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Preparation Formulation *Clay Mask* From Butterfly Pea Flower Pollen (*Clitoria Ternatea* l.) And Yam Powder (*Pachyrhizus Erosus* l.) As a Natural Antioxidant

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Abstract

Antioxidants play an important role in preventing cell damage, primarily through free radical scavenging mechanisms. This study aimed to formulate clay masks based on butterfly pea (Clitoria ternatea L.) and jicama (Pachyrhizus erosus L.) flower powder and to evaluate their physical characteristics. Butterfly pea flowers were used for their anthocyanin and flavonoid content, which act as antioxidants, while jicama was chosen for its vitamin C and flavonoid content. Clay mask formulations were made with varying concentrations of butterfly pea and jicama flower powder. These were then tested for organoleptic properties, homogeneity, pH, drying time, and antioxidant activity. The clay mask results showed good physical properties: a semi-solid texture, and a pH value within the skin-friendly range of 4.5-8.0, indicating no irritation. The homogeneity test confirmed that all formulations were uniform, without lumps or unmixed particles. The drying time of the clay masks ranged from 15.19 to 15.26 minutes, meeting the optimal range of 15-20 minutes. Antioxidant activity, formula 0 has an IC50 of 102.75 µg/mL (moderate activity), formula 1 (10% butterfly pea flowers, 10% jicama) shows strong antioxidant activity with an IC50 of 62.15 µg/mL. Formula 2 (12% butterfly pea flowers, 8% jicama) shows strong antioxidant activity with an IC50 of 53.70 µg/mL. Formula 3 (8% butterfly pea flowers, 12% jicama), with an IC50 of 41.20 µg/mL, so it is classified as very strong.

Keywords: Antioxidants, Butterfly Pea Flower, Clay Mask, Jicama.

INTRODUCTION

Ultraviolet rays can cause skin damage through free radical mechanisms. To prevent the aforementioned facial skin problems, interventions can be carried out through the use of oral and topical medications (Patimah et al., 2025). Oral medications for skin problems include various types, such as vitamins, zinc supplements, collagen, and antibiotics (Nur Rohmah, 2021). Furthermore, there are also topical medications commonly used in cosmetic products. Some ingredients frequently used in cosmetic formulations include butylated hydroxytoluene (BHT), butylated hydroxyanisole (BHA), and tert-butylhydroquinone (TBHQ). However, these ingredients have carcinogenic potential and can transform into toxic compounds in the body. Therefore, choosing safe and effective products is crucial for skin health (Patimah et al., 2025).

Among the plants that act as antioxidants are butterfly pea flowers (Clitoria ternatea L.) and jicama (Pachyrhizus erosus L.). Butterfly pea flowers contain anthocyanin and flavonoid compounds, which also act as antioxidants (Patimah et al., 2025). Meanwhile, jicama contains compounds that act as antioxidants, namely vitamin C and flavonoids. Vitamin C functions as a protective agent against sunlight by neutralizing ROS (Reactive Oxygen Species) radicals produced by the sun (Chandra et al., 2023).

Purpose, Urgency, and Novelty of the Research

In relation to the identified problem, this study has several main objectives. First, I wanted to determine whether butterfly pea flowers and jicama can be used together. Second, I wanted to determine the antioxidant properties of a clay mask formula that combines butterfly pea and jicama flower powder. Given the high prevalence of skin cancer caused by ultraviolet light exposure, this research is crucial. Furthermore, there is growing public interest in using more natural masks that do not cause side effects. A new focus of this study is the combination of clay masks at various concentrations; the goal is to provide strong scientific evidence regarding which concentration is more effective in scavenging free radicals.

RESEARCH METHODS

Types and Methods of Research

A quantitative experimental method was used in this study to compare the antioxidant activity of clay masks with concentrations of 12%, 10%, and 8% to counteract free radicals. This method was chosen because it provided strong and measurable evidence of the differences in antioxidant potential between the three clay mask formulas. The entire study was conducted in a controlled environment of the Chemistry Laboratory of the Undergraduate Pharmacy Study Program, Duta Bangsa University, Surakarta, to ensure data precision and validity.

Research Population and Sample

The populations in this study were butterfly pea flowers (Clitoria ternatea L.) and jicama (Pachyrhizus erosus L.). The samples used were butterfly pea flowers (Clitoria ternatea) obtained from the Tawangsari area, Sukoharjo, and jicama (Pachyrhizus erosus) obtained from Bayat, Klaten. The selection of these locations was based on availability and samples that met the research criteria. These two samples will be processed into simple preparations and then subjected to further testing. Selecting representative samples is crucial to ensure that the research results can be generalized (Lutfiah, 2022).

RESULTS AND DISCUSSION

Sample Collection and Plant Determination

Sampel yang digunakan dalam penelitian ini yaitu tanaman bunga telang (*Clitoria ternatea*) yang diperoleh dari daerah Tawangsari, Sukoharjo dan bengkuang (*pachyrhizus erosus*) yang diperoleh dari Bayat, Klaten. Tanaman bunga telang dan bengkuang di determinasi dengan cara mengidentifikssi seluruh bagian tanaman yang dilakukan di Unit Pelaksana Fungsional (UPF) Pelayanan Tradisional yang berada di Tawangmangu, Karanganyar, Jawa Tengah. Proses determinasi dilakukan untuk memastikan kebenaran dari tumbuhan yang digunakan benar tanaman bawang putih majemuk dan bawang putih tunggal dengan nama latin *Allium sativum* L (Lampiran 1). Hasil determinasi menunjukkan bahwa sampel tanaman merupakan tanaman bawang putih majemuk dan bawang putih tunggal yang termasuk dalam famili *Amarylidaceae*.

Making Simplicia

Butterfly pea and yam bean flowers were taken and wet sorted then weighed and obtained a yield of 2500 grams of yam bean and 2000 grams of butterfly pea flowers. The weighed butterfly pea and yam bean flowers were then washed, chopped and dried. The drying process was carried out using the drying method under sunlight. After drying, the butterfly pea and yam bean flowers were then weighed and obtained 251 grams of butterfly pea flower simplicia and 510 grams of yam bean. The results of drying butterfly pea and yam bean flowers can be seen in table 1.

Table 1. Results of Calculation of the Percentage of Simple Clitoria Ternatea and Yam Bean Flowers.

Simplicity	Wet Weight	Dry weight	Percentage (%)
Bunga telang	2000 g	251 g	12,55%
Bengkuang	2500 g	510 g	20,4%

Table 1 shows that butterfly pea flowers account for 12.55% of the dry weight, while jicama accounts for 20.4%. As the moisture content decreases during the drying process, the moisture content decreases. The purpose of drying is to reduce the amount of water contained in the material to prevent mold growth and to ensure long-term storage.

Standardization of Simplicia and Extracts

This parameter standardizes non-specific parameters. These non-specific parameters determine chemical, microbiological, and physical aspects that will ensure quality, thus ensuring consumer safety and product stability.

Determination of Drying Loss of Simple Drugs

The determination of drying loss is carried out to provide a range or limit on the amount of compounds lost during the drying process. The drying loss parameter is basically a measurement of the material residue after drying at a temperature of 105°C to a constant weight, expressed as a percentage (Ministry of Health of the Republic of Indonesia, 2017). The results of the determination of drying loss for compound garlic powder, single garlic, and black garlic can be seen in Table 6.

Table 2. Results of determining the drying loss of compound garlic, single garlic and black garlic simple powder.

Sample	Test	Powder weight (g)	Drying shrinkage (%)	Average
Butterfly flower	c1	2 grams	7,6 %	
	Replication 2	2 grams	9,5%	7,5%
	Replication 3	2 grams	5,5%	
Butterfly flower	Replication 1	2 grams	9 %	
	Replication 2	2 grams	7,5 %	8,1%
	Replication 3	2 grams	8%	

Based on the results of determining the drying loss of the simplicia, it was found that the drying loss for the butterfly pea flower and jicama flowers was 7.5% and 8.1%, respectively. The drying loss obtained met the requirements for simplicia, which is <10% (Ministry of Health of the Republic of Indonesia, 2017).

Water Content of Simplicia and Extract

Water content is a standardization measure that aims to determine the water residue after the evaporation process from the maceration filtrate into a thick extract. The water content parameter is the amount of water contained in a simplicia or extract using a moisture analyzer (Ministry of Health of the Republic of Indonesia, 2017). The results of determining the water content of the simplicia for compound garlic, single garlic, and black garlic are shown in Table 7.

Table 3. Results of Determination of Water Content of Compound Garlic, Single Garlic and Black Garlic Simples.

Sample	Initial weight (g)	Water content of simple drugs (%)			Average (%)
		Replication 1	Replication 2	Replication 3	
Butterfly flower	2 g	3,11%	2,11%	1,79%	3,36%
Jicama	2 g	6,58%	5,65%	5,23%	5,82%

Based on the results of determining the water content of the simplicia obtained, it can be seen that the water content of the simplicia of butterfly pea flower and jicama is 3.36% and 5.82%, respectively. The water content obtained has met the water content requirements for garlic simplicia, which is <10% (Ministry of Health of the Republic of Indonesia, 2017).

Phytochemical Screening

Phytochemical screening is one method used to determine the presence of secondary metabolites in a sample. Some of the compounds examined for their presence include flavonoids, alkaloids, saponins, tannins, and steroids/triterpenoids.

Table 4. Results of Phytochemical Screening Test of Butterfly Pea Flower Powder and Jicama Powder

compound	reagent	positive sign	results		information
			jicama	telang	
Flavonoid	Mg powder and concentrated HCL	Yellowish, orange to red colors are formed	+	+	orange red (telang) yellowish (jicama)
Alkaloid	Reagen dragendrof	A red precipitate is formed	+	+	Orange red sediment
	Reagen mayer	There is a white precipitate	+	+	White precipitate
	Reagen wagner	A brown color is formed	+	+	Brown
Tanin	$FeCl_3$%	A blackish green color is formed	-	+	Butterfly pea flowers turn bluish
Saponin	Aquadest dan HCl	There is stable foam	+	-	Jicama has a stable foam
triterpenoid dan steroid	Kloroform + H_2SO_4	Terpenoids are produced if a red or purple color forms. Steroids A positive result is produced if a green color appears..	+	+	Butterfly pea flowers produce purple. Jicama produces green.

Description: (+) contains metabolite compounds
(-) does not contain metabolite compounds
Based on the research above, the results obtained from butterfly pea flowers show that there are no saponin compounds in butterfly pea flowers, while jicama does not contain tannin compounds.

Making clay masks

Table 5. Results of Phytochemical Screening Test of Butterfly Pea Flower Powder and Jicama Powder

Composition	Concentration (% b\v)				Function
	F0	F1	F2	F3	
Butterfly pea flower powder	-	2	2,4	1,6	Active substance
Jicama powder	-	2	1,6	2,4	Active substance
Kaolin	6	6	6	6	Base
Bentonite	0,2	0,2	0,2	0,2	Base
Glycerin	1,6	1,6	1,6	1,6	Humectant
Nipagin	0,1	0,1	0,1	0,1	Preservative
Xanthan gum	0,1	0,1	0,1	0,1	Thickener
Aquadest	8	8	8	8	Solvent

The process of making a clay mask from butterfly pea flower powder and yam powder by dissolving nipagin and bentonite in a mortar and adding 5ml of distilled water, stirring until homogeneous, then adding xantam gum, stirring until homogeneous, after that adding glycerin, kaolin, and powder, then adding aquadest little by little.

Organoleptic test

Table 6. Organoleptic test results of clay mask

observation	formulation			
	f0	f1	f2	f3
color	Bone white	Bluish ash	Purplish blue	Bluish green
aroma	Typical	Typical	Typical	Typical
texture	Semi solid	Semi solid	Semi solid	Semi solid

The color test results on F0 showed bone white, on F1 showed bluish gray, on F2 showed purplish blue and on F3 showed bluish green. These results indicate that differences in the amount of active ingredients in the simplicia powder can affect the color of the clay mask. The results of the aroma test on F0, F1, F2 and F3. The results of the texture test obtained F0, F1, F2 and F3 have the same texture, namely semi-solid and easy to apply.

Test pH

Table 7. Results of the clay mask pH test

Formulation	1	2	3	Average	Library
0	6,05	6,04	6,03	6,04	(Yul, 2024)
1	6,34	6,33	6,40	6,35	
2	6,55	6,56	6,58	6,56	
3	6,42	6,40	6,41	6,41	
k+	7,67	7,75	7,58	7,66	

The pH results of the clay mask preparation using a combination of butterfly pea flower powder and yam bean powder were replicated 3 times for each formula. The pH test can be seen in the table above. Where F0 is 6.04; F1 is 6.35; F2 is 6.56; F3 is 6.41. The pH results of the preparations obtained meet the skin pH requirements of 4.5-8.0 and all four formulas are still considered safe for use. While the positive control showed a pH of 7.66 which is considered a safe pH, the pH of topical

preparations below 4.5 or too acidic pH can potentially cause skin irritation, while a pH that is too alkaline has the potential to cause scaly or dry skin (Yul, 2024).

Irritation test

The research results showed that no symptoms such as skin redness or itching occurred. This is due to the skin's pH, allowing the clay mask preparation to penetrate within the skin's pH range. Therefore, the results in the table above indicate that the clay mask preparation containing butterfly pea flower powder and jicama powder did not cause irritation.

Homogeneity test

The homogeneity test was conducted to visually observe the uniformity of the color of the clay mask mixture and the clay mask base. The test was performed by applying 0.1 gram of the clay mask preparation to a glass slide to observe its physical characteristics.

Drying time test

Table 8. Drying time test

formulation	repetition (minutes)			Average
	1	2	3	
0	15.29	15.21	15.28	15.26
1	14,53	14,50	14,59	14,54
2	15.20	14.40	14,44	14,68
3	15.28	15.21	15.10	15,19

The drying time test results for the clay mask formula using butterfly pea (Clitoria ternatea L.) and jicama (Pachyrizus erosus L.) powder met the requirements, with a drying time of 15-20 minutes (Kumalasari, 2023).

Antioxidant Test Results

The results of the antioxidant test on the Clay Mask preparation made from butterfly pea flower powder and yam bean powder are presented as research findings to obtain the percentage of antioxidant activity. The percentage of antioxidant activity was calculated using the following formula.

$$\%\boldsymbol{inhibitor} = \frac{(\boldsymbol{Abs.\ kontrol - Abs.\ sample})}{\textbf{Abs. kontrol}} \text{ x } 100\%$$

Description: Control ABS: absorbance of the radical solution

Sample ABS: absorbance of the sample solution that has been added with radicals

Wavelength measurement results

The maximum wavelength was determined to determine the highest absorbance using a DPPH solution. In this wavelength measurement, the blank used was methanol p.a. The maximum wavelength determination was carried out in the wavelength range of 400-600 nm (Putri & Mahfur, 2023). The results of the maximum wavelength measurement obtained an absorbance value of 0.782 at a wavelength of 494 nm.

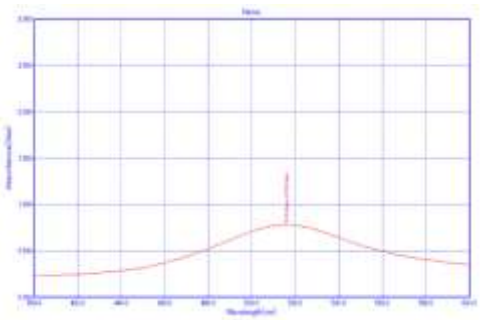

Figure 1. Wavelength

Operating time

Determination of the Operating Time (OT) in the DPPH solution aims to determine the most appropriate time for the duration of immersion in the DPPH test solution. The Operating Time for immersion in the DPPH test solution was 28 minutes at a maximum wavelength of 494 nm.

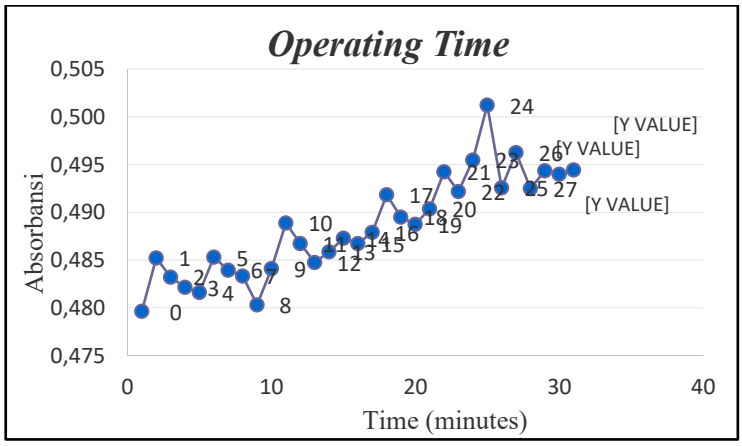

Figure 2. OT graph

Table 9. Results of Antioxidant Activity Test of Powder

Sample	Concentration	Replication 1	Replication 2	Replication 3	Average	% Inhibition	IC_{50}	category
Jicama	20	0,488	0,484	0,478	0,483333	38,192	42,96	≤50 very strong
	40	0,368	0,361	0,354	0,361	53,836		
	60	0,346	0,345	0,345	0,345333	55,839		
	80	0,331	0,328	0,221	0,293333	62,489		
	100	0,216	0,211	0,211	0,212667	72,804		
Butterfly flower	20	0,471	0,466	0,461	0,466	40,409	40,60	≤50 µg/ml. very strong
	40	0,479	0,370	0,367	0,405333	48,167		
	60	0,355	0,341	0,238	0,311333	60,187		
	80	0,233	0,226	0,224	0,227667	70,886		
	100	0,222	0,216	0,208	0,215333	72,463		

Table 10. Antioxidant activity of clay mask

Sample	Concentration	Replication 1	Replication 2	Replication 3	Average	% Inhibition	IC_{50}	category
Formulas 0	20	0,566	0,555	0,540	0,553667	29,198	102,75	100-150 µg/ml. currently
	40	0,525	0,521	0,503	0,516333	33,972		
	60	0,457	0,455	0,453	0,455	41,815		
	80	0,428	0,424	0,421	0,424333	45,737		
	100	0,419	0,409	0,403	0,410333	47,527		
Formulas 1	20	0,484	0,448	0,448	0,469667	39,940	62,15	50-100 µg/ml. strong
	40	0,453	0,44	0,439	0,431667	44,799		
	60	0,411	0,371	0,366	0,407333	47,911		
	80	0,376	0,345	0,329	0,374	52,173		
	100	0,310	0,279	0,277	0,294333	62,361		
Formulas 2	20	0,466	0,448	0,448	0,454	41,943	53,78	>50 µg/ml. strong
	40	0,444	0,44	0,439	0,441	43,606		
	60	0,373	0,371	0,366	0,37	52,685		
	80	0,349	0,345	0,329	0,341	56,393		
	100	0,281	0,279	0,277	0,279	64,322		

Formulas 3	20	0,454	0,455	0,435	0,448	42,711	41,20	≤50 µg/ml. very strong
	40	0,373	0,371	0,367	0,370333	52,642		
	60	0,361	0,360	0,355	0,358667	54,134		
	80	0,341	0,338	0,268	0,315667	59,633		
	100	0,266	0,261	0,257	73,225	66,581		

The results of the activity test of the clsy mask preparation in the four formulas, formula 0 without jicama powder and jicama powder with an IC50 value of 102.75 µg/ml showed moderate antioxidant activity in the formula because the IC50 was in the category of 100-150 µg/ml (Kristantri, 2024). Formula 1 with a concentration of 10% jicama powder and 10% telang flower powder obtained an IC50 value of 62.15 µg/ml showing strong antioxidant activity in the formula because the IC50 was in the category of 50-100 µg/ml. Formula 2 with a concentration of 12% telang flower powder and 8% jicama powder obtained an IC50 value of 53.70 indicating strong antioxidant activity because the IC50 was in the category of >50 µg/ml. Formula 3 with a concentration of 8% butterfly pea flower powder and 12% yam bean powder obtained an IC50 value of 41.20 µg/ml indicating very strong antioxidant activity because the IC50 value is in the category <50 µg/ml.

The three formulas with the addition of butterfly pea flower powder and jicama powder showed strong and very strong antioxidant activity (Andriani & Murtisiwi, 2020). It can be concluded that the greater the concentration of powder in the sample, the smaller the absorbance value but the greater the % inhibition value. While the positive control as a comparison, namely the clay mask brand (The Originot), obtained an IC50 result of 39.13 µg/ml indicating very strong antioxidant activity where vitamin C is a pure compound and both have high antioxidant compounds. The smaller the IC50 value, the more active the clay mask preparation as a DPPH radical scavenger or antioxidant compound. From the results obtained, the clay mask as the highest antioxidant compound in formula 3 with an IC50 value of 41.20 µg/ml with a powder concentration of 8% and jicama powder 12%. Butterfly pea flower powder and jicama powder have very strong antioxidant activity because butterfly pea and jicama flowers contain many bioactive compounds such as anthocyanins, vitamin C and flavonoids. Where flavonoids are polyphenol compounds that have the ability to donate hydrogen atoms to free radical compounds, the antioxidant activity of polyphenols can be produced in the neutralization reaction of free radicals or in stopping the chain reaction that occurs.

CONCLUSIONS

Based on the results of this study, it can be concluded that butterfly pea flower powder (Clitoria ternatea L.) and jicama (Pachyrizus erosus L.) can be combined because both have active ingredients that support each other, especially in terms of antioxidants and brightening the skin, thus producing a more optimal effect. A good formulation for facial skin is 8% powder and 12% jicama powder or formula 3 due to its very strong antioxidant activity of 41.20 µg/ml, helping to protect against free radical damage and preventing signs of premature aging.

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