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FORMULATION AND IN VITRO EVALUATION OF HERBAL FACE SERUM USING ORANGE PEEL EXTRACT

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ABSTRACT
The rising demand for plant-based cosmetic formulations has led to the development of safe, effective, and eco-friendly skincare products. In the present study, a herbal face serum containing orange peel extract as a natural active ingredient was formulated and evaluated in vitro. Orange peel, an agro-industrial waste, is rich in bioactive compounds such as flavonoids, vitamin C, and phenolics, which are known for their antioxidant, antimicrobial, and skin-enhancing properties. A lightweight, fast-absorbing preparation was developed to ensure efficient delivery of active ingredients into the skin. The formulated serum was evaluated for product quality, stability, and user acceptability by assessing various physicochemical parameters, including organoleptic properties, pH, viscosity, and spread-ability. The results revealed that desirable characteristics were exhibited by the prepared serum, such as appropriate pH, good consistency, satisfactory spread-ability, and stability without phase separation. The presence of natural antioxidants from orange peel extract suggests that improvement in skin texture may be achieved, protection against oxidative stress may be provided, and overall skin appearance may be enhanced. Therefore, the successful use of orange peel extract in the formulation of a herbal face serum was demonstrated in the present study, and a promising alternative to synthetic cosmetic products was provided.

KEYWORDS: Herbal face serum, orange peel extract, Herbal cosmetics, Antioxidant activity, In vitro evaluation, Natural skincare.

1. INTRODUCTION

Cosmetics are defined as substances or preparations intended to be applied to the external parts of the human body, such as the skin, hair, nails, lips, and teeth, for the purposes of cleansing, beautifying, promoting attractiveness, or changing appearance without altering the structure or function of the body.[1] Face serum is considered a special type of cosmetic preparation that is applied to the facial skin, and it is formulated with ingredients that are used to address specific concerns such as dryness, aging, pigmentation, and dullness. Greater effectiveness than regular creams and lotions is exhibited by face serums because faster absorption and higher concentrations of active ingredients are achieved. In recent years, great attention has been received by herbal cosmetics due to their natural origin, safety, and

reduced side effects. A preference for plant-based products over synthetic ones is increasingly being demanded by consumers, and as a result, innovative formulations combining traditional knowledge with modern technology have been developed.[2,3]



Fig (1): Herbal Serum.

Serums are lightweight, highly concentrated skincare preparations designed to deliver active ingredients into the skin more effectively than conventional creams or lotions. Based on their function and active ingredients, serums can be classified into several types. Hydrating serums contain ingredients such as hyaluronic acid, glycerine, and aloe vera that help increase skin moisture and maintain hydration.[4,5] Brightening serums commonly contain vitamin C, niacinamide, alpha-arbutin, or liquorice extract and are used to improve skin radiance and reduce the appearance of uneven pigmentation. Anti-aging serums contain ingredients such as retinol, peptides, vitamin C, and antioxidants that support collagen production and help minimize fine lines and wrinkles.[6,7] Acne-control serums may contain salicylic acid, niacinamide, azelaic acid, or tea tree-derived ingredients to help control excess sebum, clogged pores, and acne. Antioxidant serums are formulated with substances such as vitamin C, vitamin E, and plant polyphenols to protect the skin from oxidative stress caused by environmental factors. Exfoliating serums contain alpha-hydroxy acids (AHAs), beta-hydroxy acids (BHAs), or polyhydroxy acids (PHAs) to remove dead skin cells and improve skin texture. Soothing serums generally contain aloe vera, centella asiatica, chamomile, or panthenol and are intended for sensitive or irritated skin.[8,9]

2. METHOD OF PREPARATION

Preparation of Orange Peel Extract (Maceration Process)

Fresh orange peels were collected and thoroughly washed with distilled water to remove dirt and impurities. They were then shade dried at room temperature for several days until complete removal of moisture was achieved. The dried peels were ground into a coarse powder using a mechanical grinder. The powdered material was subjected to maceration for 48–72 hours with occasional stirring, using a suitable solvent such as ethanol or distilled water for extraction. The mixture was then filtered through muslin cloth, followed by filtration using Whatman filter paper. The obtained filtrate was concentrated at a controlled temperature in a water bath until a semi-solid extract was obtained, which was then stored in an air-tight container for further use.[9,10]



Fig. 2: Dried Orange Peel.



Fig. 3: Dried Orange Peel Powder.



Fig. 4: Orange Peel Extract.

Formulation of Face Serum

A suitable base for the serum was prepared by dispersing required quantities of gelling or thickening agents such as Carbopol or xanthan gum in distilled water under continuous stirring to avoid lump formation. Full hydration of the mixture was allowed to be achieved. Humectants such as glycerin were added to improve moisture retention, and preservatives were incorporated to prevent microbial contamination. The prepared orange peel extract was then added to the base under continuous stirring to ensure uniform distribution. The pH of the formulation was adjusted to match the skin pH using suitable agents such as triethanolamine or citric acid. Finally, fragrance (as required) and other optional ingredients such as stabilizers or essential oils were added. The mixture was thoroughly blended until a homogeneous smooth serum was obtained.[11,12]

Table (1): List of ingredients and their quantity with uses.

Ingredient	Quantity(100ml)	Uses
Orange peel extract	5 ml	Active ingredient due to its antioxidant, antimicrobial, anti-aging, and skin-brightening properties
Carbopol 940	1 ml	Used as gelling and thickening agent
Glycerin	5 ml	Used as humectant and moisturizing agent
Triethanolamine	0.5 ml	Used as pH adjustment and stabilization
Methyl paraben	0.2 ml	Used as preservative
Vitamin E	1 ml	Used to combat dry skin, reduce inflammation
Rose water	10 ml	Used as refreshing and toning agent

Final Processing and Storage

The final serum was then transferred into clean, dry, and previously sterilized containers to prevent contamination. Packaging was carried out using amber-colored glass bottles or opaque plastic containers to protect the formulation from light-induced degradation, as natural extracts such as orange peel are prone to oxidation and light exposure. Each container was properly labelled with relevant details such as formulation code, date of preparation, and storage conditions to facilitate identification and tracking during stability studies. The filled containers were stored under controlled environmental conditions, generally at room temperature (25 ± 2°C) and away from direct sunlight and humidity. Additionally, samples were also stored under different conditions such as refrigerated temperature (4–8°C) and elevated temperature (around 40°C) for stability testing. The serum was periodically observed for any changes in physical appearance, pH, viscosity, odor, or overall performance over time.[13]

3. EVALUATION PARAMETERS

The assessment of face serums is carried out through a combination of physicochemical, microbiological, and dermatological evaluations to ensure the stability, safety, and effectiveness of the product. These parameters are considered essential for determining the quality and performance of the formulation.[15]

Organoleptic Evaluation

The serum was visually inspected for color, clarity, and phase separation. Odor and texture were evaluated manually to determine acceptable characteristics.[16,17]

pH Measurement

The pH of the serum was determined at room temperature using a calibrated digital pH meter. The obtained values were recorded and compared with the acceptable range of skin pH.[17,18]

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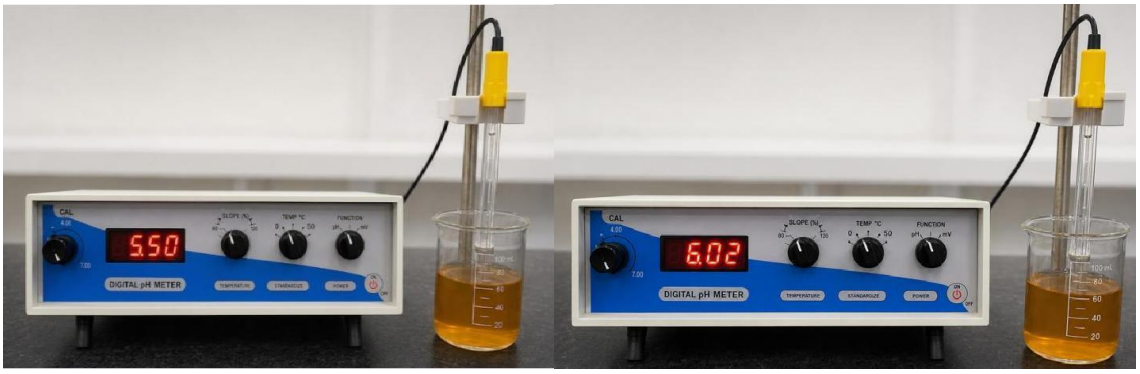

Fig. 5: pH Measurement result.

Viscosity Measurement

The flow characteristics of the formulation were determined by measuring viscosity using a Brookfield viscometer at a specified spindle speed and temperature.[19,20]



Fig. 6: Viscosity Measurement.

Spread-ability Test

The spread-ability of a fixed amount of serum placed between two glass slides was determined using a standard weight.[24,20]

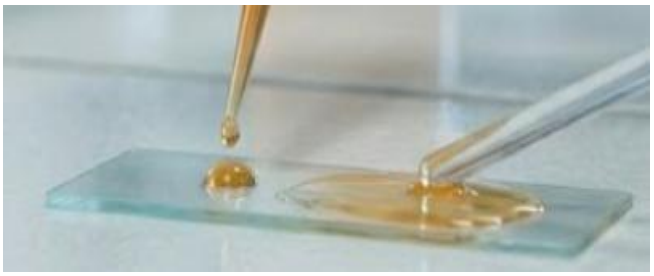

Fig. 7: Spreadability Test.

Homogeneity Test

The formulation was evaluated through visual inspection and tactile assessment for uniform distribution of ingredients. A good homogeneity was confirmed by the absence of lumps and aggregates.[22,23]

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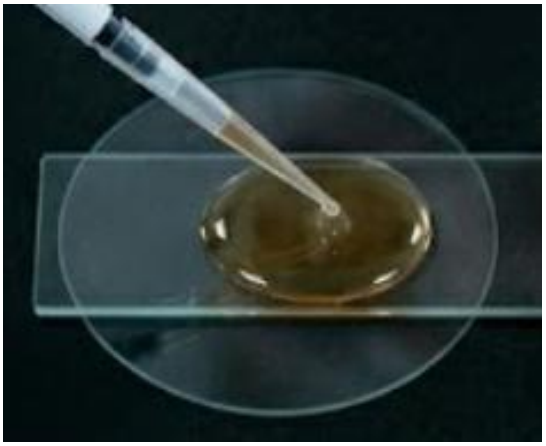

Fig. 8: Homogeneity Test.

Stability Test

The serum was stored under different conditions such as room temperature, refrigerated conditions, and elevated temperature (e.g., 40°C) for a specified period. Stability was monitored at regular intervals by observing changes in color, odor, pH, and consistency.[25,26]

Irritation Test (Patch Test)

A small amount of serum was applied to a limited area of skin (usually the forearm), and the area was observed for 24 hours. Any signs of redness, itching, or irritation were recorded.[27,28]



Fig. 9: Irritation Test (Patch Test).

Washing Test

A small amount of serum was applied to the skin and subsequently washed with tap water. The ease of removal was assessed to determine user convenience.[29,30]



Fig. 10: Irritation Test (Patch Test).

4. RESULT AND OBSERVATION

The formulated herbal face serum exhibited satisfactory physicochemical characteristics. The formulation was light orange in color with a pleasant citrus odor, a smooth and uniform texture, and a semi-liquid consistency. The measured pH of 5.5 was within the acceptable range for topical application and compatible with the natural pH of the skin. The serum demonstrated suitable viscosity, good spread-ability, and excellent homogeneity, ensuring ease of application and uniform distribution on the skin. Stability studies indicated that the formulation remained physically stable without any noticeable changes during the study period. Furthermore, the patch test showed no signs of irritation, indicating that the formulation was safe and suitable for topical use.

Table 2: Test and Observation.

S No.	TEST	OBSERVATION
1	**Physical Evaluation**	
	Colour	Light Orange
	Odour	Pleasant citrus odour
	Texture	Smooth & uniform

	Consistency	Semi-liquid
2.	**pH test**	5.5
3.	**Viscosity test**	Suitable
4.	**Spreadability test**	Good
5.	**Homogeneity test**	Good
6.	**Stability test**	Stable
7.	**Irritation test**	No irritation
8.	**Washing**	Easy to wash

5. CONCLUSION

In the present study, an herbal face serum was successfully formulated using orange peel extract as a natural and sustainable active ingredient. Acceptable physicochemical properties such as pH, viscosity, stability, and ease of application were exhibited by the formulation, indicating good skin compatibility and user convenience.

Functional benefits were contributed by orange peel extract due to its antioxidant and skin- enhancing properties, thereby supporting its potential use for improving skin health and appearance. Moreover, the utilization of natural waste material reflected an eco-friendly approach in cosmetic formulation.

Thus, the formulated serum was considered a safe, stable, and effective herbal cosmetic product. However, in vivo studies and long-term stability evaluations are recommended to be conducted to confirm its efficacy and commercial applicability.

6. REFERENCES

1. Central Drugs Standard Control Organization. (2020). *The Cosmetics Rules, 2020*. Ministry of Health and Family Welfare, Government of India. https://cdsco.gov.in/opencms/en/Acts-and-rules/Cosmetics-Rules/
2. Central Drugs Standard Control Organization. (2025). *Guidance document on registration and import of cosmetics into India*. Ministry of Health and Family Welfare, Government of India. https://www.cdsco.gov.in/opencms/export/sites/CDSCO_WEB/Pdf-documents/cosmetics/Guidance-Document-on-Registration-and-Import-of-cosmetics-into-India-converted.pdf
3. Draelos, Z. D., Diaz, I., Namkoong, J., Wu, J., & Boyd, T. (2021). Efficacy evaluation of a topical hyaluronic acid serum in facial photoaging. *Dermatology and Therapy*, *11*(4): 1385–1394. https://doi.org/10.1007/s13555-021-00566-0
4. Imhof, L., & Leuthard, D. (2021). Topical over-the-counter antiaging agents: An update and systematic review. *Dermatology*, *237*(2): 217–229. https://doi.org/10.1159/000509296
5. Pillaiyar, T., Manickam, M., & Jung, S. H. (2023). Recent advances in cosmeceuticals and skin delivery systems for anti-aging applications. *Pharmaceutics*, *15*(3): 903. https://doi.org/10.3390/pharmaceutics15030903
6. Yadav, N., Chauhan, P., & Mohire, G. (2024). Herbal face serum: Formulation, evaluation, and recent advances in cosmeceutical applications. *International Journal of Pharmaceutical Sciences Review and Research, 86*(1): 45–53.
7. Vaishampayan, P., & Rane, M. M. (2022). Herbal nanocosmeceuticals: A review on cosmeceutical innovation. *Journal of Cosmetic Dermatology*, *21*(11): 5464–5483. https://doi.org/10.1111/jocd.15238
8. Durmus, N., Gulsunoglu-Konuskan, Z., & Kilic-Akyilmaz, M. (2024). Recovery, bioactivity, and utilization of bioactive phenolic compounds in citrus peel. *Food Science & Nutrition, 12*(12): 9974–9997. https://doi.org/10.1002/fsn3.4570
9. Poljšak, N., & Kočevar Glavač, N. (2022). Vegetable butters and oils as therapeutically and cosmetically active ingredients for dermal use: A review of clinical studies. *Frontiers in Pharmacology*, *13*: 868461. https://doi.org/10.3389/fphar.2022.868461
10. Kouassi, M.-C., Grisel, M., & Gore, E. (2022). Multifunctional active ingredient-based delivery systems for skincare formulations: A review. *Colloids and Surfaces B: Biointerfaces, 217:* 112676. https://doi.org/10.1016/j.colsurfb.2022.112676
11. Draelos, Z. D. (2021). The science behind skin care: Moisturizers and topical delivery systems. *Dermatologic Clinics*, *39*(3): 433–441. https://doi.org/10.1016/j.det.2021.02.007
12. Nogueira, A. R. A., Neto, D., Luísa Correa, M. A., & Chorilli, M. (2021). Microemulsions and nanoemulsions in cosmetic and dermatological formulations: A review. *International Journal of Pharmaceutics*, *603*: 120711. https://doi.org/10.1016/j.ijpharm.2021.120711
13. Puglia, C., Offerta, A., Tirendi, G. G., Tarico, M. S., Curreri, S., Bonina, F., & Perrotta, R. E. (2022). Nanostructured lipid carriers and emulsions for skin delivery of cosmetic active ingredients: Current advances and future perspectives. *Pharmaceutics, 14*(10): 2118. https://doi.org/10.3390/pharmaceutics14102118
14. Rai, V. K., Mishra, N., Yadav, K. S., & Yadav, N. P. (2023). Recent advances in topical delivery systems for cosmeceuticals: Formulation strategies and skin delivery approaches. *Pharmaceutics, 15*(2): 560. https://doi.org/10.3390/pharmaceutics15020560
15. Singh, B., Singh, J. P., Kaur, A., & Singh, N. (2021). Bioactive compounds in citrus fruits and

their health-promoting properties: A review. *Food Research International*, *142*: 110287. https://doi.org/10.1016/j.foodres.2021.110287
16. Xiao, Q., Zhang, Y., Wang, H., Liu, Y., & Chen, L. (2021). Agarose stearate–Carbomer 940 as stabilizer and rheology modifier for surfactant-free cosmetic formulations. *Marine Drugs*, *19*(6): 344. https://doi.org/10.3390/md19060344
17. Fluhr, J. W., Darlenski, R., & Surber, C. (2020). Glycerol and the skin: Holistic approach to its origin and functions. *British Journal of Dermatology*, *182*(4): 878–886. https://doi.org/10.1111/bjd.18518
18. Nair, A. B., Shah, J., Jacob, S., Al-Dhubiab, B. E., & Sreeharsha, N. (2021). Development and evaluation of Carbopol-based topical gel formulations: Recent advances and pharmaceutical applications. *Gels*, *7*(3): 96. https://doi.org/10.3390/gels7030096
19. Dreger, M., Wielgus, K., & Kaczmarek, A. (2024). Preservatives in cosmetics: Current regulatory status, safety assessment, and future perspectives. *Cosmetics*, *11*(2): 54. https://doi.org/10.3390/cosmetics11020054
20. Azwanida, N. N. (2022). A review on the extraction methods used in medicinal plants, principle, strength and limitation. *Medicinal & Aromatic Plants*, *11*(1): 1000412.
21. Rajendran, P., Ramu, G., Krishnasamy, G., & Shanmugam, S. (2022). Citrus peel as a sustainable source of bioactive compounds: Extraction techniques, phytochemistry, and industrial applications. *Food Chemistry Advances*, *1*: 100067. https://doi.org/10.1016/j.focha.2022.100067
22. Tadros, T. F. (2021). *Emulsion Formation and Stability* (2nd ed.). Walter de Gruyter. https://doi.org/10.1515/9783110587505
23. United States Pharmacopeia. (2023). *United States Pharmacopeia and National Formulary (USP–NF)*. United States Pharmacopeial Convention.
24. European Commission. (2022). *Cosmetic products notification portal (CPNP): Guidelines for cosmetic product safety and packaging*. Publications Office of the European Union. https://health.ec.europa.eu/
25. International Organization for Standardization. (2024). *ISO 22715:2024—Cosmetics—Packaging and labelling*. International Organization for Standardization. https://www.iso.org/standard/84120.html
26. Baki, G., & Alexander, K. S. (2021). *Introduction to cosmetic formulation and technology* (2nd ed.). John Wiley & Sons.
27. Lambers, H., Piessens, S., Bloem, A., Pronk, H., & Finkel, P. (2021). Natural skin surface pH is on average below 5, which is beneficial for its resident flora. *International Journal of Cosmetic Science*, *43*(2): 105–114.
28. Ribeiro, H. M., Marto, J., Raposo, S., Agapito, M., Isaac, V., Chiari-Andréo, B. G., Lisboa, P. F., Paiva, A., & Rodrigues, A. (2021). From the inside out: A comprehensive review of topical delivery systems for cosmetic applications. *Pharmaceutics*, *13*(10): 1624. https://doi.org/10.3390/pharmaceutics13101624
29. Khan, M. A., Ahmad, M., Akhtar, N., & Aslam, N. (2023). Recent advances in topical gel formulations: Development, characterization, and evaluation. *Gels*, *9*(4): 287. https://doi.org/10.3390/gels9040287
30. Sadeq, Z. A., Hussein, A. A., & Al-Kinani, A. A. (2022). Advances in semisolid topical dosage forms: Formulation strategies and evaluation methods. *Pharmaceutics*, *14*(11): 2376. https://doi.org/10.3390/pharmaceutics14112376

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