

Formulation of Fruit *Extract* Peel-Off Gel Mask Preparation Papaya (*Carica papaya L.*) As a skin lightener with polyvinyl alcohol (PVA) base

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A B S T R A C T

Background Peel-off gel masks are one of the cosmetic preparations for facial care that are practically used, because they have a gel form that after application will dry out in a certain period of time so that they can be removed easily without the need to rinse. **Objectives** The purpose of this study is focused on the formulation of peel-off gel masks made from papaya fruit extract (*Carica papaya L.*) with the addition of polyvinyl alcohol (PVA) as the gel base, which can be used as a skin lightening agent. Papaya extract is obtained by method Papaya extract is obtained through the maceration method using 96% ethanol, then formulated at three different concentration levels, namely 0.75%, 1.25% and 1.75%. The tests carried out included organoleptic parameters, pH, homogeneity, dispersibility, adhesion, and drying time. The results showed that all formulas met the physical quality requirements of peel-off gel masks, with orange characteristics, typical papaya aroma, semi-dense and homogeneous texture, pH 4.15–4.30 in accordance with skin pH, drying time 17–25 minutes, spread power 5–6.4 cm, adhesion 1–2 minutes, and no irritation to respondents. Variations in extract concentrations affect drying time and spreadability, where higher concentrations tend to prolong drying times and decrease spread. **Conclusion** The results of the study prove that papaya extract has the potential to be formulated into a peel-off gel mask preparation that is stable and safe to use, meets physical quality criteria, and has the potential to brighten the skin due to its antioxidant content.

INTRODUCTION

Indonesia is one of the countries with the largest population in the world, so the demand for cosmetic products continues to increase. Cosmetics are generally used to protect the body and maintain appearance. Herbal cosmetics have their own advantages for consumers because they tend to cause fewer side effects than synthetic cosmetics, which can contain harmful chemicals if they are not suitable for your skin type. (Yuniarsih et al., 2021)

The skin is the outermost layer of tissue of the body that is responsible for protecting it from various environmental influences. In addition to its protective function, the skin is also closely related to appearance. Healthy skin reflects self-confidence, while poorly cared for skin can cause problems such as acne, blackheads, fine lines and the accumulation of dead skin cells to appear, so proper skin care is needed to maintain skin health and appearance. (Silvia & Dewi, 2022)

Peel-off gel face masks are known as practical cosmetic products because they are gel-like that hardens after application and can be removed without the need to rinse. The advantages of this product include cooling effect, optimal dispersibility and adhesion, as well as effective distribution of active ingredients through direct contact with the skin. Peel-off gel masks do not leave a waxy layer on the surface of the skin. Thus, the treatment does not interfere with the physiological function of the skin or cause blockages in the pores. In addition to cleansing the face from dirt, this mask can also moisturize, tighten the skin, stimulate active skin cells, repair skin tissue, and increase blood flow to the surface of the facial skin. Its main characteristics are high adhesion, easy to remove, good dispersibility, and effective release of active ingredients. (Amaliah et al., 2018).

In facial care, masks are included in cosmetic products that are often used, masks function to remove blackheads and help brighten the skin. This product can be divided into several types, including gelatin masks (peel-off), powder masks and natural masks. Gel-shaped or peel-off masks generally use a jelly-like base made of gum or latex and are generally available in tube packaging (Sylvia Br. Ginting & Susanti Siregar, 2022)

The formulation of peel-off gel masks can be done with natural ingredients that contain antioxidants, which function in caring for and protecting facial skin. Antioxidants act as electron or reductant donors. Antioxidants work by donating electrons to oxidants, thereby inhibiting their activity. Antioxidants are essential for the health of the body by breaking the cycle of free radical reactions that occur in the body. (Wardani et al., 2022). Antioxidants play a role in preventing harmful reactions for the body due to the presence of free radicals. When the level of free radicals is balanced with antioxidants, their presence is harmless. However, when free radicals exceed the body's capacity to neutralize them, this can cause damage. (Nur Ika Sari, Lianti Sari, Mustika Inayatul Khasanah, Tania Ardea Putri, 2023).

Papaya is a plant known to contain antioxidant compounds with an IC₅₀ value of 33,537. This value indicates significant antioxidant potential because it is below 50. Natural ingredients rich in antioxidants, including papaya, can be used in the manufacture of peel-off gel masks to help maintain the condition and beauty of facial skin. (Chasna Nasrina et al., 2024)

Carica papaya L. or papaya fruit, known for its high nutritional value and various health benefits. Cultivation Papaya requires low temperature conditions to be able to supports its growth, therefore it is suitable for tropical climatic conditions. (Sri, 2015)

Papaya is a tropical fruit with a variety of skin and flesh colors, including reddish-orange, greenish-yellow, orange-yellow, and orange. This fruit is rich in vitamins, especially containing vitamins A, B, C, and E, as well as various minerals, including phosphorus, magnesium, iron, and calcium that are beneficial for skin health. The flesh of papaya fruit is red or yellow in color with a soft, sweet taste, and refreshing texture due to its high water content. In addition, papaya also contains vitamin C and beta-carotene which act as antioxidants. Each 100 grams of papaya contains about 70.2 mg of vitamin C and 20.722 mg of beta-carotene (Sari et al., 2019). The nutritional content of papaya contributes to protecting the body from various diseases. The flesh of ripe papaya fruit is easy to digest, so it can help relieve indigestion. (Abdimesin & Susilowati, 2023)

METHOD

Research Design

The research design carried out is a type of laboratory experimental research using the maceration method.

Time and location of the research

The research locations include the Pharmaceutical Laboratory of Baubau Polytechnic and Bina Husada Polytechnic, while the time of implementation of the research will be carried out in April-July 2025.

Tools and Materials Used

In this study, the equipment used included a chemical cup, measuring cup, petri dish, watch cup, horn spoon, Bunsen burner, pH meter, split funnel, spatula, analytical balance, blender, rotary evaporator, and water bath. In this study, a number of ingredients were used, namely papaya fruit (*Carica papaya L.*) as an active ingredient, hydroxypropyl methylcellulose (HPMC) and polyvinyl alcohol (PVA) as a matrix forming agent, glycerin as a moisturizing agent, methylparaben and propylparaben as preservatives, 96% ethanol as a solvent, and distilled water as an additional solvent.

Sample preparation

Sample papaya fruit (*Carica papaya L.*) wash it thoroughly, then separate the pulp from the skin. The pulp is then cut into pieces about 1 cm to increase the effectiveness and uniformity of the drying process. Papaya pieces are dried by drying them in the sun using a black cloth as a protector to prevent excessive direct exposure, or by naturally aerating them until they reach optimal levels of dryness. This method is chosen to maintain the quality of the texture and nutrient content of the fruit during the drying process, the simplicia are weighed, mashed using a blender until smooth, weighed again, and then stored in a clean, sealed container, such as a glass jar.

The process of making papaya fruit extract (*Carica papaya* L.)

A total of 945.2 grams of dried papaya powder were put into a glass container, then 96% ethanol was added as a solvent to extract the active compounds from the fruit powder. Extraction was carried out using the maceration method for 3 days at room temperature, with the container protected from light to prevent degradation of photo-sensitive compounds. During the process, the solution is stirred periodically to increase the contact between the solvent and the fruit powder, so that the extraction of the active compound can take place more effectively and evenly. Next, the mixture is filtered using flannel cloth to separate the pulp from the filtrate. The filtered pulp is then macerated again using new 96% ethanol until the solvent appears clear, to ensure that all active compounds are extracted to the maximum. The filtrate obtained is then vaporized using a rotary evaporator with a vacuum system at 60°C, in order to remove solvents without damaging the bioactive components, so that a viscous extract is obtained that is ready to be used for the next formulation

Making peel-off gel masks from papaya extract (*Carica papaya* L.)

The first step is to prepare the equipment and materials, then put 4.5 g of PVA in a beaker. 50 mL of distilled water is added while stirring until the solution appears clear and homogeneous. Furthermore, 1.5 g of HPMC is added gradually. Next, 0.15 mL of methylparaben and 0.25 mL of propylparaben are added to the solution until homogeneity is achieved.. Add the remaining distilled water to the beaker, then once all the components are well mixed, add the ethanol extract of the papaya fruit (*Carica papaya* L.).

Physical Evaluation

The preparation was then evaluated through a series of tests, including organoleptic tests, pH measurements, homogeneity checks, dispersion determination, adhesion, drying time, and skin irritation tests using the patch test method.

RESULTS & DISCUSSION

a. Organoleptic test

Organoleptic testing was carried out to assess the quality of peel-off gel mask preparations from papaya fruit extract (*Carica papaya* L.), including aspects of color, aroma, and shape, using human senses as an assessment tool. The organoleptic results can be seen in the following table:

Table 1. Organoleptic Test Results

Formula	Color	Smell	Shape	Standard
F1	Orange	Distinctive smell	Semi-compact	Meet standards
F2	Orange	Distinctive smell	Semi-compact	Meet standards
F3	Orange	Distinctive smell	Semi-compact	Meet the standards

Source : Primary Data, (2025)

Information:

F1: Papaya fruit extract (*Carica papaya* L.) with a concentration of 0.75%

F2: Papaya fruit extract (*Carica papaya* L.) with a concentration of 1.25%

F3: Papaya fruit extract (*Carica papaya* L.) with a concentration of 1.75%

b. Homogeneity test

The homogeneity test aims to evaluate the degree of uniformity of the peel-off gel mask preparation, which can be determined by observing the absence of fine particles or clumps in the preparation. The data from the homogeneity test of the preparation is presented in the following table:

Table 2. Homogeneity Test Results

Formula	Homogeneity evaluation results	Standard
F1	Homogeneous	Meet standards
F2	Homogeneous	Meet standards
F3	Homogeneous	Meet standards

Source : Source Data, (2025)

Information:

F1: Peel-off gel masks contain papaya fruit extract (*Carica papaya* L.) at a concentration of 0.75%.

F2: The peel-off gel mask contains papaya fruit extract (*Carica papaya* L.) at a concentration of 1.25%.

F3: The peel-off gel mask contains papaya fruit extract (*Carica papaya* L.) at a concentration of 1.75%.
c. pH test

The pH test is carried out to evaluate the acidity or alkaline level of the peel-off gel mask preparation and assess the suitability of the pH value of the mask with the pH of the facial skin. The results of pH measurements are shown in the following table:

Table 3. pH Test Results

Formula	pH evaluation results	Standard
F1	4,30	Meet standards
F2	4,25	Not Meets standards
F3	4,15	Not Meets standards

Source : Source Data, (2025)

Information:

F1: Papaya fruit extract (*Carica papaya* L.) with a concentration of 0.75%

F2: Papaya fruit extract (*Carica papaya* L.) with a concentration of 1.25%

F3: Papaya fruit extract (*Carica papaya* L.) with a concentration of 1.75%

d. Dispersion test

The dispersion test was carried out to assess the ability of the peel-off gel mask to spread evenly on the surface of the skin. Good dispersibility is important to ensure consistent distribution of papaya fruit extract (*Carica papaya* L.), improve ease of use, and support the effectiveness of preparations. The results of the dispersion test are presented in the table below:

Table 4. Dispersion Test Results

Formula	Dispersion evaluation results	Standard
F1	6,4	Meet standards
F2	5,3	Meet standards
F3	5	Meet standards

Source : Source Data, (2025)

Information:

F1: Papaya fruit extract (*Carica papaya* L.) with a concentration of 0.75%

F2: Papaya fruit extract (*Carica papaya* L.) with a concentration of 1.25%

F3: Papaya fruit extract (*Carica papaya* L.) with a concentration of 1.75%

e. Adhesion test

Adhesion testing is performed to assess the ability of the peel-off gel mask to adhere to the skin and last during use. Optimal adhesion is important to ensure that the mask remains at the application site, so that the active ingredient of papaya fruit extract (*Carica papaya* L.) can work effectively and provide comfort for the user. The results of the adhesion test are seen in the following table:

Table 5. Adhesion Test Results

Formula	Results of the adhesive evaluation	Standard
F1	1 min 33 sec	Meet standards
F2	1 minute 99 seconds	Meet standards
F3	1 minute 61 seconds	Meet standards

Source : Source Data, (2025)

Information:

F1: Papaya fruit extract (*Carica papaya* L.) with a concentration of 0.75%

F2: Papaya fruit extract (*Carica papaya* L.) with a concentration of 1.25%

F3: Papaya fruit extract (*Carica papaya* L.) with a concentration of 1.75%

f. Dry time test

A drying time test is carried out to determine how long the peel-off gel mask takes until it dries completely and is ready for use. This assessment is important to ensure the comfort of use and to maintain the stability and effectiveness of the preparation during application to the skin. The results of the drying time test are shown in the table below:

Table 6. Dry Time Evaluation Results

Formula	Dry-time evaluation results	Standard
F1	17 minutes	Meet standards
F2	20 minutes	Meet standards
F3	25 minutes	Meet standards

Source : Source Data, (2025)

Information:

F1: Papaya fruit extract (*Carica papaya* L.) with a concentration of 0.75%

F2: Papaya fruit extract (*Carica papaya* L.) with a concentration of 1.25%

F3: Papaya fruit extract (*Carica papaya* L.) with a concentration of 1.75%

g. Irritation test

An irritant test is performed to assess the presence of an irritating reaction to the skin, such as redness, red spots, or itching, after the use of a peel-off gel mask. This test is important to ensure the safety of the preparation for the skin, so that it can be used without causing adverse side effects. The results of the irritation test can be seen in the following table.

Table 7. Irritation Test Results

Formula	Results of irritation test evaluation	Standard
F1	No irritation occurs	Meet standards
F2	No irritation occurs	Meet standards
F3	No irritation occurs	Meet standards

Source : Source Data, (2025)

Information:

F1: Papaya fruit extract (*Carica papaya* L.) with a concentration of 0.75%

F2: Papaya fruit extract (*Carica papaya* L.) with a concentration of 1.25%

F3: Papaya fruit extract (*Carica papaya* L.) with a concentration of 1.75%

Discussion

This study is an experimental laboratory study that aims to formulate and evaluate peel-off gel face masks made from papaya extract (*Carica papaya* L.). This study is directed to determine the most effective method of making masks and the most effective concentration of papaya extract for application on facial skin

The active ingredient used in this study in the preparation of peel-off gel masks is papaya extract (*Carica papaya* L.). Papaya fruit is rich in vitamins A, C, and E which act as antioxidants, brighten, moisturize, and protect the skin from damage caused by free radicals. In addition, peel-off masks also function to help remove dead skin cells, so that the skin looks smoother and fresher.

Papaya extract (*Carica papaya* L.), the main ingredient, is obtained from Nugraha Work Market, Baubau City, Southeast Sulawesi, and processed in the Bina Husada Polytechnic laboratory. The manufacturing process includes wet sorting, washing, cutting, drying, and dry sorting.

Papaya (*Carica papaya* L.) is a plant native to tropical America that is now widespread in various tropical and subtropical regions. This plant has a single stem that grows upright, is not woody, cylindrical, hollow, and is greenish-white in color. The leaves are large, pinnate, and grow on long stalks, while the fruits are oval or round, thin-skinned, and contain many small, black seeds. This morphology makes papaya easy to recognize and plays an important role in the production of fruits rich in nutrients and bioactive compounds.

Peel-off gel masks are a type of practical mask with the unique characteristic of containing an adhesive that forms a film layer, so it can be removed by peeling off after drying. This preparation generally contains several important components, namely a film forming that functions to form a thin layer on the skin, a gelling agent that provides the appropriate consistency and viscosity, and a humectant that helps maintain moisture and skin comfort during use.

The extraction process is carried out using the maceration method with 96% ethanol as a solvent. The liquid extract obtained is then evaporated until it forms a thick extract. Peel-off gel masks are formulated with papaya extract (*Carica papaya* L.) at concentrations of 0.75%, 1.25%, and 1.75%. The stages of making the extract include the preparation of tools and ingredients, washing the papaya fruit with running water until clean, drying and softening, cutting into small pieces, smoothing using a blender, weighing as much as 945 grams, then put into a glass container and soaked in 96% ethanol for 24 hours. The soaking solution is filtered using flannel cloth and evaporated until a thick extract is obtained.

The process of making peel-off gel masks begins with making a basic gel, which is by dissolving PVA in distilled water heated to 80°C and stirred until homogeneous, then adding HPMC, glycerin, methyl parabens, and propyl parabens until a gel is formed. The active ingredients are gradually added to the PVA base until well mixed, then stored in a sealed container for 24 hours to

remove the air bubbles, resulting in a peel-off gel mask base. Preparation evaluation was carried out using PVA as a film former, HPMC as a gel base, glycerin as a humectant, methyl paraben and propyl paraben as preservatives, as well as 96% ethanol and distilled water as solvents. The evaluation tests carried out included organoleptic tests, pH, homogeneity, drying time, adhesion, dispersibility, and irritation. The results of organoleptic tests on formulas 1, 2, and 3 show that the preparation is orange-colored, distinctively flavored, gel-shaped, homogeneous, soft, particle-free, and easy to apply.

The results of organoleptic tests on formulas 1, 2, and 3 show that the preparation is orange, distinctly flavored, gel-shaped, homogeneous, soft-textured without particles, and easy to apply.

The results of the pH measurement of peel-off gel masks from papaya fruit extract (*Carica papaya* L.) show that formula 1 has a pH of 4.30, formula 2 pH 4.4, and formula 3 pH 4.5. This pH value is still within the normal skin pH range (4.5–8.0). A pH that is too acidic has the potential to cause irritation, while a pH that is too alkaline can cause the skin to become dry.

The results of the drying time of the peel-off gel mask of papaya fruit extract (*Carica papaya* L.) showed that formula 1 dries in 17 minutes, formula 2 in 20 minutes, and formula 3 in 25 minutes. Formulas 1 and 2 have faster drying times than formula 3, which is likely due to differences in the concentration of active ingredients, which is 1.75% in formula 3, while formulas 1 and 2 are 0.75% and 1.25% respectively. All drying results are still within the ideal range for peel-off gel masks, which is 15–30 minutes.

Dispersivity testing was performed on peel-off gel masks formulated with papaya fruit extract (*Carica papaya* L.) to evaluate the ability of the preparation to spread evenly on the surface of the skin by yielding values of 5.5 for formula 1, 5.2 for formula 2, and 3.2 for formula 3. This difference has to do with the amount of HPMC used, as higher concentrations of HPMC cause reduced dispersibility, while lower concentrations increase the dispersion of the preparation.

Testing of the adhesion of peel-off gel masks formulated with papaya extract (*Carica papaya* L.) was conducted to assess the ability of the preparation to adhere to the skin during application as well as its effectiveness during the drying process. The test results showed that formula 1 had an adhesion time of 12 seconds, formula 2 of 10 seconds, and formula 3 of 7 seconds. This difference in adhesion time is likely influenced by the concentration of papaya extract in the preparation, where formulas with higher concentrations tend to have faster adhesion. All formulas still meet the adhesive standards of peel-off gel masks, which are less than 7 minutes 14 seconds, so they are safe and comfortable to use on the skin.

Irritation testing was performed on peel-off gel masks formulated with papaya fruit extract (*Carica papaya* L.) to assess the safety of the preparation against the skin. The test results show that the product is safe to use, as it does not cause irritating symptoms such as redness, pain, or damage to the skin. These findings confirm that this peel-off gel mask is safe for topical application and can be used without causing adverse side effects.

Based on the results of the study on the formulation of peel-off gel masks from papaya extract (*Carica papaya* L.), the three formulas (F1, F2, and F3) meet the basic requirements as a peel-off gel mask preparation. Evaluation of physical properties showed that formula 1 was the most optimal, as it met all test parameters according to the standard, including organoleptic test, homogeneity, irritation test, adhesion test, dispersion test, drying time, and pH. Meanwhile, formulas 2 and 3 only meet most of the test parameters and do not meet the standard criteria on pH parameters, so they are considered less optimal than formula 1.

COVER

Based on the results of research and testing, it can be concluded that papaya-based peel-off gel masks are effective in removing dead skin cells and dirt on the face, so that the skin becomes smoother and brighter. In addition, this mask has a texture that is easy to apply, comfortable to use, and provides a refreshing sensation on the skin of the face.

This research has several limitations. First, the test was limited to physical parameters, such as organoleptic properties, homogeneity, pH, dispersability, adhesion, drying time, and simple irritation tests, so it did not include tests of the long-term stability or clinical effectiveness of masks in brightening the skin. Second, the papaya extract formulation tested included only three concentrations, so a wider variation of concentration has not been explored. Third, the number of respondents to the irritation test is still limited, so the results cannot be generalized. Therefore, follow-up research is recommended with

larger sample sizes, more diverse parameter evaluations, and phytochemical content analysis to strengthen the evidence of the effectiveness and safety of the preparation.

Suggestions for further research can be made to determine the long-term effects of the use of papaya peel-off gel masks on various skin types.

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