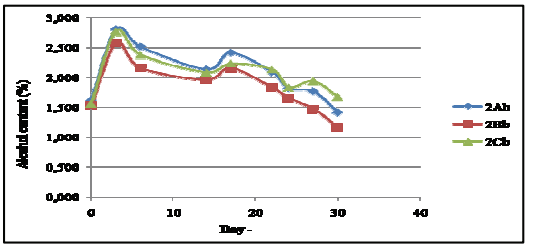


Fig. 14 The alternation of alcohol content for aloe skin fermentation without sugar condition (0%)

3.2 Physicochemical properties alteration of aloe fermentation in different initial sugar condition

Based on the aloe part used as the fermentation ingredients, the product was divided into two types, distinguished by adding sugar until the initial sugar reaches 24% and without adding sugar

3.2.1 Total soluble solids (TSS) content

The value of the best TSS content changes that occur during the 30-days fermentation process using bottom, middle, and tip parts were 22.37% to 10.20%, 22.23% to 10.17%, and 22.00% to 10.23%, respectively. These results indicated that the fermentation process that goes well for fermentation from the bottom, middle, and tip part of the aloe was obtained with the initial sugar condition of 24% and uses the aloe skin part.

3.2.2 pH value

In general, the changes of pH value for aloe parts variation given were similar. For fermentation with an initial sugar condition of 24%, it was seen that there was a decrease in the pH value, while for the initial conditions without adding sugar the pH value increased during the process. These results had shown that fermentation with initial sugar conditions of 24% gave better process results, where in the fermentation

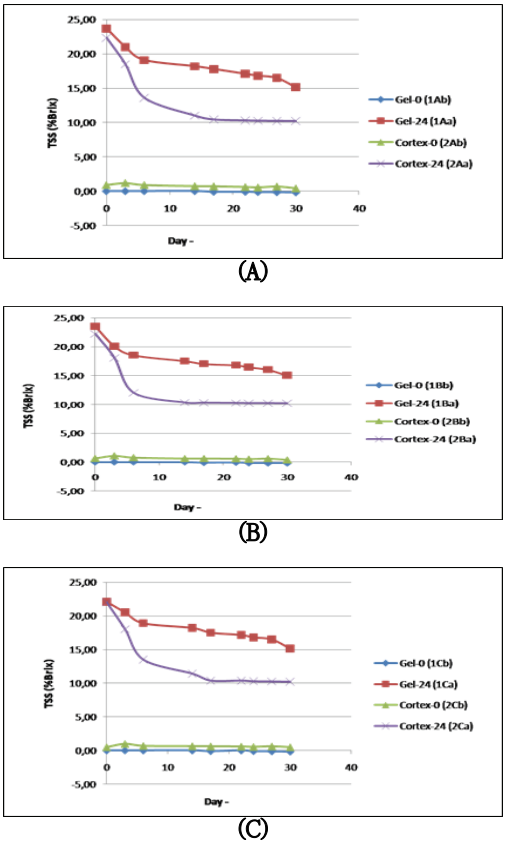
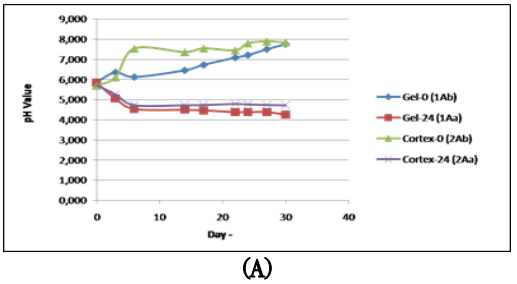


Fig. 15 The alteration of aloe fermentation TSS content using bottom part of aloe (A), middle part of aloe (B), and tip part of aloe (C)

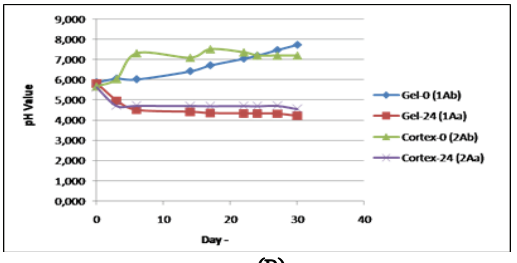
process the pH value should decrease as the TSS content decreases due to the conversion process involving lactic acid bacteria. While an increase in the pH value that occurs in fermentation with the condition of pure initial sugar without the sugar addition can be occured may be due to lack of food intake for bacteria to be converted, so that acid cannot be produced during the fermentation process.

Comparing between the use of skin and

aloe gel as a fermentation material with the initial sugar condition of 24% for all aloe part variation given, it were seen that fermentation using aloe gel gave more significant decrease in pH value. The pH value changes that occur during the 30-days fermentation process using aloe gel from bottom, middle, and tip parts were 5.840 to 4.240, 5.823 to 4.215, and 5.790 to 4.223, respectively.



(A)



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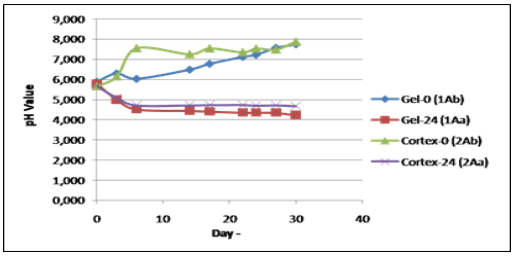


(C)

Fig. 16 The alteration of aloe fermentation pH value using bottom part of aloe (A), middle part of aloe (B), and tip part of aloe (C)

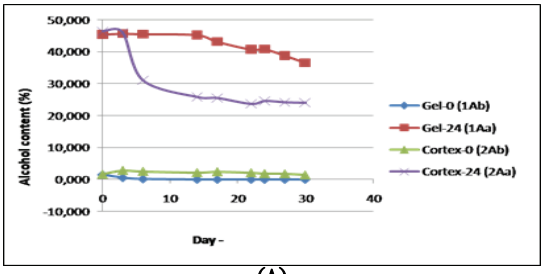
3.2.3 Alcohol content

Similar with the other physicochemical properties value observed before, the changes of alcohol content for aloe fermentation using bottom, middle, and tip part had a similar trend. In general, the changes of alcohol content for aloe parts variation given were decrease during the process. These results also indicated that the alcohol fermentation process can take place quite well in this experiment. However overall it appeared that a decrease in alcohol content that occurs in samples with initial sugar conditions by 24% was more significant than samples without sugar addition at the beginning of the process.

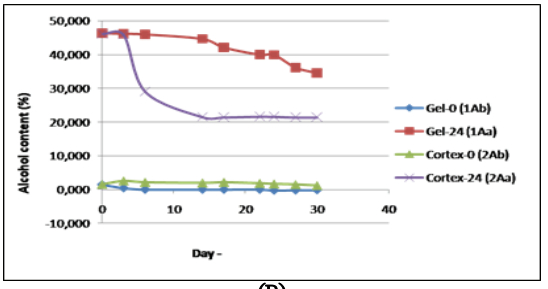
Whereas, comparing between the use of aloe skin and gel as a fermentation material with the initial sugar condition of 24% for all aloe part variation given, it were shown that fermentation using aloe skin gave more significant decrease in alcohol content. The alcohol content changes that occur during the 30-days fermentation process using aloe skin from bottom, middle, and tip parts were 46.387% to 23.937%, 46.167% to 21.400%, and 45.817% to 21.973%, respectively

4. Conclusion

Based on this research about Aloe Saponaria fermentation process with variation of initial sugar content and leaf parts of aloe used as the ingredients, it can be concluded



(A)



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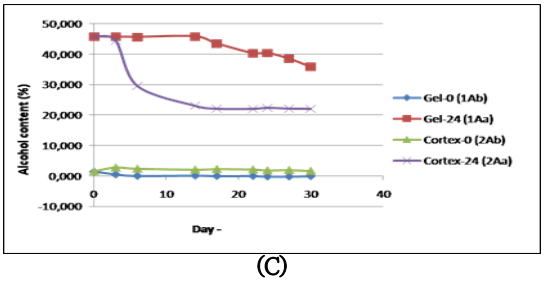

(C)

Fig. 17 The alteration of aloe fermentation alcohol content using bottom part of aloe (A), middle part of aloe (B), and tip part of aloe (C)

as follow:

1. The use of aloe skin and gel as a fermentation material gave quite different results for each of its physicochemical properties, where overall it was known that the use of aloe skin as a fermentation ingredient changed the physicochemical properties of fermented product better than fermentation using aloe gel.

2. Variations in aloe leaf part used as fermentation ingredient carried out in this study indicated that there was no significant difference in the process or the results of the fermentation products. However, when compared in more detail it can be seen that the use of the middle part of the leaf as a fermentation material gave better results than using the bottom or tip of the aloe leaf.

3. Variations in the initial sugar conditions used in this study also provided significant differences in the results both in the process and from the physicochemical properties of fermentation products, where the treatment with initial sugar conditioning of 24% gave better results in various conditions for fermentation of Aloe Saponaria.

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(Manuscript received November 18, 2020;
revised December 1, 2020; accepted December 2, 2020)