



Formulation, Evaluation Of Physical Properties And Skin Irritation Potential Of Facemist Preparation From Ethanolic Extract Of Chinese Betel Leaves (*Peperomia pellucida* L.)

Formulasi, Evaluasi Sifat Fisik Dan Potensi Iritasi Kulit Sediaan Facemist Ekstrak Etanol Daun Sirih Cina (*Peperomia pellucida* L.)

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ABSTRACT

Background: *Peperomia pellucida* L. contains bioactive compounds, including flavonoids, saponins, tannins, and alkaloids, which have potential anti-acne properties. One natural pharmaceutical approach is developing these compounds into a face mist formulation. **Objective:** This study aimed to formulate a face mist containing ethanol extract of *P. pellucida* leaves, evaluate its physical characteristics, and assess its irritation potential. **Methods:** The leaves were extracted by maceration using 70% ethanol and formulated into three preparations: F0 (without extract), F1 (0.5%), and F2 (1%). Evaluations included organoleptic properties, homogeneity, pH, spreadability, drying time, specific gravity, viscosity, and skin irritation testing. **Results:** All formulations remained physically stable throughout four weeks of storage and complied with the required quality standards. No signs of skin irritation were observed during testing. **Conclusion:** Ethanol extract of *P. pellucida* leaves can be successfully formulated into a physically stable and safe face mist, indicating its potential as a natural topical preparation for acne-prone skin.

INTRODUCTION

Acne is a common skin disorder caused by bacterial infection accompanied by inflammation of the sebaceous glands. Excessive sebum production may clog skin pores and promote bacterial growth, particularly *Propionibacterium acnes* and *Staphylococcus aureus*. (Aspia, 2024). Various approaches have been developed to manage acne, including the utilization of herbal medicinal plants with antibacterial properties (Ngurah, Merta and Yustiantara, 2022).

One of the medicinal plants widely found in humid environments is *Peperomia pellucida* L. Previous phytochemical screening studies

revealed that this plant contains steroid compounds, triterpenoids, phenolics, flavonoids, saponins, tannins, and alkaloids. (Permadani *et al.*, 2024). Saponins and tannins are known to exhibit antibacterial effects by damaging bacterial cell membranes, leading to cell lysis. (Endriyatno and Puspitasari, 2023). Research conducted by Rivane Gabriella Dalope (2024) entitled Antibacterial Activity Test of Ethanol Extract of Chinese Betel Leaves against *Propionibacterium acnes*, the Cause of Acne, stated that ethanol extract of Chinese betel leaves can inhibit bacteria that cause acne, starting from a concentration of 10% (Dalope, Kalalo and Rondonuwu Mervina,

2024). In addition, alkaloids can denature bacterial proteins, resulting in bacterial cell death.

The development of topical pharmaceutical and cosmetic formulations from natural ingredients has gained increasing attention. One of the dosage forms considered practical and convenient for skin care is the face mist preparation. Face mist is a liquid cosmetic preparation applied by spraying directly onto the facial skin (Sukirawati, Yusriyani, 2025). It provides hydration, refreshes the skin, helps moisturize the face, and may reduce excess facial oil. Furthermore, spray formulations minimize direct hand contact with facial skin, thereby reducing contamination risk (Aspia, 2024). Face mist preparations are also easy to carry and rapidly absorbed into the skin, making them suitable for daily use (Saraswati, 2023). Based on the description above, the researcher is interested in conducting research with the title Formulation, Physical Evaluation and Irritation Potential of Facemist Preparations from Ethanol Extract of Chinese Betel Leaves (*Peperomia pellucida* L.).

METHODS

This study was conducted using an experimental design, and the obtained data were analyzed descriptively. The plant sample was identified at the Herbarium of Andalas University. Chinese betel leaves (*Peperomia pellucida* L.) used in this study were collected from East Padang District, Padang City, Indonesia

1. Sample Preparation

Fresh leaves were sorted to remove damaged materials and washed under running water to eliminate adhering impurities. The leaves were then sliced into smaller pieces and air-dried without direct sunlight exposure. After drying, the samples were re-sorted, blended into powder, and sieved using a mesh with a number 60 (Fiyati, Anjasmara and Yunita, 2023).

2. Extraction Process

The powdered sample was extracted by maceration with 70% ethanol. The sample was

soaked for 24 hours, then filtered to collect the filtrate and retain the residue. The residue was remacerated twice to maximize extraction efficiency. The combined filtrates were concentrated with a rotary evaporator to obtain a viscous extract. (Verawaty., 2025).

3. Formulation of Face Mist Preparation

Table 1. Formula of Face Mist Preparations Containing Ethanol Extract of *Peperomia pellucida* Leaves

No	Ingredients	Concentration (%)			Function
		F0	F1	F2	
1.	Ethanol extract of <i>Peperomia pellucida</i> leaves	0	0,5	1	Active Ingredient
2.	Glycerin	15	15	15	Humectant
3.	PVP	4	4	4	Thickening agent
4.	Distilled Water (Ad)	100	100	100	Solvent

PVP was dispersed in 20 mL of distilled water and triturated until a mucilage mass was formed. Glycerin was then added gradually while stirring continuously until homogeneous. The ethanol extract was incorporated into the base, followed by the addition of the remaining distilled water. The final preparation was transferred into spray bottles (Febriani, Sari and Melisa, 2025).

4. Physical Evaluation of Face Mist Preparations

a. Organoleptic test

Organoleptic testing is carried out to assess the physical appearance of the face mist by observing its shape, color, and smell (Marlina, Agustien and Susanti, 2023).

b. Homogeneity test

The homogeneity test for face mist is performed by spraying the preparation onto a transparent slide, then visually observing it to ensure there are no undissolved particles or clumps. The preparation is considered homogeneous if all components are evenly mixed without any sediment or agglomeration (Putri, 2025).

c. pH measurement

The pH test was performed on 50 mL of face mist, using a calibrated pH meter as the test tool. The face mist was then dipped into the mist until a consistent reading appeared on the meter. The face mist must meet the skin pH criteria, which is between 4.5 and 6.5. The



room temperature was chosen to ensure the accuracy of the pH measurement results. (Putri *et al.*, 2023; Verawaty., 2025).

d. Spraqy dispersion test

The face mist preparation was sprayed onto a petri dish at a distance of 5 cm, and the spreadability of the preparation was measured using a ruler. The parameter used was the diameter. (Aspia, Malahayati and Oktaviannoor, 2024). Good spray coverage 5 - 7 cm (Imtitsal Nabila & Indah Safitri, 2024).

e. Drying time test

Drying time testing is carried out to determine the optimal time for the preparation to dry properly, which is less than 5 minutes. (Putri, 2025). Drying time testing was performed by spraying the preparation on a volunteer's forearm.

f. Specific gravity determination

Specific gravity is determined using a pycnometer. The steps include weighing an empty pycnometer (W1), a pycnometer filled with distilled water (W2), and a pycnometer filled with the sample (W3). The data obtained is then used to calculate the specific gravity of the sample. (Putri, 2025).

g. Viscosity measurement

Viscosity measurements are performed using an Ostwald viscometer. The procedure begins by inserting the face mist preparation into the viscometer, then the liquid is sucked up using a bulb until it reaches the upper limit mark. The liquid is then allowed to flow until it reaches the lower limit mark, and the time taken for the flow to occur is recorded. (Imtitsal Nabila and Indah Safitri, 2024).

h. Irritation Test

In this study, an irritation test was conducted by spraying the face mist on the forearm. The area was then covered with gauze and left for 24 hours, avoiding contact with water. Participants were 20 years of age or older and did not have sensitive skin or allergies. Five participants participated (Wahyuni, 2019).

RESULTS AND DISCUSSION

In this study, three face mist formulations were prepared: F0, F1, and F2. F0 (no active ingredient), F1 (0.5% ethanol extract of Chinese betel leaf), and F2 (1% ethanol extract

of Chinese betel leaf). The ingredients used as the base for the face mist were glycerin and polyvinyl pyrrolidone (PVP). After the face mist was completed, a physical evaluation was conducted. These physical evaluations included organoleptic properties, homogeneity, pH, spreadability, drying time, specific gravity, viscosity, and the presence of irritation. The physical evaluations were conducted over a period of four weeks.

The organoleptic evaluation of the face mist with concentration F0 showed a clear, odorless liquid. At concentration F1, the face mist was a brown, odorless liquid. Meanwhile, at concentration F2, it was liquid, slightly dark brown, and odorless. After 4 weeks of observation, the color, shape, and odor of the F0, F1, and F2 facemist preparations were still stable; nothing changed (Handayani, Puspariki, and Permatasari, 2024). The homogeneity test was carried out by placing the facemist preparation on a glass slide, then observing whether there were any coarse grains in the facemist preparation. The facemist preparation was said to be homogeneous if there were no coarse grains in the preparation. The results of homogeneity observations carried out on the facemist preparation for 4 weeks remained homogeneous because there were no coarse grains in it that made the preparation difficult when sprayed on the face (Indriastuti, Harun, and Rismaya, 2023). The evaluation results can be seen in Table 2.

Table 2. Organoleptic Testing, Homogeneity, pH, Spreadability, Drying Time Test, Specific Gravity, Viscosity.

Parameter	F0	F1	F2
Form	Liquid	Cair	Cair
Color	Clear	Brownish Green	Dark Brownish Green
Odor	Tidak berbau	Tidak berbau	Tidak berbau
Homogeneity	Odorless	Odorless	Odorless
Average pH	4,74	5,23	5,36
Spray Dispersion	4,57 cm	4,75 cm	5,30 cm
Drying Time	293 seconds	303 seconds	312 seconds
Specific Gravity	1,08%	1,07%	1,08%
Viscosity	1,81 cP	1,58 cP	1,60 cP
Irritation Test	-	-	-

Notes (-) = No irritation observed
(+) = Irritation observed

The pH test of the face mist preparation was carried out using a pH meter. The pH measurement was carried out once a week to see whether the pH of the preparation had changed or not. The average results of the pH test of the face mist preparation for 4 weeks at F0 were 4.73, F1 was 5.23, and F2 was 5.36.

From the results of the data, it was concluded that the face mist preparation met the requirements because the pH range of the face mist preparation was the same as the expected pH, which is 4.5-6.5 (Melviani, 2025; Zikri *et al.*, 2025). Checking the pH of a product is useful for determining whether it's too acidic or alkaline. If the pH is too acidic, it will irritate the skin, while if it's too alkaline, it will dry out and become flaky. (Okkyana Kusuma Putri, 2025). The results of pH observations can be seen in Table 3.

Table 3. Results of pH observations of the preparation for 4 weeks.

Formulation	pH test of the preparation on the day				Average
	0	7	14	21	
F0	4,55	4,83	4,93	4,64	4,73±0,173
F1	5,2	5,35	5,29	5,11	5,23±0,105
F2	5,3	5,43	5,36	5,37	5,36±0,053

The pH diagram can be seen in Figure 1.

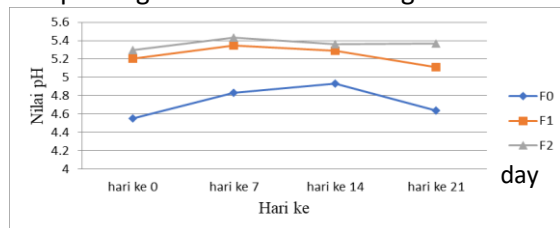


Figure 1. Line diagram of pH of facemist preparations

In the spreadability test of the preparation, the diameter of the facemist preparation was measured by spraying the preparation on a Petri dish that was pressed together and waiting for 1 minute, then measuring the diameter using a ruler. The average results of the spreadability test obtained at F0 were 4.57 cm, F1 was 4.75 cm, and F2 was 5.30 cm. The data concluded that the F0 and F1 preparations did not meet the requirements, while the F2 facemist preparation met the requirements for a good spreadability test, which was between 5 and 7 cm. (Murdiana *et al.*, 2022; Okkyana Kusuma Putri, 2025). The reason why it is important to carry out a spreadability test is to see the ability of the face mist preparation to spread when sprayed on the face, so that it can easily spread on the surface of the face. (Aspia, 2024).

Table 4. Results of the spreadability test of the facemist preparation

Formulation	Spread Power Test Day to Day (cm)				Average
	0	7	14	21	
F0	4	4	5	5,3	4,57±0,675
F1	4,5	4	5,2	5,3	4,75±0,613
F2	5	6	4,7	5,5	5,30±0,571

Drying time test of face mist preparation, where the preparation is sprayed on the forearm and left for several minutes. Drying time is a factor to ensure the preparation meets expectations, namely, quickly absorbed into the skin, comfortable when applied, and practical for use anywhere. The results of the drying time test for 4 weeks obtained an average drying time at F0 of 293 seconds, F1 was 303 seconds, and F2 was 312 seconds. The requirement for a good drying time of the preparation is less than 300 seconds (5 minutes) (Putri *et al.*, 2023). The data in Table 5 shows that Formulas 1 and 2 had drying times of more than 5 minutes. Lisyanti *et al.* (2022) reported that the higher the viscosity of a face mist preparation, the longer the drying time. Furthermore, the hydroxyl groups in phenolic and flavonoid compounds can form hydrogen bonds with water molecules, thereby increasing the amount of bound water in the system. Bound water requires more energy to evaporate than free water, resulting in a longer drying time for Formula 2 than Formula 1 (Lisyanti, Budi and Zulfadhilah, 2022).

Table 5. Drying time of face mist preparation

Formulation	dry time test of the preparation in days (seconds)				Average
	0	7	14	21	
F0	280	283	298	312	293 ±14,77
F1	288	302	307	315	303±11,34
F2	292	320	318	320	312±13,69

The specific gravity test for the face mist preparation was conducted using a pycnometer to determine the ideal weight of the preparation. The specific gravity test was conducted to determine the effect of the ingredients used in the formulation on the specific gravity of the resulting preparation, thus achieving an ideal preparation (Imtitsal Nabila and Indah Safitri, 2024). Specific gravity measurements ranged from 1.07 to 1.08 g/mL, which complied with the standard requirements for face mist formulations. Likewise, viscosity values remained within the



acceptable range of 1.27–1.87 cP, indicating appropriate flow properties for spray application (Rusli, Amelia and Gading, 2021; Putri, 2025).

Table 6. Specific gravity test of facemist preparations

Formulation	Specific gravity test (g/mL)				Average
	0	7	14	21	
F0	1,03	1,05	1,05	1,20	1,08±0,08
F1	1,12	1,05	1,04	1,06	1,07±0,04
F2	1,08	1,05	1,05	1,13	1,08±0,04

Table 7. Results of the viscosity test of the face mist preparation

Formulation	Viscosity test (cP)				Average
	0	7	14	21	
F0	1,79	1,49	1,76	2,22	1,8150±0,301
F1	1,29	1,53	1,38	2,15	1,5875±0,387
F2	1,45	1,53	1,37	2,07	1,6050±0,316

The irritation test was conducted by spraying the face mist on the forearm, which was wrapped in gauze, and left for 24 hours, preventing it from coming into contact with water. The purpose of this test was to determine whether skin irritation, such as redness, itching, and swelling, occurred during use. The face mist was deemed safe after the irritation test, as it did not cause any of these symptoms. The irritation test results showed that the product did not irritate the skin, making it safe for use (Safitri, 2024; Alitonang, Amir and Milda, 2025).

CONCLUSIONS

Based on the research results, a face mist preparation of Chinese betel leaf extract (*Peperomia pellucida* L.) can be formulated and provides physical evaluation results that meet the requirements.

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