Antioxidant properties and Development of facial mask cream from pomelo extract

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Abstract

This research has three objectives: 1) To examine the antioxidant effects of pomelo peel extract 2) To develop a facial mask product containing ingredients from pomelo peel extract and 3) To test the satisfaction of users of facial mask products from pomelo peel extract by taking 250 grams of pomelo peel, drying and grinding it into powder, extracted with 95% ethanol solvent at a ratio of 1 gram per 3 milliliters for a period of 24 hours then evaporate ethanol by using Rotary Evaporator at 50 C. The pomelo peel extracts were tested for antioxidant activity by using DPPH radical scavenging assay. Developed 4 formulas of facial mask products with antioxidant effects from pomelo peel extracts with concentrations of 0, 1, 3 and 5 respectively, evaluating physical properties by observing color, scent, stickiness, texture and pH. Using Heating-Cooling cycle method for stability test of the product, closed patch test method for skin test and evaluated satisfaction of 20 volunteers who used the product. Statistics used in data analysis include percentage, mean, standard deviation and One-way ANOVA.

The research results found that the antioxidant activity of pomelo peel extract using the DPPH radical scavenging assay found that pomelo peel extract had an IC_{50} value of 2.1752 ± 0.834 □g/ml. The vitamin E standard had an average IC_{50} of 277.7408 ± 58.8407 □g /ml. All four face mask cream formulas have a pH value of 6. The texture of the products in formulas 1 and 2 is thick cream, while formulas 3 and 4 have a thin cream texture. The color of formula 1 is white, formula 2 is cream, formula 3 is yellow, and formula 4 is brown. The scent of formula 1 is odorless, while formulas 2 and 3 have a slightly pungent smell, and formula 4 has a moderately pungent smell. The skin absorption times for formulas 1, 2, 3, and 4 are 30 ± 4, 18 ± 1, 16 ± 0, and 13 ± 1, respectively. There were no redness and signs of irritation, swelling, or redness in the volunteers after irritation testing. The mean overall satisfaction with the product Face Mask Cream from Pomelo Peel Extract. The highest was Formula 2 (4.16 ± 0.58), followed by Formula 1 (3.86 ± 0.72), Formula 3 (3.56 ± 0.62). and Formula 4 (3.06 ± 0.49), respectively. Comparing the level of satisfaction with the 4 formulas of pomelo peel extract facial mask cream showed statistically significantly different at the 0.05 level.

Keyword: Facial mask cream, Antioxidant, Pomelo peel extract.

1. Introduction

Currently, there is much research on the various effects of plants, both medicinal and cosmetic, due to the growing social trend towards organic products derived from nature. These products are environmentally friendly and free from harmful substances, making them safe for both the body and the environment. This applies to products in food, medicine, packaging, cosmetics, and various other consumer goods. By processing plants, they can be utilized for economic benefits in various industries, as mentioned above. This highlights the importance of local plants in different countries.

One of the key ingredients that people often prioritize in cosmetic products is antioxidants, as free radicals are unstable molecules or atoms that lack electrons. Normally, our bodies contain molecules or atoms with paired electrons. When the body loses electrons due to free radicals, it leads to unstable molecules in cells, which can cause cell damage.

Thus, cosmetics that contain natural antioxidants are highly significant and interesting in addressing these issues. Antioxidants found in plants include flavonoids, tannins, and phenolic compounds. These have been studied for use as dietary supplements, topical treatments for diseases, and in cosmetics (Kanittada Thongkao, 2024), such as face masks. Face masks are a blend of various natural ingredients mixed to create formulations that address individual skin concerns, offering a special way to nourish the skin beyond regular creams. This is because face masks provide more nourishment to the skin than regular skincare products and can more effectively solve skin issues in a shorter time (Yaowalak Suriyuth, 2016).

There are various types of face masks, but the most popular type of today is the "Sleeping Mask," which does not require rinsing. This type of mask usually contains natural ingredients such as herbs and fruits, as they help to retain moisture and nourish the skin effectively. When applied, it provides a cooling sensation and is typically a thick cream that can be left overnight without needing to be washed off (Suwannee Methajit, 2017).

Pomelo, scientifically known as *Citrus grandis* Linn. or *Citrus maxima* Merr., belongs to the Rutaceae family. Its common name is Pomelo (or Pummelos), and in Thai, it is called *som o*, *ma o*, *mak o*, and *cha dok*. Pomelo is a small to medium-sized evergreen tree, typically 5-15 meters tall. Its branches are pendulous, and the tree can also be grown as an ornamental plant. The young branches are covered with short thorns. The leaves are oval or elliptical in shape, with a rounded or slightly pointed apex. The leaf blade is about 2-12 cm wide and 5-20 cm long. The fruit is round or pear-shaped, medium to large, with a diameter of 10-30 cm. When immature, the fruit is green, but as it ripens, it turns yellow-green, and finally golden yellow. The rind is soft and 1.5-2.0 cm thick, with an inner color ranging from white to pink depending on the variety. The flesh is pale yellow or greenish pink, with large segments. The seeds are white to yellow, varying in size, with a deep groove on their surface. Each seed can only grow one seedling. The number of seeds per fruit varies by variety (Narumon Maniphan, 2008).

The pomelo peel is rich in bioactive compounds, including vitamin C, carotenoids, vitamin E, flavonoids, limonoids, phenolic compounds, lignin, fiber, pectin, and essential oils. These compounds are important antioxidants, with high levels of phenolics and flavonoids that can inhibit the formation of free radicals (Jittawadee Tanghirunrat, 2020).

Given this importance, the researcher is interested in studying the key compounds and antioxidant properties of pomelo peel extract. This research aims to develop a facial mask product in the form of a Sleeping Mask, using the antioxidant-rich pomelo peel extract. The product is lightweight, helps to increase skin hydration, reduces dullness, and promotes the

added value of pomelo peel, which is often considered waste. The results of this research will be beneficial for the development of cosmetic products and can be further commercialized.

1.1 Objective

1. To investigate the antioxidant activity of pomelo peel extract.
2. To develop a facial mask product containing pomelo peel extract.
3. To test satisfaction of user for the facial mask product containing pomelo peel extract.

2. Methodology

In this study, the researcher has defined the following experimental procedures:

1. Plant extraction for research purposes.
2. Testing antioxidant activity using the DPPH assay.
3. Development of a facial mask product from pomelo peel extract, including:
   1) Development of four formulas of facial mask products from pomelo peel extract
   2) Evaluation of certain physical properties of the facial mask product from pomelo peel extract.
   3) Testing the stability of the facial mask product from pomelo peel extract using the Heating-Cooling Cycle method.
   4) Testing for irritation using the Closed Patch Test method.
4. Evaluation of user satisfaction with the facial mask product from pomelo peel extract.
5. Data collection and statistical analysis.
6. Conclusion and preparation of the research report.

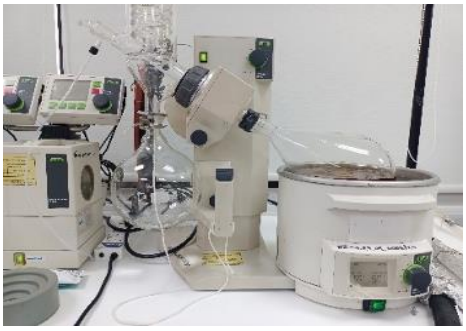
Step 1: Peel the pomelo.

Step 2: Cut the pomelo peel into small pieces.

Step 3: Put in a blender and blend until smooth.

Step 4: Soak the pomelo peel in the solvent. Use 250 g of pomelo peel/750 ml of ethanol.

Step 5 Filter the solution from the pomelo peel pulp.



Step 6 Evaporate the obtained solution to remove the solvent using a Rotary Evaporator.

Step 7: Put the crude extract in the refrigerator.

Step 8: Pack the crude extract into a brown bottle.

3. Result

1. Results of the Antioxidant Effects of Pomelo Peel Extract

Testing the antioxidant activity of pomelo peel extract using the DPPH radical scavenging assay found that pomelo peel extract had an IC_{50} value of 2.1752 ± 0.834 □g/ml. The vitamin E standard had an average IC_{50} of 277.7408 ± 58.8407 □g /ml.

2. Results of the Development of Face Mask Cream from Pomelo Peel Extract

1) Results of Testing the Physical Properties of the Face Mask Cream from Pomelo Peel Extracts: When preparing the face mask cream products from pomelo peel extract in four formulas by adding pomelo peel extract at concentrations of 0%, 1%, 3%, and 5%, respectively, the evaluation of physical and chemical properties showed the results as presented in figure 1 and table 1.

Figure 1 *Facial mask cream products from 4 formulas of pomelo peel extract*

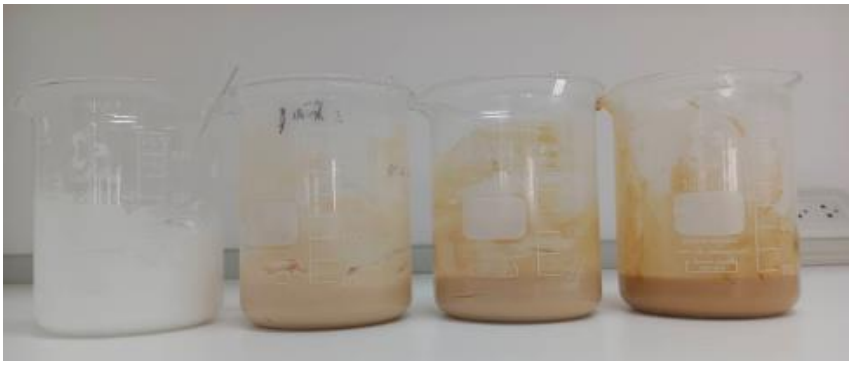


Table 1 Results of Testing Some Physical and Chemical Properties of the Face Mask Cream from Pomelo Peel Extract

Formula	Skin Absorption Time (S.)	pH Value	Texture	Color	Smell
1	30 ± 4	6	Thick cream texture	White	None
2	18 ± 1	6	Thick cream texture	Cream	Slightly pungent
3	16 ± 0	6	Thick cream texture	Yellow	Slightly pungent
4	13 ± 1	6	Thick cream texture	Brown	Moderately pungent

Table 1 shows that all four face mask cream formulas have a pH value of 6. The texture of the products in formulas 1 and 2 is thick cream, while formulas 3 and 4 have a thin cream texture. The color of formula 1 is white, formula 2 is cream, formula 3 is yellow, and formula

4 is brown. The scent of formula 1 is odorless, while formulas 2 and 3 have a slightly pungent smell, and formula 4 has a moderately pungent smell. The skin absorption times for formulas 1, 2, 3, and 4 are 30 ± 4, 18 ± 1, 16 ± 0, and 13 ± 1, respectively.

2) Irritation Test Results: In the closed patch test conducted on 20 volunteers for 24 hours, where a plaster containing the four test formulas was applied to the inner forearm, the results showed that the area tested with saline solution (Negative control) showed no redness in the volunteers. Similarly, the areas tested with the face mask cream products showed no signs of irritation, swelling, or redness in the volunteers.

3) Evaluation of Satisfaction with the Face Mask Cream from Pomelo Peel Extract: The satisfaction evaluation of the product was conducted by having 20 volunteers assess their satisfaction after using the product for 30 days, based on a questionnaire.

Table 2 Volunteer Satisfaction with the Face Mask Cream from Pomelo Peel Extract

No.	**Product Attribute**	**Formula1**	**Formula 2**	**Formula** 3	**Formula 4**
1	Color of the face mask cream	5.0 ± 0.00	3.8 ± 1.17	2.2 ± 0.75	1.0 ± 0.00
2	Smell of the face mask cream	3.4 ± 0.80	3.0 ± 0.63	2.4 ± 0.49	1.8 ± 0.40
3	Texture of the face mask cream	4.0 ± 0.89	4.0 ± 1.10	2.0 ± 0.89	1.0 ± 0.00
4	Viscosity of the face mask cream	4.2 ± 0.75	3.2 ± 0.40	1.8 ± 0.75	1.2 ± 0.40
5	Moisture level of the face after using the cream	3.0 ± 0.63	4.6 ± 0.49	4.8 ± 0.40	4.4 ± 0.80
6	Brightness of the face after using the cream	4.4 ± 1.20	4.8 ± 0.40	4.8 ± 0.40	4.4 ± 0.80
7	Absorption speed of the face mask cream	2.0 ± 0.89	4.0 ± 0.63	4.8 ± 0.40	5.0 ±
8	Product's gentleness, no irritation	4.8 ± 0.40	5.0 ± 0.00	4.8 ± 0.40	4.8 ± 0.40
9	Lightness of the product texture	3.4 ± 0.80	4.6 ± 0.49	4.8 ± 0.40	4.8 ± 0.40
10	Overall satisfaction with the face mask cream	4.4 ± 0.80	4.6 ± 0.49	3.6 ± 0.49	2.2 ± 1.66
	Total	3.86 ± 0.72	4.16 ± 0.58	3.56 ± 0.62	3.06 ± 0.49

Table 2 shows the mean overall satisfaction with the product Face Mask Cream from Pomelo Peel Extract. The highest was Formula 2 (4.16 ± 0.58), followed by Formula 1 (3.86 ± 0.72), Formula 3 (3.56 ± 0.62). and Formula 4 (3.06 ± 0.49), respectively. Comparing the level of satisfaction with the 4 formulas of pomelo peel extract facial mask cream showed statistically significantly different at the 0.05 level.

4. Conclusion

Formula 1 stands out as the most preferred overall, primarily due to its color, texture, and gentleness, although its slow absorption time was a drawback.

Formula 4 despite having the fastest absorption rate, received the lowest satisfaction due to its less desirable smell, thinner texture, and poor viscosity.

Formula 2 and **Formula 3** provided a good balance of effectiveness in terms of moisture, brightness, and texture, but **Formula 2** performed slightly better overall.To improve the products, it would be beneficial to focus on faster absorption, more appealing colors and scents, and a thicker texture for better hydration and effectiveness.

5. Discussion

The evaluation results clearly indicate that **Formula 1** stands out as the most preferred overall among the four formulations. This preference can largely be attributed to its **color**, **texture**, and **gentleness**. Users appreciated the clean, white color, which received the highest satisfaction score, as well as the thicker, creamier texture, which generally provides a more luxurious feel on the skin. Furthermore, the absence of any scent was also favored, as many users find fragrance-free products to be more suitable for sensitive skin. However, **Formula 1's slow absorption rate** (30 ± 4 seconds) was identified as a drawback, which could be a concern for consumers seeking quick results or convenience in their skincare routine. This slower absorption rate may make the product less desirable for users who prioritize efficiency in their skincare products.

On the other hand, **Formula 4**, despite having the **fastest absorption rate** (13 ± 1 seconds), received the **lowest satisfaction** overall. The primary factors contributing to its poor performance were its **unpleasant smell**, **thin texture**, and **poor viscosity**. While a faster absorption rate is generally a desirable feature in face masks, users found the strong, pungent smell and the thin texture of Formula 4 to be significant drawbacks. A thinner texture might not provide the same feeling of nourishment and could be perceived as less effective, especially when compared to the thicker formulations of **Formula 1** and **Formula 2**. Additionally, its lower viscosity and less desirable scent led to an overall unsatisfactory experience for many users, despite its fast absorption.

6. Acknowledgment

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References

Jitrawadee Tanghirunrat and colleagues (2019). Evaluation of Antioxidant Properties and Bioactive Compounds from Pomelo Peel Extract in Inhibiting Microorganisms for Cosmetics. Faculty of Science and Technology, Suan Dusit University.

Kanittada Thongkao, Pimporn Thongmuang, Robert W. Owen, Yuttana Sudjaroen (2024).Anti-hair loss and hair care properties from tropical halophyte, seablite (Suaeda maritima) root extract. *Research Journal of Pharmacy and Technology 2024*, 17(12).

Narumon Manipapan (2008). Pomelo: An Economic Fruit Full of Value. Prasanmit Publishing House Co., Ltd., Bangkok.

Siraprapa Thabandid and Chukapat Madue. (2022). Development of Jelly Mask Products Containing Duckweed Extract. Faculty of Allied Health Sciences, Suan Sunandha Rajabhat University, Samut Songkhram Campus.

Suwannee Methajit (2017). Development of a Facial Mask Product Containing Extracts from Krung Khema (Citrus species). Department of Cosmetic Science, Mae Fah Luang University.