

# The Effect of Variation in Carbopol Concentration on Peel-off Gel Mask from Avocado (*Persea americana* Mill.) Fruit Extract

Siti Fatmawaty Nakii<sup>1\*</sup>, Nurain Thomas<sup>2</sup>, Multiani S Latif<sup>3</sup>

<sup>1,2,3</sup>Department of Pharmacy, Faculty of Sport and Health, Universitas Negeri Gorontalo,  
Jenderal Sudirman Street No. 06 Gorontalo City 96128, Indonesia

\* Penulis Korespondensi. Email: [sitifatmawati.nakii@gmail.com](mailto:sitifatmawati.nakii@gmail.com)

## ABSTRAK

Alpukat (*Persea americana* Mill.) merupakan bahan alami yang sering digunakan dalam pembuatan masker gel peel-off, berkat kandungan vitamin, mineral, protein, serat, dan senyawa antioksidan seperti flavonoid. Penelitian ini bertujuan untuk mengetahui pengaruh variasi konsentrasi carbopol terhadap sifat fisik masker gel peel-off yang mengandung ekstrak buah alpukat. Metode yang digunakan meliputi ekstraksi buah alpukat dengan metode maserasi, formulasi masker gel peel-off dengan variasi konsentrasi carbopol (0,5%, 1%, dan 2%), serta evaluasi fisik sediaan meliputi uji organoleptis, pH, homogenitas, viskositas, daya sebar, daya lekat, dan waktu mengering. Hasil penelitian menunjukkan bahwa semua formula memiliki kestabilan fisik yang baik, termasuk uji organoleptis, homogenitas, pH, dan viskositas. Peningkatan konsentrasi carbopol menyebabkan peningkatan viskositas dan ketebalan gel. Selain itu, daya sebar dan daya lekat juga menunjukkan hasil yang baik, sementara waktu pengeringan formula meningkat seiring dengan penambahan konsentrasi carbopol. Berdasarkan hasil ini, dapat disimpulkan bahwa variasi konsentrasi carbopol mempengaruhi sifat fisik masker gel peel-off ekstrak alpukat dengan stabilitas yang baik dan efektif sebagai produk kosmetik.

**Kata Kunci:** Ekstrak Alpukat; Carbopol; Masker Gel Peel-Off; Evaluasi Fisik; Formulasi Kosmetik

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## ABSTRACT

Avocado (*Persea americana* Mill.) is a natural ingredient commonly used in the formulation of peel-off gel masks due to its content of vitamins, minerals, proteins, fiber, and antioxidant compounds such as flavonoids. This study aimed to investigate the effect of varying carbopol concentrations on the physical properties of peel-off gel masks containing avocado fruit extract. The methods included avocado fruit extraction using maceration, formulation of peel-off gel masks with varying carbopol concentrations (0.5%, 1%, and 2%), and physical evaluation of the preparations, including organoleptic testing, pH, homogeneity, viscosity, spreadability, adhesion, and drying time. The results showed that all formulations had good physical stability, including organoleptic testing, homogeneity, pH, and viscosity. Increasing the carbopol concentration resulted in higher viscosity and thicker gel. Additionally, spreadability and adhesion also showed good results, while the drying time increased with higher carbopol concentrations. Based on these findings, it can be concluded that varying carbopol concentrations influence the physical properties of the peel-off gel mask with good stability and effectiveness as a cosmetic product.

**Keywords:** Avocado Extract; Carbopol; Peel-Off Gel Mask; Physical Evaluation; Cosmetic Formulation

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## 1. Introduction

The desire for healthy, beautiful, soft, and youthful skin is universal, especially among young women. Achieving radiant and flawless skin is a dream that many aspire to, as it represents not only physical beauty but also good health. Skin is a reflection of the body's overall condition, and maintaining it in optimal health requires a well-rounded approach. It involves good nutrition, a healthy lifestyle, regular physical activity, and, most importantly, the use of appropriate skincare products. These elements are essential for preserving the skin's appearance and health, and for preventing the effects of aging and external factors that can compromise its integrity[1,2].

Facial skin care, in particular, is of utmost importance to maintain the health and vitality of the skin. Over time, the skin accumulates dead skin cells, dust, dirt, and remnants of makeup, all of which can clog pores and lead to various skin issues such as acne, blackheads, pigmentation, and fine lines. In addition to these, environmental stressors such as UV rays, pollution, and harsh weather conditions can exacerbate these problems, making it even more critical to implement an effective skincare routine. A proper skincare regimen helps cleanse, moisturize, protect, and rejuvenate the skin, ensuring that it remains clear, youthful, and resilient [3,4].

Among the many ways to care for the skin, cosmetic products play a key role. Various types of skincare products exist, ranging from creams and serums to masks. Masks, in particular, are a popular choice for addressing specific skin concerns due to their concentrated formulas and ease of use. Masks come in many forms, such as mud masks, sheet masks, sleeping masks, and peel-off gel masks, each offering unique benefits and serving distinct purposes. While each type of mask has its advantages, peel-off gel masks are especially favored for their ease of application and removal, as well as the effective results they provide [5,6].

The peel-off gel mask is a unique type of facial mask with the significant advantage of being easily removed, leaving behind smooth and refreshed skin. The mask is applied as a gel that transforms into a thin, transparent film once it dries. The peel-off nature of the mask allows for easy removal, leaving the skin feeling rejuvenated and cleaner. One of the major benefits of peel-off gel masks is their ability to relax the facial muscles while simultaneously cleansing, refreshing, moisturizing, and softening the skin. These masks act by forming an occlusive layer over the skin, which helps lock in moisture and prevents the evaporation of water from the skin's surface. This occlusive effect can greatly enhance the hydration of the skin, while also improving the absorption of active ingredients that promote healthy skin[7].

Peel-off gel masks are designed to dry and form a cohesive film that can be peeled off once the mask has set. This layer, which is typically made from polymers, helps to bind moisture to the skin and provide a protective barrier that prevents further damage from external factors. The process of peeling off the mask also helps to remove dead skin cells, dirt, and impurities from the surface of the skin, leaving the skin feeling clean and revitalized [8,9].

One of the key ingredients often used in peel-off gel masks is avocado (*Persea americana* Mill.) extract, a natural substance that has gained popularity for its beneficial properties in skincare. Avocado is a rich source of essential nutrients, including vitamins, minerals, proteins, and dietary fiber, all of which contribute to maintaining the skin's health and appearance. The flesh of the avocado is particularly notable for its high concentration of unsaturated fatty acids, which help maintain the skin's moisture balance and support the regeneration of skin cells. In addition to fatty acids, avocado pulp contains a variety of bioactive compounds, including carotenoids, hydroxybenzoic acid, hydroxycinnamic acid, procyanidins, condensed tannins, and flavonoids. These compounds exhibit powerful antioxidant properties, which play a crucial role in protecting the skin from oxidative stress and environmental damage caused by free radicals [10,11].

The antioxidant activity of avocado fruit extract is particularly valuable in skincare formulations, as it helps to neutralize harmful free radicals that contribute to the aging process and the development of skin conditions. The flavonoids found in avocado extract are especially potent in their ability to scavenge free radicals, thus reducing the signs of aging, such as fine lines, wrinkles, and age spots. This antioxidant capacity makes avocado extract an ideal ingredient for anti-aging and moisturizing products, as it helps to keep the skin youthful and hydrated [12,13].

In recent years, the potential of avocado extract in cosmetic formulations has garnered significant attention. Its ability to provide both nourishment and protection to the skin makes it a valuable component in products designed for skin rejuvenation and hydration. Among its many applications, avocado extract is commonly incorporated into peel-off gel masks, where it enhances the mask's ability to restore moisture and reduce signs of aging [11,14].

The use of carbopol, a commonly employed gelling agent in cosmetic formulations, plays an important role in the texture and stability of peel-off gel masks. Carbopol is known for its ability to form gels with a smooth and consistent texture, which is essential for the proper application and removal of the mask. By varying the concentration of carbopol, it is possible to adjust the viscosity and consistency of the gel, thereby affecting its performance and ease of use. The interaction between carbopol and avocado extract in peel-off gel masks is of particular interest, as it may influence the final texture, stability, and effectiveness of the formulation [15,16].

Given the increasing interest in natural skincare ingredients and the growing popularity of peel-off gel masks, this research aims to investigate the effect of varying carbopol concentrations on the formulation of peel-off gel masks containing avocado extract. By understanding how carbopol concentration influences the physical properties of the mask, such as its viscosity, spreadability, and drying time, this study seeks to optimize the formulation for improved performance and efficacy [17,18]. Additionally, the research aims to evaluate the overall stability and effectiveness of the final product, ensuring that it meets the expectations of consumers seeking high-quality, effective skincare solutions.

## **2. Methods**

### **Research design**

The research is an experimental study focused on the development of a peel-off gel mask formulated with avocado fruit extract (*Persea Americana* Mill.). The study aims to explore the formulation process and evaluate the physical properties of the peel-off gel mask, including its stability and effectiveness as a skincare product.

### Material and tools

This research utilizes various laboratory equipment, including a beaker, measuring cylinder, test tube, Erlenmeyer flask, stirring rod, analytical balance, spatula, plastic bottle, dropper, watch glass, preparation glass, filter paper, funnel, blender, water bath, and a Brookfield viscometer. These tools are essential for the preparation, formulation, and physical evaluation of the peel-off gel mask.

The materials used in this study include 70% alcohol, aquadest (distilled water), Carbopol, avocado fruit extract (*Persea americana* Mill.), glycerin, polyvinyl alcohol (PVA), parchment paper, methyl paraben, propylene glycol, tissue, and aluminum foil. These ingredients were chosen based on their roles in forming the gel matrix, enhancing stability, and providing the desired skin benefits. The avocado extract serves as the active ingredient, known for its antioxidant and moisturizing properties, while Carbopol acts as a gelling agent to form the peel-off consistency. The study aims to evaluate the optimal formulation for a stable and effective skincare product.

### Preparation of Avocado Fruit Simplisia (*Persea americana* Mill.)

The avocado fruits (*Persea americana* Mill.) were collected and subjected to wet sorting. They were then washed thoroughly with running water and drained. After cleaning, the fruits were sun dried using black cloth until the roselle petals were fully dried. The dried material was then blended into a fine powder. The powder was weighed, with a total of 600 grams obtained. Subsequently, the simplified material was placed into a well-sealed container and stored at room temperature for further use in the formulation process.

### Preparation of Avocado Fruit Extract (*Persea americana* Mill.)

Extraction was carried out using the maceration method, where 600 grams of avocado powder was extracted with 2 liters of 96% ethanol as the solvent for 3 periods of 24 hours. Afterward, remaceration was performed on the residue for an additional 24 hours. The resulting macerate was then evaporated using a rotary evaporator at 50°C until a concentrated extract was obtained.

### Preparation of Peel-Off Gel Mask from Avocado Fruit Extract (*Persea americana* Mill.)

The process begins by dissolving polyvinyl alcohol (PVA) in warm distilled water (aquadest) at a temperature of 80°C. The solution is allowed to expand for 15-30 minutes, after which it is homogenized to create Mass I. Next, carbopol is hydrated in hot distilled water within a mortar for 15 minutes, ensuring the carbopol absorbs the water effectively and forms a uniform gel. Once hydrated, the carbopol mixture is also homogenized. In a separate step, glycerin and methylparaben, both dissolved in hot aquadest, are carefully incorporated into the solution. These ingredients help maintain the moisture balance and preserve the formula. After this, Mass I and Mass II are combined in a clean mortar, and the mixture is stirred until it becomes homogeneous. To further ensure consistency, the remaining aquadest is gradually added to the mortar while stirring continuously. Once the desired consistency is achieved, a small portion of the gel base is added to a clean and dry mortar. The mixture is ground evenly to ensure proper blending. The avocado fruit extract is then introduced to the mortar and mixed thoroughly. The remaining gel base is added slowly, with continuous stirring, until the formula is fully homogenized. Once all ingredients are well-mixed and smooth, the gel is transferred to an appropriate container, labeled accordingly based on the concentration of the mask. This preparation results in a uniform, stable peel-off gel mask for skincare applications.

**Tabel 1.** Formulation of Peel-Off Gel Mask from Avocado Fruit Extract (Persea Americana Mill.)

| Ingredients             | Formula 1  | Formula 2  | Formula 3  | Function          |
|-------------------------|------------|------------|------------|-------------------|
| Avocado Fruit Extract   | 0,6%       | 0,6%       | 0,6%       | Active Ingredient |
| Polyvinyl Alcohol (PVA) | 10%        | 10%        | 10%        | Film Agent        |
| Carbopol                | 0,5%       | 1%         | 2%         | Gelling Agent     |
| Glycerin                | 10%        | 10%        | 10%        | Humectant         |
| Methyl Paraben          | 10%        | 10%        | 10%        | Preservative      |
| Aquadest                | Add 100 ml | Add 100 ml | Add 100 ml | Solvent           |

The table above illustrates the formulation of a peel-off gel mask made from avocado fruit extract (Persea Americana Mill.) with three different carbopol concentrations: FI (0.5%), FII (1%), and FIII (2%). These variations in carbopol concentration are designed to evaluate their impact on the mask's physical properties, such as viscosity, texture, and stability. Each formulation contains the same percentage of active ingredients, including avocado extract, glycerin, methyl paraben, and polyvinyl alcohol, with the primary difference being the concentration of carbopol. This study aims to assess how these differences affect the mask's performance and overall effectiveness.

#### Organoleptic test

The observation was carried out by directly examining the peel off gel mask preparation based on parameters such as color, smell, and the physical form of the mask. These sensory characteristics were assessed to determine the overall quality and consistency of the gel mask, ensuring that the formulation met the expected standards for use [19-25].

#### pH test

The pH test of the preparation was conducted to determine whether the pH of the formulation is within the acceptable range. A pH meter was dipped into 2 grams of the gel mask preparation for testing. The ideal pH range for topical formulations is between 4.5 and 6.5, ensuring that the product is safe and effective for skin application [19-25].

#### Homogeneity test

The homogeneity test was performed by applying 0.1 grams of the preparation onto a transparent glass plate. The glass plate was then observed to check if there were any areas where the mixture was not properly blended, ensuring that the formulation was uniform and free from inconsistencies or undissolved particles [19-25].

#### Viscosity test

The viscosity test of the preparation was conducted using a Brookfield viscometer with an appropriate spindle number and speed corresponding to the type of formulation. The sample was placed into a beaker until it reached a volume of 50 mL.



The spindle was then lowered until it was fully immersed in the preparation, allowing for the measurement of the viscosity based on the resistance encountered by the spindle [19–25].

#### Spreadability test

The spreadability test was performed by measuring the spread diameter of the preparation. One gram of the mask preparation was placed on a glass plate, and weights of 50 g and 100 g were applied. After one minute, the spread diameter was measured. An ideal spread diameter is between 5–7 cm, indicating that the mask has good spreading properties for even application on the skin [19–25].

#### Adhesion test

A 0.5 g sample was placed on a glass plate and covered with another glass plate. The two glass plates were then pulled apart, and the time it took for them to separate was recorded. The standard for good adhesion in a mask formulation is that the separation time should be more than 1 second, indicating the mask's effective adhesive properties on the skin [19–25].

#### Drying time test

The drying time test was performed by applying the peel-off gel mask to the back of the hand. The time required for the preparation to dry was observed, from the moment the gel mask was applied until a fully dry layer had formed. The acceptable drying time for the mask is between 15 and 30 minutes, indicating that the mask sets properly for removal [19–25].

### 3. Result and Discussion

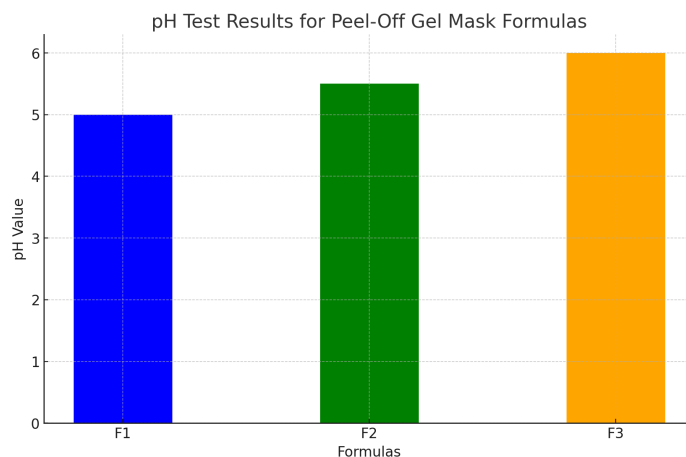
The organoleptic test is an evaluation that uses human senses as the primary tool for assessing the formulation. This test aims to measure the acceptance and comfort level of the product when used as a topical application, focusing on sensory characteristics such as appearance, smell, and texture to determine its overall usability and user preference.

**Table 2.** Organoleptic test results

| Formula | Smell                       | Color        | Texture        |
|---------|-----------------------------|--------------|----------------|
| F1      | No smell of avocado extract | Yellowish    | Slightly thick |
| F2      | No smell of avocado extract | Light yellow | Thick          |
| F3      | No smell of avocado extract | Light yellow | Thick          |

Based on the results from Table 2 of the organoleptic test, it can be observed that F1 has a slightly different consistency compared to F2 and F3, having a somewhat thicker consistency, while F2 and F3 have a thicker consistency. The higher concentration of carbopol in F2 and F3 results in a denser gel network structure, leading to a more solid and stable texture. The peel-off gel mask formula F1 produces a yellow color, while F2 and F3 show a light yellow color. The color difference in F1 is due to the 0.5% carbopol concentration, while F2 and F3 use concentrations of 1% and 2%, respectively. An increase in carbopol concentration can alter the gel structure and increase the turbidity of the solution. A denser gel with a higher carbopol concentration can affect light absorption and refraction, leading to visible changes in color due to the increased turbidity.

The pH test of the preparation was conducted to determine whether the pH of the formulation meets the required standards. A pH meter was immersed into 2 grams of the peel-off gel mask preparation for testing. The ideal pH range for a good topical formulation is between 4.5 and 6.5, ensuring that the product is safe and suitable for use on the skin without causing irritation.



**Figure 1.** Graph pH test results

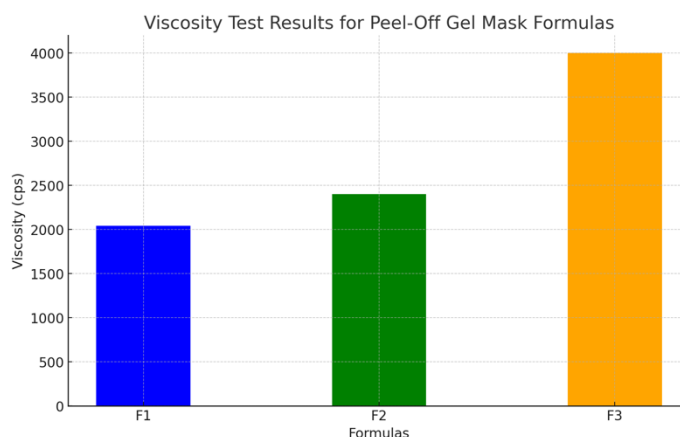
**Table 3.** pH Test Results

| Formula | pH  |
|---------|-----|
| F1      | 5   |
| F2      | 5,5 |
| F3      | 6   |

The pH results can be seen in Figure 1 and Table 3. The bar graph above presents the pH values of three peel-off gel mask formulations (F1, F2, F3). The results show that all formulations fall within the ideal pH range for topical applications, which is between 4.5 and 6.5. Formula F1 has a pH of 5, Formula F2 has a pH of 5.5, and Formula F3 has a pH of 6. These pH values indicate that the formulations are safe for skin use and are well-suited for cosmetic applications, ensuring that they are not too acidic or alkaline, which could lead to irritation or discomfort when applied to the skin.

The homogeneity test was conducted to determine whether the prepared formulations met the required criteria for uniformity. The homogeneity test is characterized by the absence of coarse particles when observed on a transparent glass plate. Based on the results of the homogeneity evaluation, all three peel-off gel mask formulations from avocado fruit extract (*Persea americana* Mill.) produced homogeneous preparations, with no visible coarse particles, despite differences in carbopol concentration for each formula. The preparations exhibited a uniform structure, confirming that they met the criteria for homogeneity without any visible particulate matter.

The viscosity test of the preparation was carried out using a Brookfield viscometer with spindle number 06 and a speed of 50 rpm. The purpose of this viscosity test is to measure the viscosity of the prepared formulation, which helps assess the consistency and thickness of the gel. This test is important to ensure the formulation has the desired texture and flow properties for proper application.



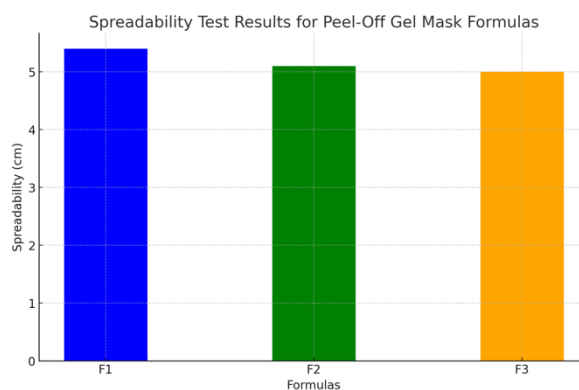
**Figure 2.** Graph viscosity test results

**Table 4.** Viscosity Test Results

| Formula | Spindle Number | Viscosity (Cps) |
|---------|----------------|-----------------|
| F1      | 6              | 2040            |
| F2      | 6              | 2400            |
| F3      | 6              | 4000            |

Based on Table 4 and Figure 1, viscosity is an important parameter to measure the thickness of a formulation. The viscosity of the peel-off gel mask was measured using a Brookfield viscometer. The viscosity values for the peel-off gel mask ranged from 2000 to 4000 cps. As seen in the results, the formulation with a viscosity of 2040 cps (Formula F1) was made with a carbopol concentration of 0.5%, while Formula F2, with a concentration of 1%, had a viscosity of 2400 cps, and Formula F3, with a 2% concentration, had a viscosity of 4000 cps. The increase in carbopol concentration leads to a higher viscosity due to carbopol's ability to form a dense gel network in the solution. This results in a thicker and more stable gel.

The spreadability test was conducted to evaluate the ability of the peel-off gel mask to spread on the skin. A good spreadability for a peel-off gel mask is considered to be between 5 and 7 cm. This measurement ensures that the gel can be evenly applied to the skin without excessive resistance, providing a smooth and consistent layer for effective application.



**Figure 3.** Graph spreadability test results

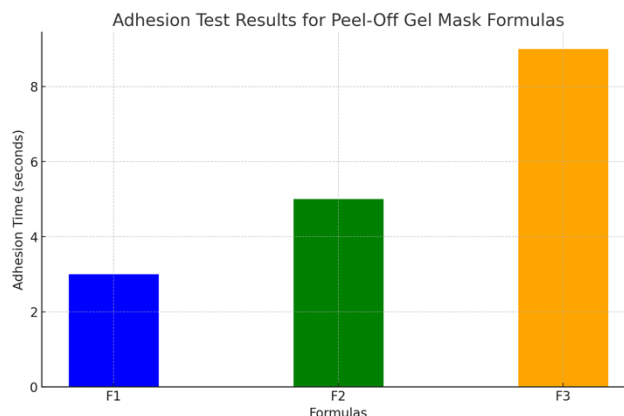


**Tabel 5.** Spreadability test results

| Formula | Spreadability (cm) |
|---------|--------------------|
| F1      | 5,4                |
| F2      | 5,1                |
| F3      | 5                  |

Based on Table 5 and Figure 3, it can be seen that the peel-off gel mask formulation from avocado fruit extract (*Persea Americana* Mill.) shows adhesion times of 5 and 9 seconds for FII and FIII, respectively. Therefore, the peel-off gel mask formulation meets the criteria for good adhesion, as it adheres well to the skin before being peeled off.

The adhesion test is conducted to determine the appropriate time for the formulation when applied to the skin. The standard for a good adhesion time in a peel-off gel mask is more than 4 seconds. This ensures that the formulation adheres adequately to the skin, allowing it to stay in place during application and be easily removed afterward.

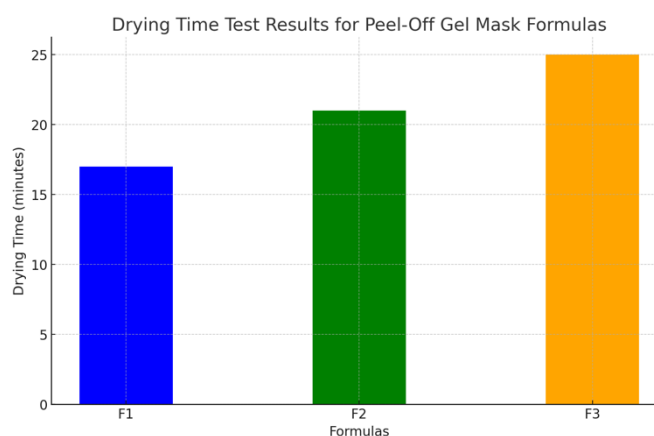
**Figure 4.** Graph spreadability test results**Tabel 6.** Adhesion test results

| Formula | Adhesion (second) |
|---------|-------------------|
| F1      | 3                 |
| F2      | 5                 |
| F3      | 9                 |

The adhesion test results, shown in Figure 4 and Table 6, indicate the time it takes for the peel-off gel mask formulations to adhere to the skin. Formula F1 has an adhesion time of 3 seconds, while F2 and F3 show adhesion times of 5 and 9 seconds, respectively. According to the standard, a good adhesion time for a peel-off mask is over 4 seconds. The results demonstrate that F2 and F3 meet the required adhesion criteria, indicating that these formulas have suitable adhesive properties for effective application and removal, ensuring proper performance of the gel mask.

The drying time test aims to determine how long the formulation takes to dry. The acceptable drying time for the peel-off gel mask is between 15 and 30 minutes, as per the standard guidelines. This ensures that the product sets properly on the skin,

forming a thin, dry layer that can be easily peeled off without causing discomfort or difficulty during use.



**Figure 5.** Graph drying time test results

**Table 7.** Drying Time Test Results

| Formula | Drying Time (minutes) |
|---------|-----------------------|
| F1      | 17                    |
| F2      | 21                    |
| F3      | 25                    |

Based on Table 7 and Figure 5, it can be seen that the three variations of gel base concentrations, F1 (0.5%), F2 (1%), and F3 (2%), have different drying times: F1 takes 17 minutes, F2 takes 21 minutes, and F3 takes 25 minutes. The difference in drying time can be attributed to the effect of the carbopol gel base concentration. A higher concentration of carbopol tends to require a longer drying time compared to peel-off gel masks with a lower concentration. A thicker gel dries more slowly because the water inside the gel needs more time to evaporate from the thicker layer.

#### 4. Conclusion

Based on the research findings, it can be concluded that varying the carbopol concentration significantly affects the physical properties of the avocado peel-off gel mask formulation (*Persea americana* Mill.), including organoleptic tests, viscosity, spreadability, adhesion, and drying time. The increase in carbopol concentration results in thicker and more stable gel formulations, improving viscosity and adhesion properties, while also affecting drying time. These variations contribute to the overall effectiveness of the peel-off gel mask, making it a viable cosmetic product with good physical stability and desirable performance characteristics.

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