The cleansing performance of the crude extracts from the fresh and dried *Litsea glutinosa* leaves

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Abstract

This study evaluated the hair-cleansing performance, foam power, and foam stability of mucilage solutions made from fresh and dried *Litsea glutinosa* leaves. *L. glutinosa*, a rainforest tree, has been used as a traditional shampoo. Its leaves are rubbed together with water to create mucilage for cleaning the hair and scalp. Mucilage from fresh and dried *L. glutinosa* leaves were extracted with water and then concentrated using a rotary evaporator to remove water, producing a mucilage solution with varying solid concentrations. All mucilage solutions were evaluated for foam power and foam stability and hair cleansing performance. The mucilage extract from fresh leaves had a higher solid content; it produced better foam power and stability and hair-cleansing performance than dried leaves using the same extraction method. The fresh leaves mucilage solution containing 9.2% solid content removed the most sebum (79.2%), compared to 1% Sodium lauryl ether sulfate (SLES) (83.5%). The mucilage from fresh leaves showed the potential to be a natural shampoo with good foam stability and hair-cleansing performance compared to synthetic shampoos. Furthermore, mucilage from fresh leaves exceeded the hair-cleansing performance of dried leaves

Keywords: *Litsea glutinosa, mucilage, foam power, foam stability, hair cleansing performance*

1. Introduction

Shampoo, an essential hair care product, was developed to clean the hair and scalp by eliminating undesirable sebum, dandruff, and dirt because water cannot remove most dirt, including sebum (Orfanos et al., 1990). Because shampoo contains a mixture of surfactants, the surfactant emulsifies greasy dirt on the hair and scalp and afterward brings the dirt into the water, allowing it to be easily washed. However, synthetic detergents used in shampoo have a negative impact on both health and the environment. Chemical residue on the scalp can cause allergies, and some surfactants can interact with the stratum corneum, causing skin irritation, itchiness, and dryness. The synthetic surfactant also damages the environment by releasing non-biodegradable chemicals that harm aquatic life (Pradhan & Bhattacharyya, 2014). Natural detergents are plant-based components that, due to their biodegradability, lower the number of health issues while also benefiting the environment (Mainkar & Jolly, 2011). *Sapindus mukorossi* (*Ritha*), its fruit coat, is formed from the wall of *Sapindus mukorossi*. The extract of the fruit coat works as a natural shampoo and is used in herbal shampoos as a hair cleanser. Dried pods of *Acacia concinna (Sheekakai)* were traditionally used in India as hair cleansers and for dandruff control (Kapoor, 2005).

Litsea glutinosa is a rainforest tree that can be found in India, Australia, the Western Pacific islands, and Asia, including China, Bhutan, Nepal, Vietnam, and Thailand (Ramana & Raju, 2017). It belongs to the Lauraceae family, and its leaves have been rubbed together with water to produce mucilage, which has been used as traditional hair shampoo (Wisetkomolmat et al., 2019). In addition to *Litsea glutinosa*, several other plants in the Lauraceae family are closely related to it, including *Litsea coriacea* (Heyne ex Meisner) and *Litsea wightiana* (Nees) discovered by Hooker, Joseph Dalton (he has been called Hook.f). and *Litsea floribunda* (Blume) Gamble. In the past, these herbal plants were used in herbal shampoos to help reduce dandruff and excess oil in the hair (Girish et al., 2014).

Although the mucilage of *L. glutinosa's* leaves has been used for a long time as a traditional shampoo, its hair-cleansing performance and foam stability have not been researched. Therefore, we report the mucilage's foam power, foam stability, and hair-cleansing performance in this study.

2. Objectives

1) To compare the mucilage solutions of fresh and dried leaves with varying solid concentrations for foam power and foam stability.
2) To evaluate the hair-cleansing performance of the mucilage solutions from fresh and dried leaves with varying solid concentrations.
3) To determine whether the mucilage solutions of fresh and dried leaves are a potential natural hair shampoo.

3. Materials and Methods

3.1 Extract of *Litsea glutinosa* leaves

The leaves of *L. glutinosa were* gathered in March 2021. Fresh *L. glutinosa* leaves (10 g) were soaked in DI water (1 L), cut using a blender at low speed for 30 minutes, and then stirred at room temperature for 60 minutes. After an hour, the mixture was filtered using Whatman filter paper No. 42, and the filtrate was centrifuged at 4,000 rpm to yield the clear mucilage solution. Mucilage from the dried leaves was extracted using the same process as the fresh leaves except that the leaves were prepared by evaporation in a hot air oven at 60°C and stirred at room temperature for 180 minutes. Since the water was removed from the dried leaves at the beginning of the preparation, it took more time than the fresh leaves to extract the mucilage, which contained the majority of water-soluble polysaccharides. Mucilage extracts from fresh and dried *L. glutinosa* leaves were concentrated by using a rotary evaporator to produce mucilage solutions with varying solid content, and all mucilage solutions were evaluated for foam power, foam stability, and hair-cleansing performance.

3.2 Foam power test

Foam power was determined by the shaking tube method (Lunkenheimer & Malysa, 2003), and 1% and 2% Sodium Laureth Sulfate (SLES) were used as controls. A 25 ml shaking tube holding 10 ml of sample was inverted 150 times at 30 inversions per minute. The foam power was measured by the volume of foam after 1 minute of shaking, and foam stability was monitored by measuring the changes in foam volume with time. Foam power (Vp) was calculated by V1 − V2, where V1 = volume of water and foam, and V2 = volume of water.

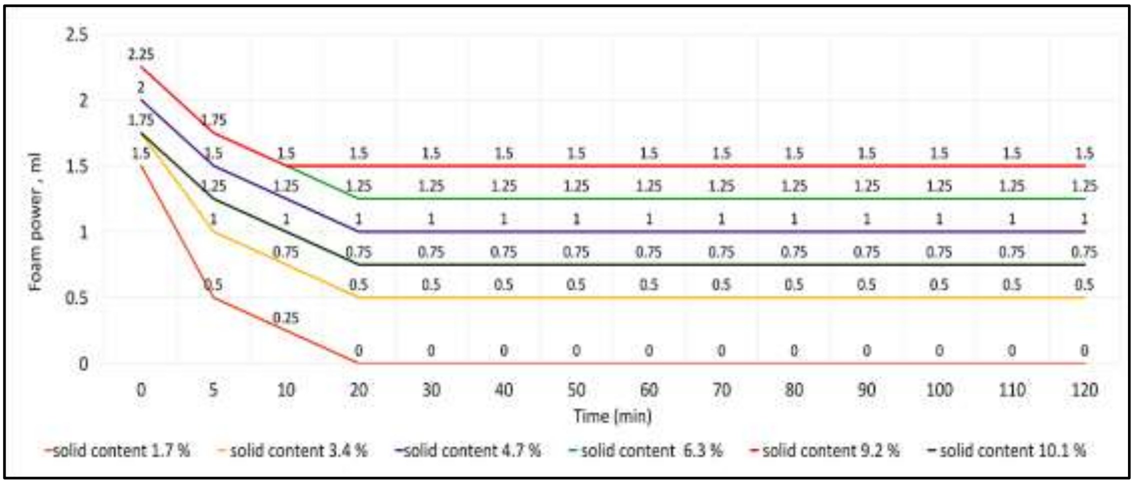
3.3 Hair cleansing performance

An 8-inch-long bundle of hair was washed with a 5% SLS solution, air-dried, and divided into 13 samples (1 gram each). Synthetic sebum was created by mixing 20% olive oil, 15% coconut oil, 15% stearic acid, 15% oleic acid, 15% paraffin, and 20% cholesterol at a temperature of 60°C. The greasy hair was made by dipping air-dried hair (1 gram) in the solution of 10% synthetic sebum dissolved in hexane (20 ml) for 15 minutes. The greasy hair was dried by a hairdryer and weighed to determine the amount of sebum on the hair. Hair cleansing performance was achieved by washing the greasy hair with a mucilage solution (20 ml) under 1% and 2% SLES (20 ml). The percentage of sebum removal was calculated using this formula: (WGH − WSRH) × 100/WS, where WGH = weight of greasy hair, WSRH = weight of hair with the sebum removed, and WS = weight of sebum on greasy hair (Moghimipour et al., 2020).

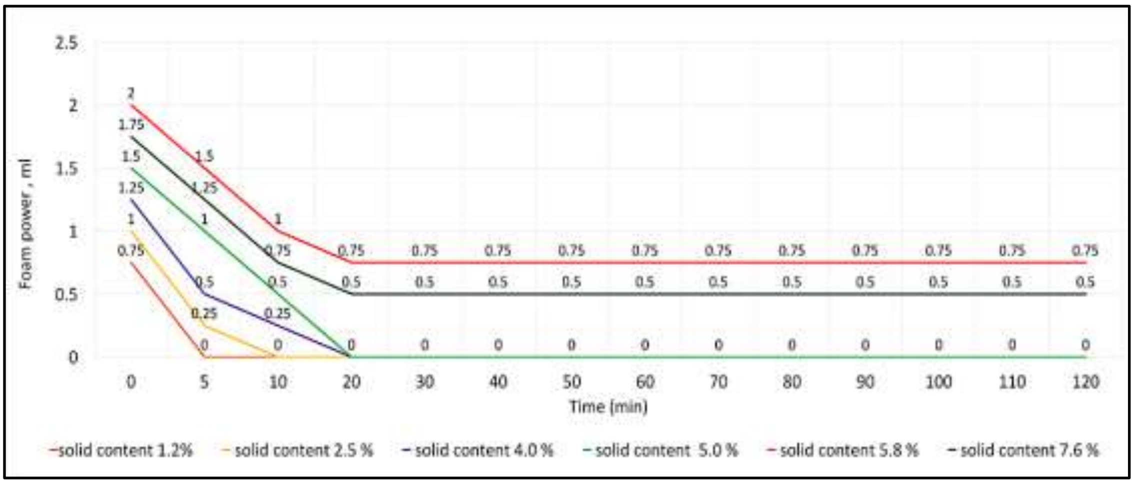
4. Results and Discussion

4.1 Foaming power and foaming stability

It was difficult to remove the mucilage without utilizing small pieces of leaves since *L. glutinosa* mucilage had considerable viscosity when used as a traditional shampoo. The mucilage of *L. glutinosa* was easily extracted using a 1:100 ratio of leaves and water. The mucilage extract of fresh and dried leaves was obtained with 1.7% and 1.2% solid content, while the traditional shampoo had approximately 9.3% solid content. The concentrated mucilage solutions with 3.4, 4.7, 6.3, 9.2, and 10.1% solid content for fresh leaves and 2.5, 4.0, 5.0, 5.8, and 7.6% solid content for dried leaves were obtained by removing water in vacuo. During the extraction procedure, we discovered that the mucilage from dried leaves was less swollen than the mucilage from fresh leaves. This may be attributed to a lower solid content of crude extract from dried leaves compared to the mucilage extract from fresh leaves.



(a) Foam power of the fresh leaves mucilage solution



(b) Foam power of the dried leaves mucilage solution

Figure 1 Foam power (Vp) of (a) fresh leaves mucilage solution and (b) dried leaves mucilage solution

Sitthithaworn et al (2018) discovered that *L. glutinosa* leaves mucilage powder had a surfactant property with a minimum value of surface tension (44.95 mN/m) at 460 g/ml or 0.46% w/v. Figures 1a and Figure 1b represent the foam power (Vp) and foam stability of mucilage solutions with various percentages of solid content. The mucilage extract from dried leaves with a solid content of 1.2% gave a Vp of 0.75 ml, while the mucilage extract from fresh leaves with a solid content of 1.7% gave a Vp of 1.5 ml. The concentrated fresh leaves mucilage solutions with 3.4, 4.7, 6.3, 9.2, and 10.1% solid content gave the Vp values of 1.75, 2, 2.25, 2.25, and 1.75 ml, respectively. On the other hand, the concentrated dried leaves mucilage solutions with 1.2, 2.5, 4.0, 5.0, 5.8, and 7.6% solid content gave the Vp values of 0.75, 1, 1.25, 1.5, 2, and 1.75 ml, respectively. The dried leaves mucilage had a substantially lower Vp value despite having a similar solid content percentage to the fresh leaves mucilage solutions. The foam stability of all mucilage solutions was also evaluated. Because foam stability is particularly essential to the consumer, it is regarded as an important criterion in shampoo evaluation. The consumer applies the shampoo, feels the foam, and instantly forms an opinion of the shampoo's performance. If it does not generate a lubricious foam, the consumer will have an unfavorable opinion of the shampoo. Each mucilage solution's foam volume gradually reduced within the first 10 minutes, then slowly decreased and was stable after 20 minutes; however, the fresh leaves mucilage solution containing 9.2% solid content and the dried leaves mucilage solution with 2.5% solid content were stable after 10 minutes. The fresh leaves mucilage solution with 6.3 and 9.2% solid content provided the highest foam power (2.25 ml). Although both fresh leaves mucilage solutions with solid contents of 6.3 and 9.2% resulted in the same Vp value of 2.25 ml, the mucilage solution with 9.2% solid content demonstrated better foam stability. The Vp value of the fresh leaves mucilage solution with 10.1% solid content was 1.75 ml, which was less than the mucilage solution with 9.2% solid content. The mucilage solution's solid content clearly affected foam power and stability. The solid content is the percentage of solids in a liquid; the higher the solid content, the more foam power is generated due to more dry matter in the solution. If a shampoo has an excessive amount of solids, it will be difficult to wash out of the hair; however, if there is not enough, it will be overly watery and quickly wash away.

4.2 Hair cleansing performance

For evaluating hair-cleansing performance, sodium lauryl ether sulfate (SLES), a commercial detergent found in many cleaning products, was used as a control. Figure 2 showed that 1% and 2% SLES solutions resulted in 83.5 and 93.7% of hair sebum removal, respectively. In a comparison of mucilage from fresh and dried leaves with various solid content values, the mucilage extract from the dried leaves (solid content 1.2%) resulted in the lowest sebum removal at 46.1%, while the rest of the mucilage solutions from the dried leaves (with 2.5, 4.0, 5.0, 5.8, and 7.6% solid content) resulted in 49.4, 53.9, 61.7, 64.7, and 51.2% sebum removal, respectively. The mucilage solutions from fresh leaves with 1.7, 3.4, 4.7, 6.3, 9.2, and 10.1% solid content resulted in 69.8, 72.1, 76.1, 78.9, 79.2, and 68.4% of sebum removal, respectively. During our study on hair-cleansing performance, we discovered that the *L. glutinosa* mucilage solutions with lower solid content could easily be rinsed out of hair, while the mucilage solution with 10.1% solid content was more difficult to rinse out.

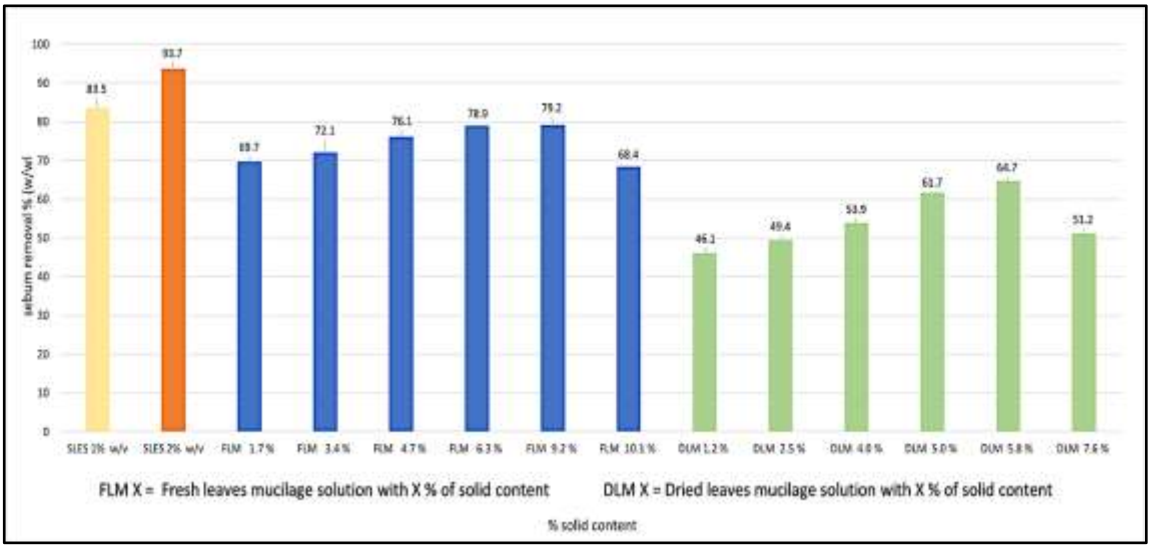


Figure 2 Average sebum removal from hair after washing with fresh/dried leaves mucilage solution

The higher the solid content value, the more concentrated the mucilage was in order to remove the sebum from the hair. However, if the mucilage was too concentrated, the value of solid content would exceed the optimal value and affect the cleaning performance. Furthermore, the mucilage solution from fresh leaves with 9.2% solid content removed the most sebum at 79.2%, which was close to the 83.5% sebum removal of the 1% SLES. For the mucilage solution of the dried leaves, the highest percentage of sebum removal of 64.7% was obtained with the solution with 5.8% solid content, which was still lower than the 69.7% of sebum removed by the mucilage extract from fresh leave with the lowest solid content of 1.7%. It is evident that the foam power of the mucilage solution and the leaves used for extraction relate to hair-cleansing performance. Consequently, the higher the Vp value, the better the hair-cleansing performance. To explain the differences in results between the mucilage from fresh and dried leaves, we measured the quantity of saponin in both mucilage extracts using the procedure described by Ehiobu and Afolayan (2021), and the fresh leaves mucilage extract had a higher saponin content. This higher saponin content may explain the fresh leaves mucilage solution's better cleansing performance and foam power over that of the dried leaves. The average percentage of sebum removal, shown in Figure 2, has been replicated several times under the same conditions.

5. Conclusion

Comparing the fresh and dried leaves mucilage solutions showed a different result, as the solid content affected both foam power and stability. Mucilage from fresh *L. glutinosa* leaves, at a solid content of 9.2%, showed a great capability of being the optimum value as a natural hair shampoo with more foam power and foam stability than mucilage from dried leaves. The hair-cleansing performance also showed results from fresh leaves at a solid content of 9.2%, which could mostly remove 79.2% of the sebum compared to 1% SLES, a synthetic surfactant commonly used in cleaning products. Dried leaves mucilage showed lower results than fresh leaves at a solid content of 5.8%, removing 64.7% of sebum. Fresh leaves mucilage showed potential as a natural hair shampoo as it removed hair sebum with good foam power and stability; mucilage from dried leaves had less hair-cleansing performance, foam power, and foam stability than fresh leaves.

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