# Comparison of Saponin Levels of Lerak Extract (*Sapindus rarak*) Maceration and Socletation Results Based on UV-Vis Spectrophotometry Analysis

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**Abstract.** The potential of Lerak fruit (*Sapindus rarak*) as a basic ingredient for medicine has been recognized because of its content, which is rich in saponin compounds. Saponin compounds are known to have antimicrobial effects, the ability to inhibit fungal growth, antidiabetic properties, and anti-inflammatory properties. To maximize the content of active compounds, optimization is required, including variations in extraction methods. This study aims to compare the levels of saponins produced by the maceration and Soxhletation extraction methods. Saponin levels were tested using the UV-Vis spectrophotometry method with standard Diosgenin. Data were analyzed using independent t-test statistics. The yield of the maceration and Soxhletation extraction methods was 70.59±0.505% and 84.71±1.956% respectively. The results of saponin levels obtained from the maceration and Soxhletation extracts were 1.395±0.005µgde/ml and 1.904±0.015 µgde/ml respectively. The statistical test results showed a significant value of 0.000, which is less than 0.05, with a 95% confidence level. The conclusion of this study was that there were significant differences in saponin levels in the macerated and soxhleted lerak extract, with the highest levels found in the Soxhletation method with levels of 1.904±0.015 µgde/ml.

## 1 Introduction

The Sapindaceae family is one of the main sources of saponins that are widespread in all tropical and subtropical regions of Asia [1]. The most common Sapindaceae plant found in Indonesia is *Sapindus rarak.* Lerak fruit is a family of Sapindaceae which has the Latin name *Sapindus rarak* [2]. *Sapindus rarak* fruit contains allelochemical compounds in the form of saponins and other active substances such as alkaloids, flavonoids, polyphenols, and tannins [3]. Saponins are hydrophobic and hydrophilic so they can interact with water and fat at once [4]. Lerak fruit has a high percentage of saponin content which is 12% [5].

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The high content of saponins makes lerak fruit widely used in various sectors. In the medical and pharmaceutical fields, saponin compounds are used in the treatment of certain diseases, such as diabetes, high blood pressure, cardiovascular problems, and high cholesterol [6]. Saponins function as antibacterial, antifungal, antioxidant, and anti-inflammatory substances [7]. In the environmental field, saponins are known as secondary metabolite compounds included in triterepenoid glycosides or steroidal glycosides that form foam or foam so that they can be used as natural detergents, insecticides and pesticides [8][9]. Previous research has shown that saponins have the potential to replace synthetic cleaning chemicals [10], able to dissolve synthetic dyes [11] and polycyclic aromatic hydrocarbons [12] in aqueous solution. Saponin compounds contained in lerak fruit can be obtained through extraction.

The maceration method is an extraction technique that involves immersing the material in a solvent corresponding to the active compound to be extracted. This process is carried out with low heating or even no heating at all. Some of the factors that affect the extraction process include time, temperature, solvent type, comparison between material and solvent, as well as material particle size [13]. The advantage of the maceration method is that it can prevent degradation of compounds because it does not apply extraction conditions that are at high temperatures and pressures [14] so that the active substance to be taken remains intact [15]. During the soaking process, there is a breakdown of the cell wall and cell membrane due to the pressure difference between outside and inside the cell, this makes secondary metabolites in the cytoplasm be released and dissolved in the organic solvent used [16]. The socletation extraction method is a method of separating substances from their mixtures through a heating process, the socleation method provides more extract results than the maceration method [17]. The principle of socleation is repeated filtering so that the results obtained are perfect and the solvent used is relatively small [18].

The choice of maceration and socleation extraction methods because it has many advantages compared to other extraction methods. The main advantage of maceration extraction method is that the procedure and equipment used are simple and not heated so that natural materials do not become decomposed [19]. Cold extraction allows many compounds to be extracted, although some compounds have limited solubility in solvents at room temperature [20]. While the socletation method is a hot method that can produce more extracts, less solvent is used (material efficiency), the time used is faster, and the sample is extracted perfectly because it is done repeatedly [21]. In addition, biological activity is not lost when heated so this technique can be used in the search for drug brood.

The principle of socleation is repeated filtering so that the results obtained are perfect and the solvent used is relatively small [22]. Methanol p.a is the best solvent that produces the highest total extraction of saponins from lerak fruit. Saponin extract will be produced more if extracted using methanol because saponins are polar so they will dissolve more easily than other solvents [9]. Determination of saponin levels is carried out by the UV-Vis spectrophotometry method. UV-Vis spectrophotometry analysis has been recognized as the main method for identification, characterization, purity checking and determination. The advantage of the UV-Vis spectrophotometry method as a method of determining levels is that it can be used for the analysis of substances in small, fast, simple, specific and sensitive amounts or levels.

## 2 Experimental details

Comparative study of saponin levels of lerak extract (*Sapindus rarak*) maceration and socleation results based on UV-Vis spectrophotometry analysis and is an experimental-based study.

### 2.1 Materials

Tools and materials that used to facilitate this research are analytical balances, vessels for maceration, parchment, soxhlet, round table bath, rotary evaporator, waterbath, steam cup, test tube, test tube rack, oven, stirring rod, beaker glass, 4 spectrophotometer UV-Vis. The ingredients used are lerak fruit, methanol p.a, diosgenin, vanillin, $H_2SO_4$ 72%, HCl 2N, aquadest, chloroform, ethanol.

### 2.2 Research Phase

The research stage is as follows.

1. The determination of *Sapindus rarak* plants was carried out at the Microbiology Laboratory of State University of Malang, East Java.
2. Making simplisia powder, then extracted using maceration and socleation extraction methods, then concentrated using a rotary evaporator.
3. Preliminary test for the presence of saponin compounds, using foam test methods and color tests.
4. Determination of saponin levels using UVVis spectrophotometry.

## 3 Results and discussion

The results of the determination showed that the samples used in this study accurately showed (*Sapindus rarak*) namely with the genus Sapindus and the species *Sapindus rarak*. The results of viscous extracts obtained by maceration and socleation methods were 17.6523 grams and 21.1848 grams, respectively. The organoleptic results of lerak extract can be seen in Table 1.

**Table 1.** Organoleptic Lerak Fruit Extract

| No | Organoleptik | Information | |
|---|---|---|---|
| | | **Maceration Results** | **Socleation Results** |
| 1. | Texture | Viscous liquid | Viscous liquid |
| 2. | Color | Light brown | Dark brown |
| 3. | Construction | Special fruit *Sapindus rarak* | Special fruit *Sapindus rarak* |

The yield value of thick extract of lerak fruit (*Sapindus rarak*) obtained from maceration and socleation extraction results can be seen in Table 2, Table 3 and Table 4.

**Table 2.** Maceration Extract Yield

| No | Weight of extracted Simplisia Powder (grams) | Maceration Extract Weight (grams) | Yield Value (%) |
|---|---|---|---|
| 1. | 25.0061 | 17.7345 | 70.92 |
| 2. | 25.0043 | 17.5702 | 70.26 |
| **Average** | | 17.6523 | 70.59±0.505 |

**Table 3.** Socletation Extract Yield

| No | Extracted Simplisia Powder Weights (grams) | Socletation Extract Weight (grams) | Yield Value (%) |
|---|---|---|---|
| 1. | 25.0072 | 21.7561 | 86.99 |
| 2. | 25.0055 | 20.6134 | 82.43 |
| **Average** | | 21.1848 | 84.71±1.956 |

(a) (b)

**Fig. 1.** Viscous Extract Foam Test Results Maceration and Socleation Results (a) Maceration (b) Socleation

(a) (b)

**Fig. 2.** Color Test Results of Lerak Fruit Extract Maceration and Socleation Results (a) Maceration (b) Socleation

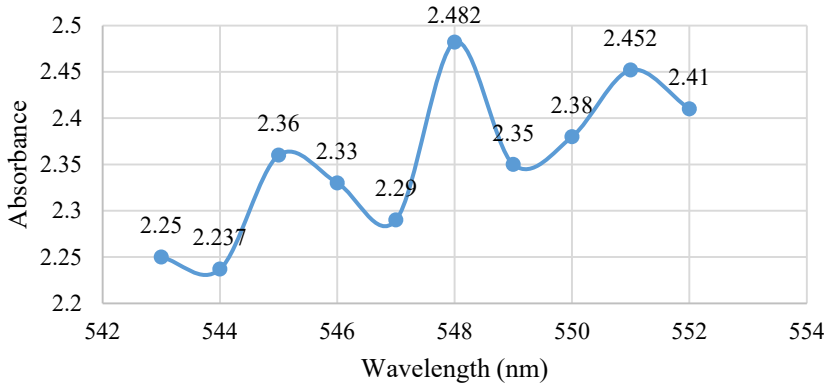


**Fig. 3.** Maximum Wavelength Curve Result

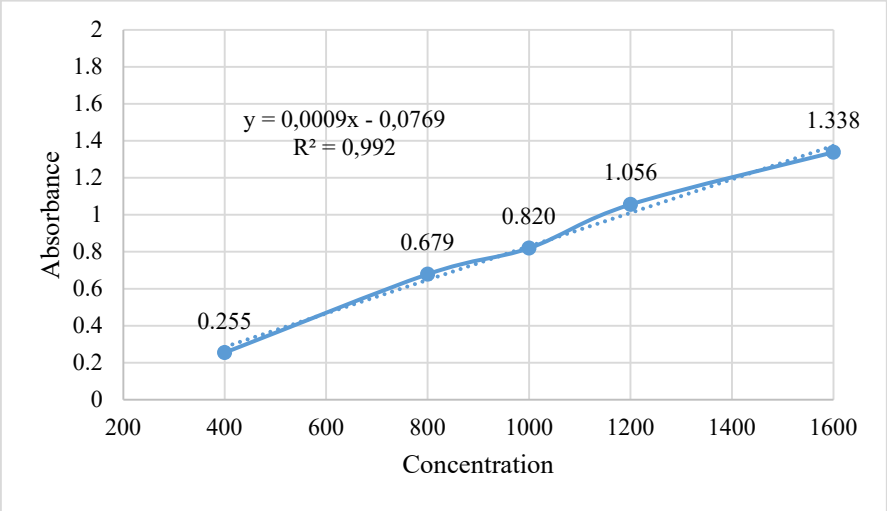


**Fig. 4.** Diosgenin Standard Curve Results

## 4 Discussion

The results of organoleptic tests on lerak fruit extract (*Sapindus rarak*) are listed in Fig. 1. The organoleptic test is seen from the color and foam produced from both extraction methods, namely maceration and socletation. Both extraction methods produce a brown color, which is the original color of lerak fruit (*Sapindus rarak*) [23]. In addition to testing the color and foam, the texture of lerak fruit extract (*Sapindus rarak*) obtained is a slightly viscous liquid. The resulting smell is the characteristic smell of lerak fruit. Both methods have similarities from the extraction results.

Based on the extraction results on lerak fruit (*Sapindus rarak*), the maceration extraction method acquires a light brown color. While the socleation method gets a dark brown color. The yield yield of maceration and socleation extraction methods was 70.59±0.505% and 84.71±1.956% respectively. It can be concluded that the use of the socleation extraction method produces a greater yield than using the maceration method[24]. Temperature treatment can increase the solvent's capacity to extract insoluble compounds at room temperature [25]. High temperatures affect the continuous circulation of solvents when interacting with simplisia, thereby maximizing compound extraction and increasing yield yield. Heat treatment has an important role in the extraction process [26]. When the temperature is increased, the solvent has a better ability to extract compounds that at room temperature may be difficult or insoluble [27]. This relates to changing the physicochemical properties of compounds and solvents at higher temperatures, allowing for more efficient interactions between them [28]. The size of the yield indicates the effectiveness of the extraction process [29]. The effectiveness of extraction is influenced by solvent type, temperature, extraction time, particle size simplisia, temperature, and extraction method [30].

The results of organoleptic tests on foams, known in samples with maceration and socleation extraction respectively in Fig. 2 and Fig. 3, obtained heights of 6.3 cm and 6.8 cm. The foam is allowed to stand for 30 seconds, so that it appears that the maceration extraction sample drops to 6.2 cm while the socleation extraction sample remains 6.8 cm. As shown in Fig. 4, the results of this foam can be concluded the content of saponins in both samples.

**Table. 4.** Results of Saponin Levels in Extract

| Lerak Fruit Thick Extract (*Sapindus rarak*) | Saponin Content (µg/mL) | Average of Saponin Content (µgDE/mL) |
|---|---|---|
| Maceration Extract | 1.389 | 1.395±0.005 |
| | 1.401 | |
| | 1.389 | |
| | 1.401 | |
| | 1.389 | |
| | 1.401 | |
| Socletation Extract | 1.921 | 1.904±0.015 |
| | 1.887 | |
| | 1.921 | |
| | 1.887 | |
| | 1.921 | |
| | 1.887 | |

The results of saponin levels obtained from the extract using the uv-vis specophotometry test, maceration and socletation results were 1.395±0.005 µgde/ml and 1.904±0.015 µgde/ml, respectively. The results of statistical tests show a sig value of 0.000 smaller than 0.05 with a confidence level of 95%. Socletation is more efficient in extracting certain compounds because heating the solvent can increase the solubility of the target compound [31]. The temperature regulation at socleation allows the solvent to reflux through the extracted material [32]. Socleation requires a shorter time compared to maceration due to its heating properties. While the maceration process is carried out at room temperature or relatively low temperature [33].

## 5 Conclusion

The results of saponin levels obtained from extracts by maceration method and socleation method were 1.395±0.005 µgde/ml and 1.904±0.015 µgde/ml, respectively. The results of the statistical test showed a significant value of 0.000, lower than 0.05, with a confidence level of 95%. The conclusion of this study is that there is a significant difference in the level of saponins in macerated and extracted lerak extract by the Socleation method, with the highest level found in the Socleation method of 1.904±0.015 µgde / ml.

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