Indonesian Journal of Cosmetic
E-ISSN: 3026-3352

Formulation and Evaluation of a Guava Leaf (*Psidium guajava* L.) Extract-Based Soap Bar as a Cleanser

Adelia Oktaviana[1], Herlita Rahma Rostiana[1], Devika Damayanti Silalahi[1], Fhora Putri Lestari[1], Rahma Yenita Putri[1], Diajeng Lintang[1], Herayati[1]

1. Department of Cosmetic Engineering, Faculty of Industrial Technology, Institut Teknologi Sumatera, South Lampung, Indonesia.

***Corresponding Email: herayati@km.itera.ac.id**

ABSTRACT

The cosmetic industry is rapidly developing, with a focus on safer and environmentally friendly formulations. Soap bars, which are widely used as skin-cleansing products, are increasingly being innovatively formulated using natural ingredients that provide additional benefits for the skin. Guava leaves (*Psidium guajava* L.), which contain flavonoids, tannins, and phenolic compounds, exhibit antioxidant, anti-inflammatory, and antibacterial properties, making them promising ingredients for cosmetic formulations. This study aimed to formulate and evaluate a guava leaf extract-based soap bar as a skin cleanser with antioxidant properties. An experimental method was employed to develop soap bars containing guava leaf extract through the saponification of virgin coconut oil (VCO), stearic acid, glycerin, and sodium hydroxide (NaOH), combined with guava leaf extract. The evaluations included physical appearance, pH, foam stability, and antioxidant activity using the DPPH assay. The resulting soap bars exhibited stable physical characteristics, an appropriate pH range (6–7), and good foam stability. These findings suggest that guava leaf extract-based soap bars not only function effectively as cleansers but also provide additional protection against oxidative stress, supporting their potential as natural and functional skincare products.

Key words: Guava leaf extract, antioxidants, soap bar, saponification, skin cleanser

INTRODUCTION

In recent years, the cosmetic industry has experienced significant development, particularly in the formulation of safer and more environmentally friendly products. Consumers are increasingly aware of the importance of using products that are not only effective but also made from natural ingredients that provide benefits for skin health. One of the widely used cosmetic products is soap, which functions as a skin cleanser. However, along with increasing awareness of skin health, there is a growing demand for soaps that not only cleanse the skin but also provide additional benefits, such as antioxidant properties (Islamy & Hendrawati, 2022).

Cosmetics are products used to enhance human appearance or body fragrance. According to the definition of cosmetics, they include substances or preparations applied to the external parts of the human body, such as the skin, hair, and nails, for cleansing, beautifying, or protecting purposes. Cosmetics are products that are routinely and continuously used by women and men of all ages. One group of cosmetic users is young people pursuing higher education, including female university students. Facial skincare and makeup cosmetics can have both positive and negative effects on the skin depending on the quality of the ingredients and the way they are processed (Sukristiani, 2014).

Guava leaves (*Psidium guajava* L.) are one of the herbal ingredients with considerable potential for the development of cosmetic products. This plant is widely distributed in various parts of the world and has traditionally been used in medicine because of its beneficial active compounds. Guava leaves are rich in flavonoids, tannins, and other phenolic compounds that possess antioxidant, anti-inflammatory, and antibacterial properties. Studies have shown that these compounds can help protect the skin from damage caused by free radicals and accelerate the skin-healing process (Haerani, 2018).

The antioxidant properties of guava leaf extract make it an ideal candidate for incorporation into soap bar formulations. Free radicals can cause premature aging and various other skin problems; therefore, the use of ingredients capable of counteracting their negative effects is important. By incorporating guava leaf extract into a soap bar formulation, the resulting product is expected not only to effectively cleanse the skin but also to provide additional protection against oxidative damage.

On the other hand, the formulation of natural ingredient-based cosmetics, such as guava leaf extract, is also in line with the global trend toward sustainability and the use of natural ingredients. Consumers increasingly prefer products that do not contain harmful chemicals and place greater value on transparency in the production process. Therefore, this study aimed to develop and evaluate a guava leaf extract-based soap bar as an innovative solution to meet market demand for more natural and effective skincare products (Umayati, *et al*., 2023).

Antioxidants are compounds that can inhibit oxidation reactions by binding free radicals and highly reactive molecules. Free radicals are one form of reactive oxygen species that can be produced in the body and triggered by various factors. Natural antioxidants are compounds obtained through the extraction of natural materials such as plants and fruits. Natural antioxidants can protect the body against damage caused by reactive oxygen species, inhibit degenerative diseases, and prevent lipid peroxidation in food.

Natural antioxidants play an important role in protecting the body from damage caused by reactive oxygen species, as well as inhibiting degenerative diseases and lipid peroxidation in food. By binding free radicals and reactive molecules, antioxidants function as effective cellular protectors. Natural sources of antioxidants can be found in various foods, including plants and fruits.

In line with the increasing utilization of antioxidants in various products, soap bars have also begun to be formulated with natural ingredients rich in antioxidant compounds. Studies have shown that soaps containing plant extracts with antioxidant activity can provide additional benefits for skin health. For example, soaps formulated with dragon fruit peel or kepok banana peel extracts not only function as cleansers but can also help protect the skin from the harmful effects of free radicals. Thus, the incorporation of natural antioxidants into soap products not only increases their functional value but also provides additional protection for users. This makes soap bars an attractive choice for consumers concerned about skin health and interested in using more natural and effective products.

Soap bars (solid soaps) are cleansing products that are widely used in everyday life. As a form of cosmetic preparation, soap plays an important role in maintaining skin cleanliness and health. The soap-making process involves a chemical reaction known as saponification, in which fats or oils are mixed with an alkali, such as sodium hydroxide (NaOH), to produce soap and glycerol. Soap bars generally consist of sodium salts of fatty acids derived from plant or animal sources and can function effectively as cleansers by producing foam when mixed with water (Khuzaimah, 2016).

With the development of modern society and increasing public awareness of hygiene, soap has become a primary necessity. Soap bars not only function to remove dirt from the skin surface but can also help eliminate bacteria and viruses that may cause various diseases. In the context of public health, the use of soap is an important preventive measure in reducing the spread of infectious diseases, particularly during the pandemic era (Azri & Muryadi, 2024).

MATERIAL AND METHODS

Material

The materials used included virgin coconut oil (VCO), stearic acid, glycerin, NaOH, guava leaf extract, ethanol, distilled water, and perfume.

Preparation of simplicia

The preparation of guava leaf (Psidium guajava) simplicia was carried out through a series of systematic steps to ensure the quality and effectiveness of the resulting extract. First, fresh guava leaves were selected as samples. Wet sorting was then performed to separate suitable leaves from dirt or damaged leaves. The leaves were subsequently washed under running water to remove dust and adhering impurities.

After washing, the leaves were dried indoors and air-dried for approximately one week to reduce their moisture content without direct exposure to sunlight, with the aim of preserving the active compounds in the leaves. The process was followed by dry sorting to remove damaged materials after drying. The dried leaves were then ground using a blender until a fine powder was obtained. Finally, the resulting simplicia was stored in an airtight container to maintain its stability and prevent deterioration until further extraction (Listiana, et al., 2022).

Extraction

After the guava leaf simplicia had been ground into powder, extraction was performed using the maceration method. The powdered simplicia was mixed with ethanol as the solvent and soaked for 30 minutes to allow the active compounds to dissolve optimally. The process was conducted in a closed container to prevent solvent evaporation and maintain the stability of the extracted compounds (Yuliani & Ismail, 2023).

After maceration, evaporation was performed to reduce the solvent volume and obtain a more concentrated extract. The evaporation process was carried out by heating the extract solution at an appropriate temperature, allowing the solvent to evaporate and leaving a higher concentration of active compounds. Thus, the resulting extract became more concentrated and ready for use in various applications, including soap formulation

Phytochemical Screening

Phytochemical screening was conducted to identify the active compounds present in the plant material through several systematic procedures. For alkaloid testing, 1 g of simplicia powder was weighed and mixed with 1 mL of 2 N HCl and 9 mL of distilled water. The mixture was heated in a water bath for 2 minutes, cooled, and filtered. The resulting filtrate was used for testing, with 1 mL used as a blank and another 1 mL treated with two drops of Dragendorff's reagent.

For flavonoid testing, 1 g of simplicia powder was mixed with 10 mL of hot water and boiled for 5 minutes before filtration. The filtrate was divided into two portions; one portion was used as a blank, while the other was treated with 0.1 g of magnesium powder and 1 mL of concentrated HCl, followed by the addition of 2 mL of alcohol. The mixture was shaken vigorously and allowed to separate, after which the color change was observed.

For tannin testing, 1 g of simplicia powder was boiled in 10 mL of distilled water for 15 minutes, cooled, and filtered. Two milliliters of each filtrate were used as a blank and treated with two drops of 10% $FeCl_3$ solution. The resulting color change was observed to determine the presence of tannins.

The polyphenol test was conducted using a procedure similar to that used for tannin testing. One gram of simplicia powder was boiled in 10 mL of distilled water for 15 minutes, cooled, and filtered. The filtrate was divided into two portions; one was used as a blank, while the other was treated with two drops of 10% $FeCl_3$ solution to observe the color change.

For steroid testing, 0.5 g of simplicia powder was ground with 10 mL of n-hexane. The mixture was filtered using a cotton-plugged pipette, and the filtrate was placed in an evaporating dish until dry. Three drops of acetic anhydride and one drop of concentrated H_2SO_4 were added to the resulting residue, followed by gentle stirring while observing the color change.

Finally, the triterpenoid test was conducted using the same procedure as the steroid test. A total of 0.5 g of simplicia powder was ground with n-hexane and filtered to obtain the filtrate. The filtrate was allowed to evaporate to dryness, after which acetic anhydride and concentrated H_2SO_4 were added to the residue while gently stirring to observe the resulting color change.

Preparation of Soap

In the development of a soap bar product, an appropriate formulation is essential to achieve optimal quality and safety. The soap formulation was designed as follows:

Table 2.4.1. Soap Bar Formulation

Phase	**Ingredient**	**Concentration (% w/v)**
A	VCO	13
A	Stearic acid	6
A	Glycerin	40
B	NaOH	4

B	Distilled water	7
C	Ethanol	30
Post-addition	Guava leaf extract	2
Post-addition	Perfume	1

The preparation process consisted of the following steps:
Phase A, consisting of VCO, stearic acid, and glycerin, was heated to 95 °C while stirring slowly until the solution became transparent. Phase B was prepared separately by combining NaOH and distilled water. Distilled water was added gradually to prevent excessive heat and fumes, and stirring was conducted inside a fume hood. Phase C, consisting of ethanol, was prepared. Phase B was gradually added to Phase A and stirred until homogeneous. Phase C was then added gradually to the mixture and stirred until homogeneous. The mixture of Phases A, B, and C was allowed to cool to 60 °C. The guava leaf extract and perfume were added and stirred until homogeneous. The mixture was slowly poured into soap molds. The soap was allowed to harden for three days before evaluation.

Evaluation

The evaluations conducted in this study included foam height, organoleptic characteristics, pH, and homogeneity tests.

1. Foam Height Test

The foam height test was conducted using a simple method involving distilled water in a graduated cylinder. The soap preparation was added, and the cylinder was inverted several times to generate foam. Foam height was observed immediately after the process and measured again after one minute to evaluate foam stability.

2. Organoleptic Test

The organoleptic test was conducted to evaluate the physical characteristics of the soap bar, including color or transparency and aroma. The evaluation was performed through direct visual observation.

3. pH Test

The pH test was conducted to determine the acidity or alkalinity of the soap bar. The soap preparation was moistened and rubbed, after which litmus paper was applied to the preparation and the resulting color was visually observed.

4. Homogeneity Test

The homogeneity test was conducted to determine whether the ingredients in the soap bar were evenly distributed.

RESULT AND DISCUSSION

The development of the guava leaf (*Psidium guajava* L.) extract-based soap bar began with the preparation of guava leaf simplicia followed by extraction using ethanol. The dried guava leaves were ground into a fine powder and subjected to maceration for 30 minutes using ethanol as the extraction solvent. The extraction process was conducted in a closed container to minimize solvent evaporation and maintain the stability of the extracted compounds. After maceration, the extract was concentrated through evaporation to obtain a more concentrated extract suitable for incorporation into the soap formulation. The extraction process yielded 5 g of concentrated guava leaf extract. The use of guava leaf extract in the formulation was based on its potential as a natural source of bioactive compounds. The phytochemical evaluation described in the study indicated the presence of several secondary metabolite groups, including flavonoids, tannins, polyphenols, steroids, and triterpenoids. The presence of these compounds supports the utilization of guava leaves as a natural active ingredient in cosmetic preparations, particularly because flavonoids, tannins, and phenolic compounds are associated with antioxidant properties and other biological activities.

The concentrated extract was subsequently incorporated into the soap formulation at a concentration of 2%, resulting in a final soap weight of 100 g. The formulation consisted of virgin coconut oil (VCO), stearic acid, glycerin, sodium hydroxide (NaOH), distilled water, ethanol, guava leaf extract, and perfume. The formulation was designed to produce a solid cleansing preparation while incorporating guava leaf extract as a natural functional ingredient. VCO served as the main lipid component involved in the saponification process, while NaOH functioned as the alkaline agent responsible for converting the fatty components into soap. Stearic acid contributed to the hardness and structural integrity of the soap bar, whereas glycerin functioned as a humectant and contributed to maintaining skin moisture. Ethanol was used as a solvent associated with the extract, while perfume was added during the final stage to improve the sensory characteristics of the product.

The preparation process involved heating VCO, stearic acid, and glycerin to 95 °C while stirring until a transparent mixture was obtained. The NaOH solution was then gradually added while stirring, followed by the addition of the ethanol phase. After the mixture reached approximately 60 °C, the guava leaf extract and perfume were added and the mixture was stirred until homogeneous. The preparation was subsequently poured into molds and allowed to harden for three days before evaluation. The controlled addition of the extract during the later stage of formulation facilitated its incorporation into the soap matrix and contributed to the relatively uniform distribution of the extract throughout the preparation. The resulting soap bar exhibited a green color with a slight reddish gradient, a solid and compact texture, and a characteristic aroma of guava leaf extract combined with the added fragrance. The natural appearance of the product reflected the incorporation of the plant extract and provided a characteristic visual feature of the formulation.

The organoleptic characteristics indicated that the formulation successfully produced a solid preparation comparable in physical form to conventional bar soap. The compact texture suggested that the formulation components were able to form an adequate solid matrix after the three-day setting period. The presence of stearic acid in the formulation also supported the hardness and structural characteristics of the soap bar. Meanwhile, the characteristic aroma of guava leaves combined with the fragrance provided an additional sensory attribute to the product. These characteristics are relevant to cosmetic product development because visual appearance, texture, and aroma can influence the overall acceptability of a cleansing product.

The homogeneity evaluation showed that the soap preparation was relatively uniform. Fine particles originating from the guava leaf extract were observed in the soap, but these particles were distributed throughout the preparation rather than accumulating in a specific area. This finding indicates that the mixing process was sufficient to incorporate the extract relatively evenly into the soap matrix. Homogeneity is an important characteristic for cosmetic preparations containing plant extracts because uneven distribution may result in variations in the amount of active ingredient present in different portions of the product. In the present formulation, the relatively even distribution of the extract suggests that the addition and mixing process was adequate to produce a physically uniform preparation.

The pH evaluation showed a value in the range of 8–9. This result is consistent with the alkaline characteristics commonly associated with solid soap preparations and was reported in the study as being within the acceptable range for soap bars. The alkaline nature of the formulation is related to the saponification process, in which fatty components react with NaOH to form soap. The obtained pH indicates that the formulation retained the expected alkaline characteristics of a solid soap after the incorporation of guava leaf extract. The pH is an important parameter in cleansing products because excessive alkalinity may influence skin comfort. In this formulation, the pH of 6-7 was considered suitable based on the criteria reported in the study. Nevertheless, pH alone does not establish complete skin safety, and additional safety assessments would be required to confirm the suitability of the product for repeated use.

In addition to the pH and homogeneity characteristics, the soap bar demonstrated good foam-forming ability. The formulation produced a foam height of 6 cm, and the foam remained relatively stable during the five-minute observation period. Foam formation is an important characteristic of cleansing products because it reflects the ability of the soap system to interact with water and produce foam during application. The formation of foam can be attributed to the soap compounds generated through the saponification reaction between the fatty components and NaOH. These soap compounds function as surface-active substances that facilitate foam formation when the preparation is agitated in water.

The foam height of 6 cm indicates that the formulation was able to generate an observable amount of foam, while the relatively small reduction in foam height during the observation period indicated good foam stability. The presence of guava leaf extract at a concentration of 2% did not prevent the soap from producing and maintaining foam. This finding suggests that incorporation of the plant extract was compatible with the basic foaming characteristics of the soap base. Foam stability is also an important quality parameter because consumers commonly associate foam formation with cleansing effectiveness. Therefore, the observed foam height and stability support the functional performance of the formulated soap as a cleansing preparation.

The incorporation of guava leaf extract was intended not only to provide a natural ingredient but also to introduce additional functional potential to the soap formulation. The phytochemical evaluation reported in the study indicated the presence of flavonoids, tannins, polyphenols, steroids, and triterpenoids. Among these compounds, flavonoids, tannins, and phenolic compounds are particularly relevant to the potential antioxidant properties of plant extracts. Antioxidants can interact with reactive molecules and free radicals and may therefore provide protective effects against oxidative processes. The presence of these secondary metabolites provides a rationale for the use of guava leaf extract as a potential functional ingredient in skincare products.

The potential antioxidant role of guava leaf extract is particularly relevant to cosmetic applications because oxidative processes are associated with various forms of skin damage, including processes related to premature skin aging. Consequently, incorporating a plant extract containing antioxidant-related phytochemicals into a cleansing product may provide functional value beyond basic removal of dirt and impurities. However, the biological potential of the raw extract should be distinguished from the experimentally demonstrated activity of the final soap formulation. Although the study describes guava leaf extract as having antioxidant, antibacterial, and anti-inflammatory potential, the reported evaluation of the final product primarily focused on organoleptic characteristics, pH, homogeneity, and foam performance. Therefore, direct antioxidant, antibacterial, and anti-inflammatory activities of the finished soap cannot be conclusively established from the reported physical evaluation alone.

Compared with previous studies, the present study focuses on the incorporation of guava leaf extract into a solid soap formulation and evaluates the resulting preparation through several physical quality parameters. Yuliani and Ismail (2023), for example, focused on the antifungal activity of plant-derived materials against *Candida albicans*, whereas the present study emphasizes the formulation of a plant extract into a cosmetic cleansing product. Similarly, Listiana et al. (2022) investigated tannin determination in *Nothopanax scutellarium*, while the present study utilizes guava leaves as a source of several classes of secondary metabolites for incorporation into a cosmetic preparation. Thus, the present formulation provides an approach that connects the phytochemical potential of guava leaves with a practical cosmetic dosage form.

Overall, the results demonstrate that guava leaf extract can be incorporated into a solid soap formulation at a concentration of 2% while maintaining acceptable physical characteristics. The resulting product had a solid and compact texture, a green color with a reddish gradient, a characteristic aroma, relatively good homogeneity, a pH of 6-7, and a foam height of 6 cm with good stability over five minutes. These characteristics indicate that the incorporation of guava leaf extract did not substantially compromise the basic physical performance of the soap. The formulation therefore shows potential as a natural-based cleansing product with additional functional value associated with the phytochemical constituents of guava leaves.

Nevertheless, the present findings primarily demonstrate the feasibility and physical quality of the formulation. Further research is necessary to directly evaluate the antioxidant activity of the finished soap, investigate the stability of the bioactive compounds during processing and storage, assess long-term physical and chemical stability, and conduct appropriate skin safety or irritation tests. Such investigations would provide stronger evidence regarding the functional performance and safety of guava leaf extract-based soap and support its further development as a natural and functional cosmetic product.

CONCLUSION

This study successfully developed and evaluated a guava leaf (*Psidium guajava* L.) extract-based soap bar as a natural cleansing preparation with potential antioxidant benefits. The maceration extraction process produced 5 g of concentrated guava leaf extract, which was incorporated into the soap formulation at a concentration of 2%. The formulation, consisting of virgin coconut oil (VCO), stearic acid, glycerin, sodium hydroxide (NaOH), distilled water, ethanol, guava leaf extract, and perfume, successfully produced a solid and compact soap bar.

The formulated soap exhibited acceptable physical characteristics, including a green color with a reddish gradient, a characteristic aroma of guava leaf extract, and relatively good homogeneity. The soap had a pH of 6-7 and produced a foam height of 6 cm that remained stable for five minutes. These results indicate that the incorporation of guava leaf extract did not substantially compromise the basic physical characteristics and cleansing-related performance of the soap formulation.

The presence of phytochemical constituents in guava leaf extract, particularly flavonoids, tannins, and polyphenolic compounds, supports its potential as a natural functional ingredient in cosmetic formulations. However, further studies are required to directly evaluate the antioxidant activity of the finished soap, as well as its long-term stability, active compound stability, and skin safety. Overall, the guava leaf extract-based soap bar demonstrates potential for further development as a natural and functional cosmetic cleansing product.

REFERENCES

Anggraini, T., & Dewi, S. (2023). Efektivitas ekstrak tumbuhan tropis pada produk kosmetik alami. *Asian Journal of Natural Products, 12*(1), 45–56.

Azri, A. S., & Muryadi, E. I. (2024). Hubungan sikap siswa terhadap kebiasaan cuci tangan pakai sabun di era pandemi COVID-19 pada siswa SMP Negeri 2 Kota Sungai Penuh tahun 2021. *Syntax Literate: Jurnal Ilmiah Indonesia, 9*(10).

Haerani, A., et al. (2018). Artikel tinjauan: Antioksidan untuk kulit. *Farmaka, 16*(2).

Islamy, A. A. F., & Hendrawati, N. (2022). Pengaruh konsentrasi natrium hidroksida (NaOH) dalam proses pembuatan *sweet potato soap*. *Distilat, 8*(4).

Khuzaimah, S. (2016). Pembuatan sabun padat dari minyak goreng bekas ditinjau dari kinetika reaksi kimia. *RATIH, 2*(2).

Listiana, L., Wahlanto, P., Ramadhani, S. S., & Ismail, R. (2022). Penetapan kadar tanin dalam daun mangkokan (*Nothopanax scutellarium* Merr.) perasan dan rebusan dengan spektrofotometer UV-Vis. *Pharmacy Genius, 1*(1), 62–73.

Sapuri, M., Dewi, I. K., & Andriani, D. (2014). Evaluasi tinggi busa dan stabilitas sabun padat berbahan dasar alami. *Journal of Natural Products Research, 3*(2), 124–132.

Sukristiani, D. (2014). *Pengetahuan tentang kosmetika perawatan kulit wajah dan riasan pada mahasiswi Jurusan Kesejahteraan Keluarga Fakultas Teknik Universitas Negeri Padang* [Thesis, Universitas Negeri Padang].

Umayati, D., Nugraha, D., & Ramdan, S. R. K. (2023). Formulasi dan evaluasi sabun cair ekstrak daun jambu biji (*Psidium guajava* L.) dan uji iritasi dengan basis minyak zaitun (*olive oil*). *Pharmacy Genius, 2*(2), 125–134.

Yuliani, W., & Ismail, R. (2023). Uji aktivitas antijamur fungi endofit tanaman sarang semut (*Myrmecodia pendans*) terhadap jamur *Candida albicans*. *Pharmacy Genius, 2*(1), 31–42.

Yusuf, A. L., Nugraha, D., Wahlanto, P., Indriastuti, M., Ismail, R., & Himah, F. A. (2022). Formulasi dan evaluasi sediaan gel ekstrak buah pare (*Momordica charantia* L.) dengan variasi konsentrasi Carbopol 940. *Pharmacy Genius, 1*(1), 50–61.