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The Identification of Saponin to Obtain the Maximum Benefit from *Aloe Saponaria*

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Abstract. The *Aloe saponaria* plant has been known and used for centuries for its health, beauty, medicinal and skin care properties. On the other hand, *Aloe saponaria* also contain antinutrition compounds namely saponin which lead negative effect. The aim of the study was to investigate the saponin content from each part of *Aloe saponaria* plant to maximize it benefits and advantages. The saponin content were analyzed from five part of *Aloe saponaria* leaf such as tip of the leaf, middle of the leaf, bottom of the leaf, leaf skin and leaf flesh. To do this, following are done. Total saponin content was identified by extraction. The procedure was performed by modifying the four thermal processing methods by Xu and Chang, 2009. The saponin analysis shows that the tip of the *Aloe saponaria* leaf contains highest concentration of saponin compare to the other part of *Aloe saponaria* leaf (1,712 mg/g).

Keywords: *Aloe saponaria*, saponin, medicinal plant.

1 Introduction

For centuries, Aloe has been used by many different cultures. Although the Aloe is an original species from South Africa, it also can be found in warm, arid climates throughout the world such as Africa, Asia, and Southern Europe, especially in the Mediterranean regions. *Aloe saponaria* is one among 400 species of plants in the Aloe genus.

There are many kind of compounds including in Aloe saponaria such as saponins, aluin, ligin, antraquinones, vitamins and minerals [1, 2]. Saponin is one of important compound in *Aloe Saponaria* leaf. There are a lot of benefits of saponins for human

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body. Saponins cause a reduction of blood cholesterol by preventing its re-absorption [3]. Saponins have antitumor and anti-mutagenic activities and can lower the risk of human cancers, by preventing cancer cells from growing [4]. Saponins also seem to help our immune system and to protect against viruses and bacteria [5]. It also have other benefits such as reduced risk of heart diseases [6].

The saponins extraction from Aloe leaf was studied by [7]. The chemical composition of saponins and aluin from *Aloe Vera* leaf was explained. However, that research doesn't specify the exact saponins percentage on each part of the leaf.

This paper proposes a detail analysis of saponins concentration on each part of the *Aloe saponaria* leaf. The purpose of this research is to identify the leaf part with highest saponins concentration. By understanding saponins concentration, benefits and advantages of *Aloe saponaria* can be optimized.

2 Material and Method

1.1 Sample Preparation

Aloe saponaria from DoYoung Aloe company (도영 알로에) were obtained from Ulsan city, Republic of Korea and storage in the refrigerator until the experiment began. After washed by tap water, the *Aloe saponaria* sliced into five parts; tip of the leaf (H), middle of the leaf (M), bottom of the leaf (B), leaf skin (S) and leaf flesh (IS) and filled in the blender glass jar and were analyzed for its saponin, pH and sugar content. The part of *Aloe saponaria* that used for this experiment can be shown in the Fig.1.

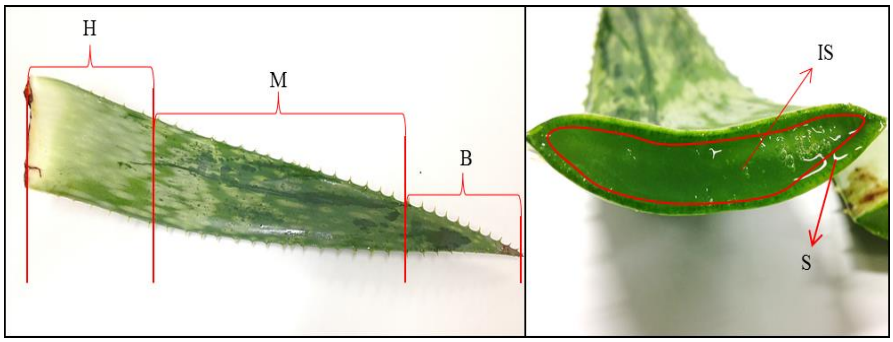

Fig. 1. Part of *Aloe saponaria*; tip of the leaf (H), middle of the leaf (M), bottom of the leaf (B), leaf skin (S) and leaf flesh (IS)

2.1 Extraction of Saponin Content from Aloe Saponaria Leaf

Extraction of saponin procedures were performed by modifying the four thermal processing methods by Xu and Chang, 2009. Briefly, 0.5g of *Aloe saponaria* samples (Fig.2) were defatted with 10mL of petroleum ether by shaking for 4h, and then the residues were extracted by 10mL of 80% aqueous methanol for 4h. The extracts were measured for 0.3mL as a samples, 0.3mL of freshly *Aloe saponaria* juice were prepared by 8% vanillin solution (in ethanol), and 3.0mL of sulfuric acid were vortexed for 5-10s. Then the mixture solution were incubated in a water bath at 60°C for 20min and cooled down in ice-cold water until the temperature decreased. Absorbance at 544nm was recorded. The results were expressed as mg of saponin equivalent per g of sample on a dry weight (mg/g DW) basis from a standard curve of different concentrations of crude saponin. Every sample solution was injected in triplicate, and the contents of the analytes were determined from the corresponding calibration curves.

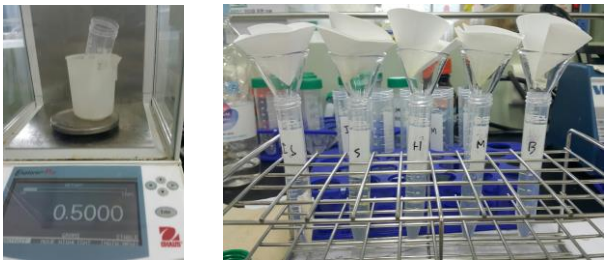

Fig. 2. Measuring 0.5g *Aloe saponaria* samples (left) and extraction process (right)

2.2 pH Value Analysis

A value characteristic of an aqueous solution is its pH value, which represents conventionally its acidity or alkalinity. pH value analysis were conducted by digital pH meter ISTEK, Inc. (Republic of Korea) type pH-250L with pH relative accuracy ±0,002 and pH range (-)20,000-19,000. This device are organized into two parts, the rod sensor and controller devices.

2.3 Sugar Content (% brix) Analysis

Brix analysis of sugar content was conducted by using a portable refractometer ATAGO co., Ltd (Japan), brix range 0-53% with resolution 0,1% brix/0,1˚C and accuracy ±0,2%brix/±1˚C, measures of relative sugar content in the *Aloe saponaria* were determined. Drops of samples extract were placed onto the refractometer slide, and the refractometer was held at 30º towards a light source to measure ºbrix. Samples of extract *Aloe saponaria* were analyzed in triplicate to determine an average brix value for each sample.

3 Result and Discussion

In this section, the experimental results of saponin extraction from Aloe Saponaria using proposed method are presented. The present study carried out on the *Aloe Saponaria* revealed the presence of medicinal active constituents. The phytochemical active compounds of *Aloe Saponaria* were qualitatively analyzed and the results are presented in Table 1 below. In analysis of Tannin compounds brownish green color developed to indicate the presence of Tannin. Similarly based on the presence or absence of color change indicates positive and negative results are indicate. In this screening process Tannin, Saponin, Flavonoids and Terpenoids gave positive results and phlobactanins and Steriods gave negative results.

Table 1. Qualitative analysis of photochemical al components

Phytochemical components	Presence/Absence
Tannin	(+)
Phlobatannins	(-)
Saponin	(+)
Flavonoids	(+)
Steriods	(-)

+ = Presence, - = Absence

The quantitative value in Aloe saponaria leaf were can be shown in Table 2 below, this value can be used for standard condition to measure the saponin content contain in the part of Aloe saponaria leaf.

Table 2. Quantitative analysis for *Aloe saponaria* leaf form whole parts

Aloe saponaria condition	Value
Initial sugar content	± 0.2 %
pH level	± 4.8 pH
Temperature	± 21.3°C

Standard calibration curve (Fig.3) was plotted by taking absorbances of different concentrations of the solution. The value of R square (R^2) for standard saponin contain in *Aloe saponaria* was 0.9994. An R^2 of 1 indicates that the regression line perfectly fits the data, while an R^2 of 0 indicates that the line does not fit the data at all. In a general form, R^2 can be seen to be related to the unexplained variance, since the second term compares the unexplained variance (variance of the model's errors) with the total variance (of the data).

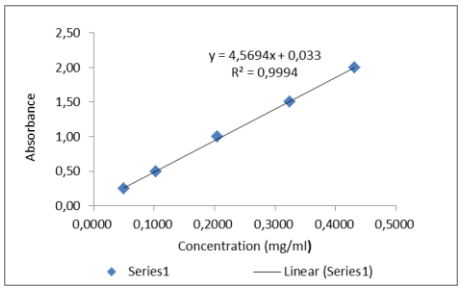

Fig. 3. Standard calibration curve for total saponin content

The different total saponin content obtained from extraction each part of *Aloe Saponaria* leaf using the proposed method is shown in Table 3. We studied that the minimum saponin content is obtained from the leaf flesh (I.S) of *Aloe Saponaria* 0.424 ± 0.036 mg/g which is the biggest part of the leaf. The bottom of the leaf (B) and the middle of the leaf (M) have almost similar amount of saponin content which is 1.254 ± 0.028 mg/g and 1.204 ± 0.064 mg/g respectively. The higher saponin content can be obtained from the leaf skin (S) 1.482 ± 0.071 mg/g. The tip of the *Aloe saponaria* leaf (H) contains highest concentration of saponin compare to the other part of *Aloe saponaria* leaf 1.712 ± 0.051 mg/g.

Table 3. Total saponin content in 1 gram of each part *Aloe Saponaria* leaf

Leaf Part	Total Saponin
Bottom of the leaf (B)	1.254 ± 0.028 mg/g
Middle of the leaf (M)	1.204 ± 0.064 mg/g
Tip of the leaf (H)	1.712 ± 0.051 mg/g
Leaf skin (S)	1.482 ± 0.071 mg/g
Leaf flesh (I.S)	0.424 ± 0.036 mg/g

The total saponin content contain in *Aloe saponaria* leaf in whole parts also can be shown in Fig. 4 as follows:

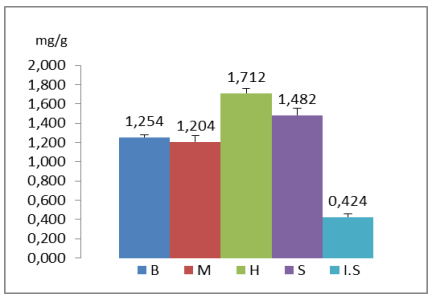

Fig. 4. Total saponin content in 1 gram of each part *Aloe Saponaria* leaf

Since the highest saponin content can be obtained from the tip (H) and the skin (S) part of *Aloe saponaria* leaf, to maximize the benefit of *Aloe saponaria*, only those

parts are recommended to be used as source of saponin. The leaf flesh can be used for the other applications such as moisture gel for cosmetics, medical treatment for thermal injury, and *Aloe saponaria* juice, etc.

4 Conclusion

This paper has revealed the presence of saponin in each part of *Aloe Saponaria* leaf. Total saponin content was identified by extraction. The procedure was performed by modifying the four thermal processing methods. The result confirmed that the amount of saponin on the tip of the leaf (H) is 1.712 mg/g, middle of the leaf (M) is 1.204 mg/g, bottom of the leaf (B) is 1.254 mg/g, leaf skin (S) is 1.482 mg/g and leaf flesh (IS) is 0.424 mg/g. Furthermore, it showed that the tip of the *Aloe saponaria* leaf contains highest concentration of saponin compare to the other part of *Aloe saponaria* leaf.

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