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## Irritation Test of Optimum Preparation of Celery Extract Face Clay Cleanser With Sodium Lauryl Sulfate and Cocamidopropyl Betaine as Surfactants

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**Abstract:** Surfactant is one of the important things in making face clay cleanser preparations. Sodium Lauryl Sulfate (SLS) is an anionic type surfactant that is often used in cosmetic products. The use of Sodium Lauryl Sulfate (SLS) can cause irritation and dry skin. Combination with cocamidopropyl betaine (CAPB) which is amphoteric can reduce skin irritation. Based on this, a safety test is needed which aims to meet the preparation requirements before being marketed to the wider community. One of the safety tests that can be done is the skin irritation test. The test method used is the human patch test. The irritation test of the optimum preparation of face clay cleanser celery herb extract (*Apium graveolens* L.) with a concentration of 0.5% SLS and 9.5% CAPB was carried out on 6 volunteers consisting of men and women aged 20-35 years, the score of the degree of irritation was 0, which means that the preparation is not irritating. Based on the evaluation with SPSS, it can be concluded that there is no significant difference ( $p > 0.05$ ) for the irritation test results and the optimum preparation of celery herb extract face clay cleanser (*Apium graveolens* L.) meets the safety requirements.

**Keywords:** irritant, sodium lauryl sulfate, cocamidopropyl betaine, celery extract

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### INTRODUCTION

Surfactant is one of the important things in making face clay cleanser. Surfactant sodium lauryl sulfate (SLS) is a type of anionic that has the ability to clean the face (Sari et al., 2020). Sodium lauryl sulfate (SLS) is widely used in cosmetic products, as well as used in stain and dirt cleaning products and helps enrich the foam in the preparation (Chasani, et al., 2022; Suryadi & Andrijanto, 2024). The permissible concentration of sodium lauryl sulfate (SLS) as a surfactant in topical applications is 1% w/v while as an anionic surfactant it is 0.5-2.5% (Rowe et al., 2017). However, the limitations of this surfactant can cause impacts in the form of irritation and dry skin (Klimaszewska et al. 2022) so that the combination of amphoteric surfactant cocamidopropyl betaine (CAPB) to reduce irritation with emollient effects and foaming properties, safe for skin and eyes compared to other surfactants (Darusman, et al., 2023). Research conducted by Chairman (2013) showed that the concentration of cocamidopropyl betaine in personal care preparations is 0.005%-11%, with a maximum usage limit of 13%. The combination of the two surfactants is expected to create a better effect, especially on cleaning power, foam stability and foam formation compared to the use of a single surfactant in facial soap preparations (Agustina, 2017; Suryadi & Andrijanto 2024). Based on this background, this study aims to analyze the irritating effects of using SLS and CAPB as surfactants in face clay cleanser with the addition of celery extract using experimental methods with human patch tests so as to determine the preparation with effective and safe results for the skin.



## METHODS

### 1. Materials

The materials used in this study include celery extract, 70% ethanol, Cocamidopropyl betaine, Sodium Lauryl Sulfate, Kaolin, Bentonite, Glycerin, Titanium Dioxide, Xanthan gum, Citric acid, Sodium citrate, Disodium EDTA, Menthol, and Aquadestilata.

### 2. Tools

The equipment used in this study includes a magnetic stirrer, beaker, oven, grinder, filter paper, pH paper, water bath, rotary evaporator, measuring cup, stopwatch, stormer viscometer, and analytical balance.

### 3. Preparation and working method

This research is an experimental research with human patch test method. The irritation test was conducted on 6 volunteers by observing for 24 hours the use of celery herb extract optimum face clay cleanser preparation. Inclusion criteria: university students, aged 20-35 years. Exclusion criteria: stopped doing the test within the specified time, using a handbody, using steroid drugs, anti-histamines while doing the test, hypersensitive reactions to the skin on which the test preparation was applied. The test preparation, namely face clay cleanser with celery herb extract, was applied to the volunteer's skin and covered with a covering material consisting of 2 cm rectangular filter paper and plaster (Trihapsoro, 2003; Lestari, 2016). The test material was placed on the right upper forearm of the volunteer for 4 hours. After that, the test material was removed and readings were taken 24 hours after the test material was removed. The parameters used were assessment of the degree of erythema and edema, followed by determination of the degree of irritation. Tests were conducted to determine the quality and safety of the preparation, with the results analyzed using theoretical and statistical approaches. Data analysis was carried out by comparing test results with literature standards related to the safety of preparations.

**Table 1. Erythema Score**

<b>Skin Reactions</b>	<b>Score</b>
Without Erythema	0
Very little erythema (almost not visible)	1
Erythema is clearly visible (25.1-30 mm)	2
Moderate erythema (30.1-35 mm)	3
Severe erythema (dark red) by forming an eschar, >35 mm)	4

**Table 2. Edema Score**

<b>Skin Reactions</b>	<b>Score</b>
Without Edema	0
Very little edema (almost not visible)	1
Edema is clearly visible (thickness) < 1 mm)	2
Moderate edema (edge raised $\pm$ 1 mm)	3
Severe edema (raised edge > 1 mm and expanding)	4



**Table 3. Irritation Score**

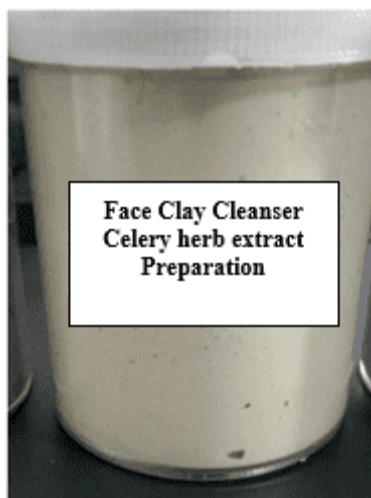
<b>Skin Reactions</b>	<b>Score</b>
Non-irritating	0
Mild Irritation	0.5-2
Moderate Irritation	>2-5
Severe Irritation	>5-8

**FORMULATION OF FACE CLAY CLEANSER PREPARATION**

Celery herb extract (*Apium graveolens* L.) face clay cleanser preparation is packaged in a 100 ml formula and then modified which can be seen in Table 4.

**Table 4. Formulation of Face Clay Cleanser**

Material	Concentration
CAPB	9.5%
SLS	0.5%
Kaolin	11
Bentonit	9
Gliserin	6
<i>Titanum Dioxide</i>	3
<i>Xanthan gum</i>	0,6
<i>Citric acid</i>	0,4
<i>Sodium citrate</i>	0,3
<i>Disodium EDTA</i>	0,2
Menthol	0,1
Celery Herb Extract	10%
Aquadest	ad 100



**Figure 1. Celery Extract Face Clay Cleanser Preparation**



## RESULT AND DISCUSSION

Well-prepared The irritation test was conducted on 6 volunteers by setting inclusion and exclusion criteria that aim to help researchers identify the study population objectively, and consistently. These criteria are important for any type of research that examines certain characteristics of a population. The test preparation, face clay cleanser with celery herb extract, was applied to the volunteer's skin and covered with a rectangular filter paper cover. This closure aims to ensure the absorption of the test material and reduce environmental influences (Trihapsoro, 2003; Laras et al, 2014).

The test material is placed on the right upper forearm of the volunteer chosen because the horn layer is thin, so the absorption of the preparation material is greater, and the test material remains in contact with the skin without moving, loose, or sagging (Trihapsoro, 2003; Laras et al, 2014). During the assessment, volunteers are allowed to only wash the skin of the application site with water, without using soap, detergent, or other cosmetic products, this aims to avoid bias or errors in observing the use of the preparation. Scores from 0 to 4 indicate how severe edema and erythema are in the test area (Laras et al., 2014). Research conducted by Priani (2020), each test material calculated the irritation index using the following formula:

$$\frac{(\text{Erythema score } 12 + 24) + (\text{Edema score } 12 + 24)}{\text{Number of volunteers}}$$

The irritation index obtained was compared with the irritation degree score to determine the severity of the irritation reaction. From the experimental results, it was found that none of the 6 volunteers experienced skin irritation, which is characterized by no edema (Score 0) or erythema (Score 0) produced. The following table of irritation test results is shown in table 5.

**Table 5. Irritation Testing Result**

No	Panelists	12 Hours	24 Hours	Conclusion
1	A	-	-	No irritation
2	B	-	-	No irritation
3	C	-	-	No irritation
4	D	-	-	No irritation
5	E	-	-	No irritation
6	F	-	-	No irritation

Celery herb extract face clay cleanser preparation produced is not irritating when used because surfactants are amphiphilic molecules, which have a water-soluble hydrophilic head and a water-insoluble hydrophobic tail. Because of this difference in properties, surfactants are able to remove dirt from the skin surface. The tail of the surfactant will interact with the dirt, and when rinsed with water, the head of the surfactant will be attracted to the water, thus removing the dirt from the body. Based on their hydrophilic nature, surfactants are divided into anionic, cationic, amphoteric, and non-ionic surfactants. Sodium Lauryl Sulfate (SLS) contained in face clay cleanser preparations is an anionic surfactant that has irritating properties where SLS is a fairly toxic ingredient with acute toxic effects or chronic toxicity including carcinogenicity that can cause irritation to the skin, eyes, mucous membranes, upper respiratory tract, and stomach. The toxicity of SLS mainly comes from its surfactant properties, which cause cell membrane damage, cytokine release, and protein conformational changes, as well as damage to bacteria present in various parts of the body and are good. However, SLS used in low concentrations does not cause harm, but when used in higher concentrations and for longer periods of time, it causes harm. Due to its surfactant quality, it damages corneocytes, causing swelling, denaturation of keratin structure by direct binding, increase in pH of stratum corneum, and alteration of lipid synthesis in corneocytes structural damage to stratum corneum increases Transepidermal Water Loss and protein denaturation (Dave dhruv, 2023).

The use of SLS surfactants is also at high risk of irritation when given in excess of the required range of levels, namely topical application which is allowed to be as much as 1% w/v while as an anionic surfactant 0.5-2.5% (Rowe, et al., 2017). So it can be concluded that the celery herb extract face clay cleanser



preparation produced is not irritating when used because the use of SLS is still in the low range of 0.5%. In addition, the use of surfactants in face clay cleanser is also combined, namely anionic SLS with amphoteric surfactants, namely CAPB where a mixture of anionic surfactants and amphoteric surfactants that can reduce the concentration of critical micelles from anionic surfactants so as to produce lower surface tension than single surfactants. The combination of amphoteric surfactants can also reduce the level of irritation because this class of surfactants has low biotoxicity and high biodegradability so that the combination of SLS and CAPB makes the micelle size even larger so that its ability to penetrate into the epidermal layer is smaller.

The use of celery herb extract (*Apium graveolens* L.) in face clay cleanser can also reduce the irritating effect of using anionic surfactants. This is because celery herb extract (*Apium graveolens* L.) contains flavonoids, tannins and saponins (Ngelu et al., 2022). Where saponins are active compounds found in plants and act as natural surfactants because they have an amphiphilic structure, which is a combination of non-polar aglycones that are hydrophobic and glycone groups that are hydrophilic. The hydrophilic part consists of sugar chains that are easily soluble in water, while the hydrophobic part can be steroids or triterpenoids that are insoluble in water. Therefore, saponins are categorized as nonionic surfactants. Nonionic surfactants do not ionize in aqueous solutions and are commonly used as wetting agents, emulsifiers, gels, and foam formers in the pharmaceutical industry (Sekhon B S, 2013). Then data processing was carried out with SPSS version 25, the results of data analysis using the Paired Samples Test showed that the data obtained had no significant difference with a value of 0.074 ( $p > 0.05$ ). Paired Samples Test results can be seen in Table 6.

**Table 6. Results of Paired Samples T-test SPSS 25**

Paired Samples Test <sup>a</sup>	
	Sig. (2-tailed)
Irritation test	.074

## CONCLUSION

Based on the research results of the irritation test of the optimum preparation of face clay cleanser celery herb extract (*Apium graveolens* L.) with sodium lauryl sulfate (SLS) and cocamidopropyl betaine (CAPB) as surfactants, it can be concluded that the resulting preparation is safe not to irritate the skin. This is shown by the results that the 6 panelists did not experience edema or erythema during the 24-hour human test patch.

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