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Formulation and Stability Evaluation of Carrot Extract (*Daucus carota* L.) Scrub Lotion as a Natural Moisturizer

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ABSTRACT

Carrots contain bioactive compounds such as beta-carotene and vitamin E that protect the skin against oxidative stress, maintain hydration, and delay premature aging. This study aimed to formulate and evaluate scrub lotions containing *Daucus carota* L. extract at concentrations of 2%, 4%, and 6%. The formulations were tested for physicochemical stability (organoleptic properties, pH, homogeneity, adhesion, and spreadability), moisturizing effect, and consumer acceptability. All formulations were stable, homogeneous, and within the safe pH range. The 6% formulation (Formula III) showed the most pronounced effect, significantly increasing skin hydration to >35% after 12 days of application ($p < 0.05$). These findings demonstrate the potential of *Daucus carota* L. extract as a natural, safe, and effective active ingredient for moisturizing and anti-aging cosmetic products. To the best of our knowledge, this is among the first studies to systematically evaluate the stability and moisturizing efficacy of carrot extract scrub lotion, although further clinical investigations are required to confirm long-term safety and performance.

Keywords:
Carrot Extract; Natural Moisturizer; Lotion; Anti-aging; Stability

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1. Introduction

Indonesia, as a tropical country, is exposed to intense sunlight throughout the year. Ultraviolet (UV) radiation is a major environmental factor that induces free radical formation, triggering oxidative stress, inflammation, tissue damage, and premature skin aging if exposure is prolonged [1],[19]. Oxidative stress also disrupts skin homeostasis, leading to dryness and early aging signs.

Antioxidants play a crucial role in neutralizing free radicals and maintaining skin health. Among natural sources, carrot (*Daucus carota* L.) extract is particularly rich in beta-carotene [2],[3] and vitamin E [3],[4] which provide synergistic protective effects. Beta-carotene prevents UV-induced oxidative damage, while vitamin E acts as a natural moisturizer that enhances hydration and supports skin regeneration. Recent reviews have emphasized the importance of carotenoids and other antioxidants in delaying skin aging and maintaining barrier function [4], [19]. These properties make carrot extract a promising candidate for cosmetic formulations with moisturizing and anti-aging functions.

Although the health benefits of carrot-derived antioxidants are well established, studies on their incorporation into stable topical formulations remain limited. Previous attempts with herbal-based creams and lotions have shown potential but were not specifically designed to evaluate the stability and moisturizing effects of carrot extract [5],[17]. Furthermore, consumer interest in natural cosmetics is rapidly increasing, particularly in Indonesia, highlighting the need for scientifically validated herbal-based formulations [8].

Therefore, this study aimed to formulate scrub lotions containing *D. carota* extract at concentrations of 2%, 4%, and 6%, and to evaluate their physicochemical stability, moisturizing efficacy, and consumer acceptability.

2. Methods

Materials

The ingredients used in this study were carrot extract, shellfish powder, stearic acid, triethanolamine (TEA), liquid paraffin, methyl paraben, propylene glycol, and distilled water.

Equipment

The equipment used included analytical balances, measuring cups, beakers, funnels, stirring rods, parchment paper, mortar and pestle, spatulas, volumetric flasks, blenders, maceration apparatus, rotary evaporator, and a skin analyzer.

Preparation of Simplicia

Fresh carrot tubers were obtained from a traditional market in Tarub District, Tegal Regency. The tubers were cleaned, washed, and cut into small pieces, then dried naturally through aeration and sun exposure until the moisture content was below 10%. After drying, foreign materials were removed, and the dried material was pulverized into fine carrot powder.

Extraction

A total of 600 g of dried carrot simplicia powder was macerated in 3 L of 96% ethanol for 48 hours in a tightly closed container, with stirring every 24 hours to ensure homogeneity. The extract was filtered through a flannel cloth, concentrated using a rotary evaporator, and further thickened in a water bath to obtain a viscous carrot extract.

Scrub Lotion Formulation

Scrub lotion formulations were prepared by incorporating carrot extract at concentrations of 2% (Formula I), 4% (Formula II), and 6% (Formula III), as shown in **Table 1**.

Table 1. Formula Preparation of Scrub Lotion

Material Name	Formula I (%)	Formula II (%)	Formula III (%)	Standard (%)	Function	Literature
Carrot Extract	2	4	6	—	Active substance	[5]
Shellfish Flour	20	20	20	—	Scrub	—
Stearic Acid	5	5	5	1–20	Emulsifier	[6]
Triethanolamine	2	2	2	2–4	Emulsifier	[6]
Liquid Paraffin	15	15	15	1–32	Oil base	[6]
Methyl Paraben	0.2	0.2	0.2	0.02–0.3	Preservative	[6]
Propylene Glycol	5	5	5	5–80	Humectant	[6]
Aquadest	ad 100 g	ad 100 g	ad 100 g	—	Solvent	—

The formulation process began by melting stearic acid in a preheated mortar. Triethanolamine, liquid paraffin, and preheated distilled water were then added, followed by methyl paraben, shellfish powder (dissolved in hot water), and propylene glycol with continuous stirring. Finally, carrot extract was incorporated, and the mixture was homogenized using a magnetic stirrer.

Evaluation of Physical Characteristics

The physical characteristics of the scrub lotion formulations were evaluated through several parameters to assess their stability, performance, and suitability for topical application.

Organoleptic properties were observed visually, including aroma, color, shape, and texture, to detect possible changes during formulation and after storage that could affect product acceptability [7].

pH values were determined using pH indicator strips, with the resulting color compared against a standard reference scale to ensure values remained within the safe range for topical application [8].

Homogeneity was assessed microscopically by examining samples from the top, middle, and bottom of the lotion. Preparations were considered homogeneous if no clumps or phase separation were observed [7].

Adhesion was evaluated by placing 0.5 g of lotion between two glass plates under a 1 kg load for five minutes. The time required for the plates to separate was recorded as the adhesion value [9].

Spreadability was determined by placing 0.5 g of lotion on a 15 cm glass plate, covering it with another plate, and sequentially applying 50 g and 100 g weights for one minute each. The spread diameter was then measured to indicate the ease of application [10].

Moisturizing effect (humidity test) was conducted on six panelists by measuring baseline skin hydration before application. The scrub lotion was applied twice daily (morning and evening) for 12 days, and skin moisture levels were recorded on days 0, 4, 8, and 12 using a skin analyzer [11].

These evaluations were repeated after storage under freeze–thaw cycles to assess physical stability under fluctuating conditions. Changes in organoleptic properties, pH, homogeneity, adhesion, and spreadability across cycles were recorded as stability indicators [12].

Data Analysis

Data obtained from the physical and moisturizing evaluations were analyzed descriptively and statistically. Descriptive analysis was used to assess changes in organoleptic properties, pH, homogeneity, adhesion, and spreadability before and after freeze–thaw storage. Moisturizing effect (skin hydration) data were analyzed using one-way ANOVA to determine significant differences among formulations, with the significance level set at $p < 0.05$.

3. Results and Discussion

Organoleptic Properties

Organoleptic testing is one of the fundamental evaluations in cosmetic formulation, as it determines the product's sensory attributes such as appearance, color, odor, and texture. These characteristics are directly related to consumer acceptance and

can also serve as preliminary indicators of product stability. Changes in organoleptic properties during storage may reflect chemical degradation of active compounds or instability in the base formulation, which could compromise both safety and efficacy [7]. Therefore, assessing organoleptic stability is crucial in ensuring the quality and acceptability of scrub lotion formulations containing natural extracts. Organoleptic evaluation was conducted to observe the visual characteristics of the scrub lotion, including shape, color, odor, and texture. The results before and after accelerated stability testing are presented in **Table 2**.

Table 2. Organoleptic Test Results

Formula	Before Stability Test				After Stability Test			
	Shape	Color	Smell	Texture	Shape	Color	Smell	Texture
Formula I	Semi solid	Light brown	Typical carrots	Soft	Semi solid	Light brown	Typical carrots	Soft
Formula II	Semi solid	Dark brown	Typical carrots	Soft	Semi solid	Dark brown	Typical carrots	Soft
Formula III	Semi solid	Dark brown	Typical carrots	Soft	Semi solid	Dark brown	Typical carrots	Soft

The results showed that all three formulations maintained their organoleptic stability after the freeze–thaw cycles, with no detectable changes in odor, texture, or general consistency. The three formulations exhibited similar aroma (typical carrot smell) and texture (semi-solid), although there were slight variations in color intensity. Formula I demonstrated a lighter brownish shade compared with Formulas II and III, while Formula III exhibited the darkest color, which is attributable to the higher concentration of carrot extract. The correlation between extract concentration and the intensity of the brownish color confirms that pigment content increases proportionally with extract levels [7].

These findings are consistent with previous reports that herbal extracts containing carotenoids tend to impart a deeper coloration at higher concentrations, while maintaining acceptable sensory stability [15]. Hence, the scrub lotion formulations were organoleptically stable and suitable for further stability and efficacy testing.

pH Test

The pH value is an essential parameter in topical formulations, as it influences skin compatibility and product safety. Human skin naturally maintains an acid mantle with a physiological pH range of 4.5–6.0, which helps preserve barrier function, regulate microbial flora, and maintain skin hydration [13]. Cosmetic products, however, are regulated to meet a wider safety range. According to **SNI 16-4399-1996**, the acceptable pH range for lotions is 4.0–8.0, ensuring that variations in formulation components do not cause irritation or compromise stability [14]. The pH of the scrub lotion formulations was measured before and after accelerated stability testing. The results are presented in **Table 3**, and the changes observed across freeze–thaw cycles are illustrated in **Figure 1**.

Table 3. pH Test Data

Formulation	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Standard
Formula I	6.8	6.8	7.8	7.8	7.8	4.0–8.0 [14]
Formula II	6.8	7.8	7.8	7.8	8.0	4.0–8.0 [14]
Formula III	7.8	7.8	7.8	7.8	8.0	4.0–8.0 [14]

The pH values of all formulations remained within acceptable limits during the stability cycles. Formula I showed relatively lower values (6.8–7.8), whereas Formula III, with the highest carrot extract concentration (6%), consistently recorded the highest pH, reaching 8.0 at cycle 5. Although Formula III was at the upper threshold of the SNI standard (4.0–8.0), it still complied with safety requirements and did not pose a risk of irritation.

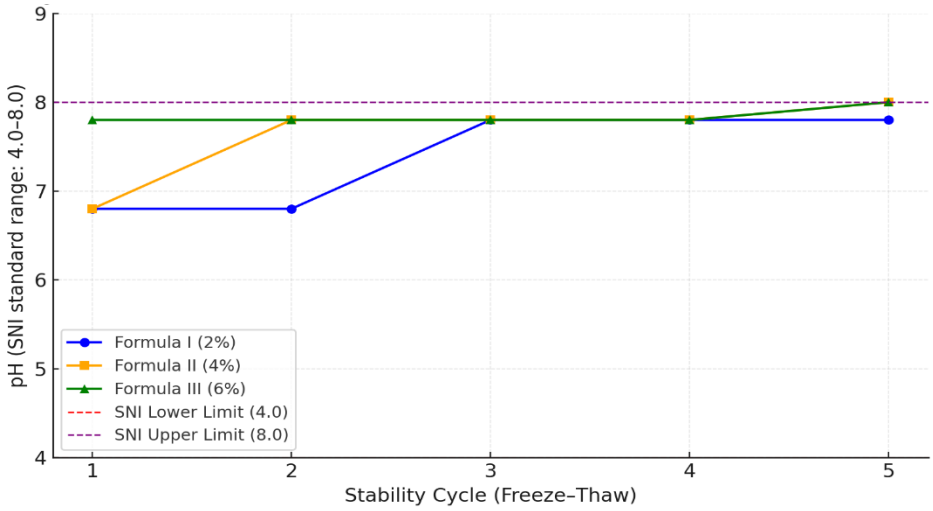

Figure 1. Stability Test Graph Against pH Value

The upward shift in pH observed with higher extract concentrations may be attributed to alkaloids and other basic compounds present in the carrot extract, which can modify the chemical characteristics of the lotion [15]. Despite these variations, the pH of all formulations remained close to the skin's physiological range (4.5–6.0), indicating good compatibility and minimal potential for irritation. These results confirm that carrot extract scrub lotion is both safe and stable in terms of pH.

Homogeneity Test

Homogeneity testing is an important parameter to evaluate the uniform distribution of active substances and excipients in topical formulations. A homogeneous preparation ensures that the active ingredients are evenly dispersed, preventing phase separation and guaranteeing consistent therapeutic and cosmetic effects. The absence of aggregates or clumps also reflects good emulsification and formulation stability, which are essential for consumer acceptability [7]. The results of the homogeneity test for the three formulations across five stability cycles are shown in **Table 4**.

Table 4. Homogeneity Test Data

Formula	Replication	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5
I (2%)	1	H	H	H	H	H
II (4%)	1	H	H	H	H	H
III (6%)	1	H	H	H	H	H

Note: H = Homogeneous

The homogeneity test results indicated that all three formulations (2%, 4%, and 6%) maintained uniform characteristics throughout five freeze–thaw stability cycles. None of the formulations showed signs of phase separation, clumping, or uneven distribution of carrot extract, confirming that the emulsification process was effective.

The use of stearic acid and triethanolamine as emulsifiers contributed to the stable and homogeneous dispersion of oil- and water-phase ingredients, while propylene glycol acted as a humectant that further improved consistency [6].

These findings are in line with previous studies reporting that emulsifier systems containing stearic acid and TEA provide stable lotion bases with good homogeneity over prolonged storage [16]. Therefore, it can be concluded that the carrot extract scrub lotion formulations are physically stable and homogeneous, which is a prerequisite for product safety, efficacy, and consumer acceptance.

Adhesion Test

Adhesion testing is performed to evaluate how long a formulation can adhere to the skin surface, which is an important characteristic for topical products. A lotion with adequate adhesion ensures that the active ingredients remain in contact with the skin for sufficient time to exert their moisturizing and protective effects. However, excessively high adhesion may interfere with spreadability and user comfort. According to cosmetic formulation standards, adhesion times greater than two seconds are considered acceptable for lotion preparations [16]. The adhesion test results of the three formulations across five stability cycles are shown in **Table 5** and illustrated in **Figure 2**.

Table 5. Adhesion Test Data

Cycle	Formula I (2%)	Formula II (4%)	Formula III (6%)	Standard
1	4.21	3.93	5.13	> 2 s [16]
2	3.55	4.66	4.71	> 2 s [16]
3	3.12	3.99	3.90	> 2 s [16]
4	2.69	3.12	4.35	> 2 s [16]
5	2.79	3.42	4.45	> 2 s [16]

The results indicated that all formulations met the minimum adhesion standard (>2 seconds), with Formula III (6%) consistently showing the highest adhesion values compared to Formula I (2%) and Formula II (4%). This suggests that increasing the concentration of carrot extract improved the viscosity of the formulation, thereby enhancing adhesion to the skin surface. Nevertheless, the slight decrease observed in some cycles (e.g., Cycle 3 for Formula I) may reflect variations during the manufacturing process or physical changes during stability testing.

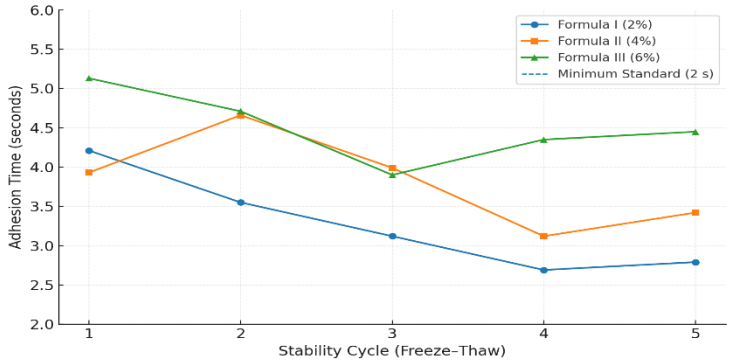

Figure 2. Stability Test Graph of Adhesion Values across Freeze–Thaw Cycles

The findings align with previous studies reporting that higher concentrations of plant extracts tend to increase the viscosity and adhesive properties of emulsified

formulations, resulting in longer skin contact times [17]. Adequate adhesion is beneficial for maintaining hydration and providing longer-lasting effects, but excessive adhesion could reduce spreadability and consumer comfort. Thus, while Formula III showed the highest performance in adhesion, balancing this property with spreadability remains essential for optimal product acceptability.

Spreadability Test

Spreadability is a key parameter in lotion evaluation, as it indicates the ease with which a product can be applied and distributed over the skin surface. A lotion with good spreadability improves user comfort, ensures uniform application of active substances, and enhances consumer acceptability. According to cosmetic formulation standards, ideal spreadability values for topical lotions are typically between 5–7 cm in diameter [17], [18]. The spreadability test results of the carrot extract scrub lotion formulations during the five freeze–thaw cycles are presented in **Table 6** and illustrated in **Figure 3**.

Table 6. Spreadability Test Data

Cycle	Formula I (2%)	Formula II (4%)	Formula III (6%)	Standard
1	3.05	3.45	3.35	5–7 cm [18]
2	3.05	3.50	3.30	5–7 cm [18]
3	2.90	3.35	3.35	5–7 cm [18]
4	3.10	3.55	3.20	5–7 cm [18]
5	3.10	3.15	3.70	5–7 cm [18]

The results showed that all formulations produced spread diameters between 2.9–3.7 cm, which are below the standard reference value of 5–7 cm. Among the formulations, Formula II (4%) showed the highest spreadability in cycles 2 and 4 (3.5–3.55 cm), whereas Formula III (6%) exhibited a gradual increase in spreadability, reaching 3.7 cm in cycle 5. In contrast, Formula I (2%) maintained relatively low values around 3.0 cm throughout the cycles.

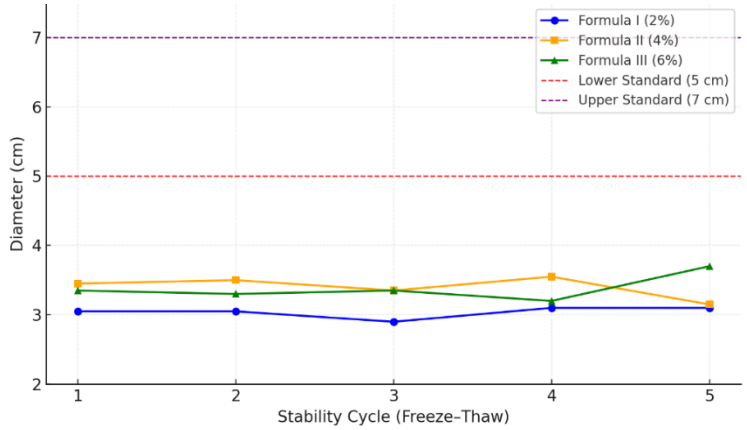

Figure 3. Spreadability Values of Scrub Lotion Formulations across Freeze–Thaw Cycles

The lower spreadability compared with the standard range may be attributed to the relatively high viscosity of the formulations, influenced by the concentration of carrot extract and emulsifying agents. This is consistent with findings from Raharjeng and Purwati (2025), who reported that higher extract and emulsifier contents tend to reduce

spreadability due to increased formulation thickness [18]. Nevertheless, the values obtained are still acceptable for scrub lotion formulations, as higher adhesion and viscosity may be beneficial for longer skin contact and sustained moisturizing effect.

Humidity Test (Moisturizing Effect / Anti-aging Indicator)

Skin hydration plays an essential role in maintaining elasticity, barrier function, and preventing premature aging. Based on skin physiology, hydration levels below 30% are classified as dry, 30–35% as normal, and above 35% as well hydrated [19]. Therefore, humidity testing provides a direct indicator of the moisturizing performance and potential anti-aging effects of cosmetic formulations.

The results of the humidity test are presented in **Figure 4**, showing hydration changes over 12 days of application. All formulations increased skin moisture, although the magnitude of effect varied according to carrot extract concentration. Formula I (2%) produced the lowest increase and remained in the normal hydration range, Formula II (4%) demonstrated moderate improvement, while Formula III (6%) showed the greatest increase, elevating hydration above 35% by day 12. This indicates that the highest extract concentration effectively shifted skin condition into the well-hydrated category, supporting its role as an anti-aging agent.

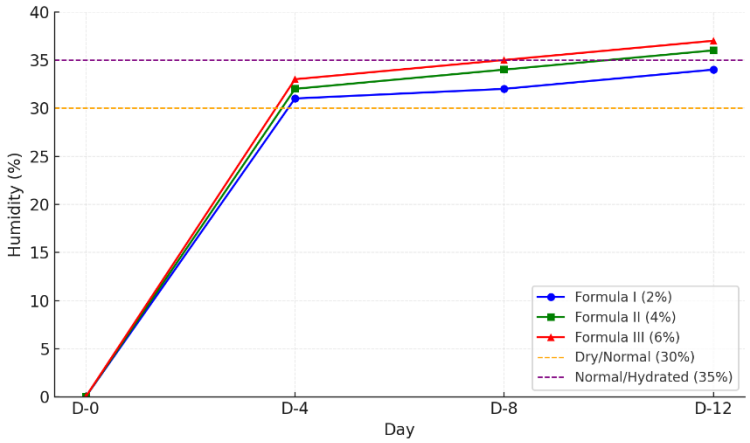

Figure 4. Humidity Test Results of Scrub Lotion Formulations across 12 Days

Statistical analysis confirmed significant differences among the formulations, as shown in **Table 7**. One-way ANOVA revealed $F(2,15) = 7.059$, $p = 0.007$, indicating that increasing carrot extract concentration significantly enhanced moisturizing performance. These results align with the established functions of beta-carotene and vitamin E in carrots, which reduce oxidative stress, inhibit lipid peroxidation, and support repair of UV-induced damage, thereby improving hydration and delaying skin aging [19],[20].

Table 7. ANOVA Test Results of Humidity (%)

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	21.333	2	10.667	7.059	0.007
Within Groups	22.667	15	1.511		
Total	44.000	17			

Several studies corroborate these findings. Singh *et al.* (2019) reported that cosmetic emulsions containing carrot seed oil at 2–6% improved antioxidant activity and

hydration, with the 6% formulation showing the highest consumer acceptability and stability. Likewise, Lotos *et al.* (2024) demonstrated that emulsions with up to 10% carrot oil enhanced hydration and provided antimicrobial activity with stable physicochemical properties. Other herbal-based lotions, such as *Tephrosia vogelii* leaf cream (0.05–0.25%) [21] and moisturizers with mixed herbal extracts (0.139–0.9%), also showed good stability and hydration effects, but lacked the specific antioxidant profile of carrot extract. These comparisons highlight that the high beta-carotene and vitamin E content in carrot extract may offer unique advantages against UV-induced damage and oxidative stress.

This study has several limitations that should be considered when interpreting the findings. First, the moisturizing effect was evaluated on only six panelists, which limits the statistical power and generalizability of the results. Second, the evaluation period was relatively short (12 days), providing only preliminary evidence of the moisturizing and anti-aging potential of carrot extract scrub lotion. Longer-term studies are necessary to confirm sustained efficacy and safety. Third, the assessment of moisturizing activity relied solely on instrumental skin hydration measurements, without complementary parameters such as transepidermal water loss (TEWL), elasticity, or clinical dermatological evaluations, which could provide a more comprehensive understanding of skin barrier improvement. Fourth, variations in individual skin type, lifestyle, and environmental conditions were not controlled, which may have influenced hydration responses. Finally, while freeze–thaw cycles were used to simulate stability under fluctuating storage conditions, real-time stability testing over extended shelf life was not conducted.

4. Conclusion

This study demonstrated that scrub lotion formulations containing carrot extract (*D. carota*) at concentrations of 2%, 4%, and 6% exhibited good physicochemical stability, with acceptable organoleptic properties, homogeneity, pH within the SNI standard range, and adhesion above the minimum requirement, although spreadability values were slightly below the ideal range for cosmetic lotions. Among them, the 6% formulation (Formula III) showed the most optimal performance, producing the greatest improvement in skin hydration and achieving the well-hydrated category after 12 days of application, confirming the role of carrot extract's bioactive compounds, particularly beta-carotene and vitamin E, in providing moisturizing, antioxidant, and anti-aging effects. Future research should involve larger and more diverse populations, longer evaluation periods, and additional parameters such as transepidermal water loss (TEWL), elasticity, and real-time stability testing, in order to comprehensively confirm the long-term efficacy and safety of carrot extract scrub lotion.

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Conflicts of Interest:

The author declare that there is no conflict of interest regarding the publication of this paper.

References

[1] M. J. Sewell, C. N. Burkhart, and D. S. Morrell, "Dermatological pharmacology," in *Goodman & Gilman's: The Pharmacological Basis of Therapeutics*, 13th ed., L. L. Brunton, R. Hilal-Dandan, and B. C. Knollmann, Eds. New York, NY: McGraw-Hill Education, 2017. [Online]. Available: http://accessmedicine.mhmedical.com/content.aspx?aid=1162548094

[2] L. V. Achumi, E. S. Peter, A. Das, and C. V. L. Achumi, "Studies on preparation of gummy candy using pineapple juice and carrot juice," *International Journal of Chemical Studies*, vol. 6, no. 5, pp. 1015–1018, 2018. [Online]. Available: https://www.chemijournal.com/archives/?year=2018&vol=6&issue=5&ArticleId=3688&si

[3] R. Hartati, I. Fidrianny, and A. Fitria, "Phytochemical screening characteristics of carrot (*Daucus carota* L.) simplicia and a review of its chemical content and pharmacological activities," *Acta Pharmaceutica Indonesiana*, vol. 48, no. 2, pp. 12–25, 2023. [Online]. Available: https://doi.org/10.5614/api.v48i2.22428

[4] S. M. Baswan et al., "Role of ingestible carotenoids in skin protection: a review of clinical evidence," *Photodermatology, Photoimmunology & Photomedicine*, vol. 37, no. 6, pp. 490–504, Nov. 2021. [Online]. Available: https://doi.org/10.1111/phpp.12690

[5] R. M. Febri and Y. Rosa, "Secondary metabolite activity of carrot (*Daucus carota* L.) tuber ethanol extract against *Candida albicans*," *Jurnal Kesehatan: Jurnal Ilmiah Multi Science*, vol. 12, no. 1, pp. 34–40, 2022. [Online]. Available: https://doi.org/10.52395/JKJIMS.V12I01.341

[6] R. C. Rowe, P. J. Sheskey, and M. E. Quinn, *Handbook of Pharmaceutical Excipients*, 6th ed. London, UK: Pharmaceutical Press, 2009. [Online]. Available: https://www.ncbi.nlm.nih.gov/books/NBK222310/

[7] W. Hutauruk, H. P. Yamlean, P. V. Y. Yamlean, and Wiyono, "Formulation and antibacterial activity of celery (Apium graveolens L.) ethanol extract cream against Staphylococcus aureus," *Pharmacon*, vol. 9, no. 1, pp. 73–81, 2020. [Online]. Available: https://doi.org/10.35799/pha.9.2020.29275

[8] S. A. Syahrul and L. Mayangsari, "A study of motives in choosing natural cosmetics among Indonesian women," *Malaysian Journal of Social Sciences and Humanities*, vol. 5, no. 8, pp. 60–71, Aug. 2020. [Online]. Available: https://doi.org/10.47405/mjssh.v5i8.464

[9] S. Rohmani and T. B. Pangesti, "Sunscreen cream formulation from a combination of propolis extract and titanium dioxide," *Journal of Advanced Pharmacy Education & Research*, vol. 14, no. 2, pp. 77–83, 2024. [Online]. Available: https://doi.org/10.51847/wzPc0dCU6c

[10] A. A. M. Siti Sunari, N. P. R. Artini, and D. P. Apsari, "Comparison of cream quality between Adeps Lanae base and ghee (cow milk butter)," *Widya Kesehatan*, vol. 2, no. 2, pp. 24–29, 2020. [Online]. Available: https://doi.org/10.32795/widyakesehatan.v2i2.962

[11] P. A. Cahya, *Formulation and antioxidant activity test of anti-aging serum based on black cumin oil using the DPPH method*, Undergraduate Thesis, Universitas Islam Indonesia, 2020. [Online]. Available: https://dspace.uii.ac.id/123456789/29311

[12] A. F. Tsabitah, A. K. Zulkarnain, M. S. H. Wahyuningsih, and D. A. A. Nugrahaningsih, "Optimization of carbomer, propylene glycol, and triethanolamine in ethanol extract gel formulation of Tithonia diversifolia leaves," *Majalah Farmaseutik*, vol. 16, no. 2, p. 111, 2020. [Online]. Available:

https://doi.org/10.22146/farmaseutik.v16i2.45666

[13] S. G. Brooks, R. H. Mahmoud, R. R. Lin, J. W. Fluhr, and G. Yosipovitch, "The skin acid mantle: an update on skin pH," *Journal of Investigative Dermatology*, vol. 145, no. 3, pp. 509–521, 2025. [Online]. Available: https://doi.org/10.1016/j.jid.2024.07.009

[14] D. Hartono, A. Sulasmi, A. D. Oktaviani, R. P. Ismanur, and Y. H. Sipahutar, "Fortification of sodium alginate and lavender extract in skin lotion formulation," in *Proceedings of Simnaskp*, vol. 8, 2021. [Online]. Available: https://journal.unhas.ac.id/index.php/proceedingsimnaskp/article/view/14909

[15] F. Shufyani, M. Andry, and R. E. Tarigan, "Formulation of carrot (Daucus carota L.) scrub cream as anti-aging," *Journal of Pharmaceutical Sciences*, vol. 6, no. 3, pp. 1007–1025, Jul. 2023. [Online]. Available: https://doi.org/10.36490/journal-jps.com.v6i3.177

[16] B. Iskandar, N. Frimayanti, F. Firmansyah, T. T. Agustini, and D. D. Putri, "Evaluation of physical properties and moisturizing activity of commercial lotions sold in online shops," *Jurnal Dunia Farmasi*, vol. 4, no. 1, pp. 8–16, 2019. [Online]. Available: https://doi.org/10.33085/jdf.v4i1.4561

[17] E. D. Lotos et al., "The potential emulsions of xanthan gum and Daucus carota macerated oil in functional textiles for skincare applications: Formulation, characterization, and performance evaluation," *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, vol. 682, p. 132960, 2024. [Online]. Available: https://doi.org/10.1016/j.colsurfa.2023.132960

[18] S. W. Raharjeng and E. Purwati, "Formulation and physical quality evaluation of body lotion from rambutan (Nephelium lappaceum L.) peel extract," *Jurnal Crystal: Publikasi Penelitian Kimia dan Terapan*, vol. 7, no. 1, pp. 61–69, Mar. 2025. [Online]. Available: https://doi.org/10.36526/jc.v7i1.4998

[19] A. Budzianowska, K. Banaś, J. Budzianowski, and M. Kikowska, "Antioxidants to defend healthy and youthful skin—current trends and future directions in cosmetology," *Applied Sciences*, vol. 15, no. 5, 2025. [Online]. Available: https://doi.org/10.3390/app15052571

[20] S. Singh, A. Lohani, A. K. Mishra, and A. Verma, "Formulation and evaluation of carrot seed oil-based cosmetic emulsions," *Journal of Cosmetic and Laser Therapy*, vol. 21, no. 2, pp. 99–107, 2019. [Online]. Available: https://doi.org/10.1080/14764172.2018.1469769

[21] S. H. Mlozi, J. A. Mmongoyo, and M. N. Chacha, "In vitro evaluation of the herbal cream formulation from methanolic leaf extracts of Tephrosia vogelii Hook.f for topical application," *Clinical Phytoscience*, vol. 9, no. 1, p. 3, 2023. [Online]. Available: https://doi.org/10.1186/s40816-023-00357-4