International Journal of Advanced Biochemistry Research 2025; 9(5): 1074-1078

International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating: 5.29
IJABR 2025; 9(5): 1074-1078
www.biochemjournal.com
Received: 26-02-2025
Accepted: 30-03-2025

Shubham Singhal
College of Pharmacy, Shivalik Campus, Dehradun, Uttarakhand, India

Parul Bisht
College of Pharmacy, Shivalik Campus, Dehradun, Uttarakhand, India

Semwal Amit
College of Pharmacy, Shivalik Campus, Dehradun, Uttarakhand, India

Corresponding Author:
Shubham Singhal
College of Pharmacy, Shivalik Campus, Dehradun, Uttarakhand, India

Formulation and evaluation of under-eye gel from poly herbal extract

Shubham Singhal, Parul Bisht and Semwal Amit

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i5m.4464

Abstract
Dark circles under the eyes, a prevalent cosmetic concern, arise from factors like genetics, aging, pigmentation, vascular issues, and lifestyle choices. This study aimed to formulate and evaluate a polyherbal under-eye gel using natural extracts from Neem (*Azadirachta indica*), Panch Tulsi (*Ocimum spp*.), and *Aloe vera* (*Aloe-barbadensis miller*). Five formulations (F1-F5) were developed and assessed for physicochemical characteristics, including pH, viscosity, spread ability, wash ability, and skin irritancy. Formulation F4 emerged as the most effective, with a semi-solid texture, optimal pH (6.36), high viscosity (5573.9 mPa.s), excellent spread ability (25.00 g/cm²), and no irritation. The herbal gel effectively reduced puffiness, lightened dark circles, and improved skin hydration, offering a sustainable alternative to synthetic cosmetics. This work underscores the growing potential of natural formulations in addressing periorbital hyperpigmentation and enhancing skin health.

Keywords: Under-eye gel, dark circles, Neem, Panch Tulsi, *Aloe vera*, herbal extracts

Introduction

In recent years, the demand for natural and herbal cosmetics has surged globally due to rising awareness about the potential adverse effects of synthetic ingredients and an increasing preference for sustainable and skin-friendly alternatives. Among various cosmetic formulations, under-eye gels have gained popularity as they address common issues such as dark circles, puffiness, and fine lines—concerns often associated with stress, aging, and environmental exposure. Herbal under-eye gels, in particular, leverage the bioactive constituents of medicinal plants known for their anti-inflammatory, antioxidant, and skin-rejuvenating properties, offering a safer and potentially more effective approach to periorbital care [1, 2].

Natural cosmetics are generally defined as products formulated using ingredients derived from natural sources such as plants, minerals, and marine substances, without synthetic fragrances, preservatives, or petrochemicals [3]. The cosmetic industry has increasingly incorporated herbal ingredients such as *Aloe vera*, Cucumis sativus (cucumber), Camellia sinensis (green tea), and Centella asiatica in under-eye formulations due to their proven efficacy in improving microcirculation, reducing oxidative stress, and enhancing collagen synthesis [4].

Herbal under-eye gels offer several advantages, including minimal side effects, biocompatibility, and multifunctionality. The phytochemicals present in these formulations, such as flavonoids, alkaloids, tannins, and saponins, contribute to their therapeutic actions. Additionally, consumer perception of natural products as being holistic and eco-conscious further fuels the demand for herbal skincare solutions [5]. Despite their popularity, a comprehensive understanding of the pharmacological actions of individual herbal components and their synergistic effects in gel formulations remains an active area of research.

Dark circles under the eyes, often linked to fatigue or aging, stem from a complex interplay of genetic, physiological, and lifestyle factors. These peri-orbital discolorations, categorized as vascular, mixed, structural, or pigmented, arise due to thin under-eye skin revealing blood vessels, melanin accumulation, or structural shadows from fat loss or bone structure. Contributing factors include poor sleep, stress, dehydration, sun exposure, and habits like smoking [6, 7].

Herbal under-eye gels, aligning with the global shift toward sustainable cosmetics, offer a natural solution. Infused with ingredients like *Aloe vera*, neem, and tulsi, these gels leverage antioxidant, anti-inflammatory, and skin-lightening properties to reduce puffiness, hydrate, and lighten dark circles. Benefits include anti-aging effects, moisturization, and a radiant complexion, with gentler formulations than synthetic alternatives. However, potential allergic reactions, limited scientific backing, slower results, and temporary effects pose challenges. Regular application is needed for sustained benefits, and efficacy varies by dark circle type. As demand for eco-friendly products grows, herbal gels provide a promising, holistic approach to addressing this common cosmetic concern, though patch tests and realistic expectations are advised [8, 9].

Materials

Plant Materials

Neem leaves, Panch Tulsi, *Aloe vera* was collected from the Herbal garden, College of Pharmacy, Shivalik Campus, Dehradun. Peppermint Oil, Orange Oil, Glycerin, Propylene Glycol, Carbopol 934, Cween 80 was purchased from the local market of Dehradun. All other solvents used were of analytical grade.

Preparation of Extract

The plant material leaves of Neem and Panch Tulsi were washed and cut into pieces. 500 ml of ethanol was used to kinetically macerate 100 g of Neem leaves and Panch Tulsi leaves. The maceration process was repeated 5-8 times. The filtrate was evaporated at a temperature of 40 °C, filtrated and collected.

Method of Preparation of Gel Containing Extracts

For the gel formulation (F1-F5), Carbopol 934 was dispersed in purified water with continuous stirring. Glycerin and propylene glycol were added to the dispersed medium when mixed with the *Azadirachta Indica* extract, *Ocimum Sacntum* extract, *Aloe Barbabdensis miller* geland Cween 80 while continuous stirring. Add the peppermint oil, orange oil in the mixture for fragrance. Remaining quantity of water was added and the neutralized to the pH using 10% 0.1 M NaOH Solution with continuous stirring for 10 minutes [11, 12].

Formulation of Under-eye Gel

Ingredient Used	Scientific Name	Plant Part	Role of Ingredient	F1 (%) (10 g)	F2 (%) (10 g)	F3 (%) (10 g)	F4 (%) (10 g)	F5 (%) (10 g)
Neem Liquid Extract	*Azadirachta indica*	Leaves	Antibacterial, Antifungal	0.50	0.50	0.50	0.50	0.50
Panch Tulsi	*Ocimum spp.*	Leaves	Antimicrobial, Immunomodulatory	0.50	0.50	0.50	0.50	0.50
Aloe vera Gel	*Aloe barbadensis miller*	Leaves	Moisturizer, Healing Agent	6.00	6.00	6.00	6.00	6.00
Peppermint Oil	*Mentha piperita*	Leaves	Cooling Agent, Fragrance	0.03	-	0.03	-	0.03
Orange Oil	*Citrus sinensis*	Orange Peel	Fragrance, Antioxidant	-	0.03	-	0.02	-
Glycerin	-	-	Humectant, Moisturizer	0.50	0.50	0.50	0.50	0.50
Propylene Glycol	-	-	Solvent, Humectant	0.50	0.50	0.50	0.50	0.50
Carbopol 934	-	-	Gelling Agent, Thickener	0.05	0.10	0.20	0.30	0.20
NaOH Solution (10%)	-	-	pH Adjuster	~0.02-0.05	~0.02-0.05	~0.02-0.05	~0.02-0.05	~0.02-0.05
Purified Water	-	-	Solvent, Base Medium	1.72	1.72	1.72	1.72	1.72
Cween 80	-	-	Emulsifier, Surfactant	0.50	0.75	1.00	1.25	1.25

Evaluation

A. Physical Evaluation

Colour, Odour, texture and state of the gel were all evaluated in this test [12, 13].

B. pH

pH was measured using the digital pH meter. 0.5 gm gel was spread in 50 ml purified water.

C. Viscosity

At a temperature of 25 ℃, the viscosity of the gel was done using the Brookfield Viscometer with the spindle No. L4 at 60 RPM [14, 19].

D. Irritancy Test

On the left-dorsal hand surface, make a (1cm^2) mark. The gel was then topically applied to the surface and the time was recorded. Then, for up to 24 hours, it is evaluated for irritancy and edema, if any, and reported [20, 21, 22, 23].

E. Wash Ability

To evaluate the gel removal ease, the area where it was applied was rinsed with tap water.

F. Spread Ability [24, 25]

The spread ability was measured by the time it took two glass slides to slip away from the gel, which was placed between the slides, under a specific force. The better spread ability, the less time it takes to separate the two slides. Two sets of standardized glass slides were taken. The gel mixture was then placed on a slide of appropriate size. This test was evaluated by placing about 1gm of the formulation on a glass slide. Take another glass slide of the same length and place above it. A mass of 500 gm was put on the glass slides and spreads at a certain distance. Time taken for the gel to travel the distance from place of its position was noted down. Spread ability was determined by the formula [26, 27, 28]

$$S=M\times L/T$$

Where,
S= Spread ability
M= Mass of the weight
L= Length of the glass
T= Time

Results

Table A: Organoleptic Evaluation

S. No.	Formulation Code	Colour	Odour	Texture	State
1	F1	Orange	Peppermint	Smooth	Liquid
2	F2	Yellow	Orange	Smooth	Semi-Solid
3	F3	White	Peppermint	Smooth	Semi-Solid
4	F4	Orange	Orange	Smooth	Semi-Solid
5	F5	Orange	Peppermint	Smooth	Semi-Solid

Table B: pH

S. No.	Formulation Code	pH
1	F1	6.87
2	F2	6.55
3	F3	6.48
4	F4	6.36
5	F5	6.45

Table C: Viscosity

S. No.	Formulation Code	RPM	Viscosity (mPa.S)
1	F1	60	0.00
2	F2	60	1715.9
3	F3	60	4097.5
4	F4	60	5573.9
5	F5	60	6453.6

Table D: Irritancy Test

S. No.	Formulation Code	Irritant Effect	Edema
1	F1	No	No
2	F2	No	No
3	F3	No	No
4	F4	No	No
5	F5	No	No

Table E: Wash Ability

S. No.	Formulation Code	Wash ability
1	F1	Easily Washable
2	F2	Easily Washable
3	F3	Easily Washable
4	F4	Easily Washable
5	F5	Easily Washable

Table F: Spread Ability

S. No.	Formulation Code	Time (sec)	Length (cm)	Spread ability (g/cm^2)
1	F1	7	1.5	21.43
2	F2	9	2	22.22
3	F3	10	2.5	25.00
4	F4	10	2.5	25.00
5	F5	8	2	25.00

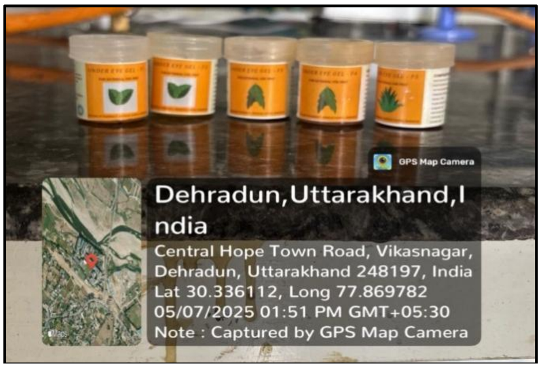

Fig A: Organoleptic Evaluation

Fig B: pH

Fig C: Viscosity

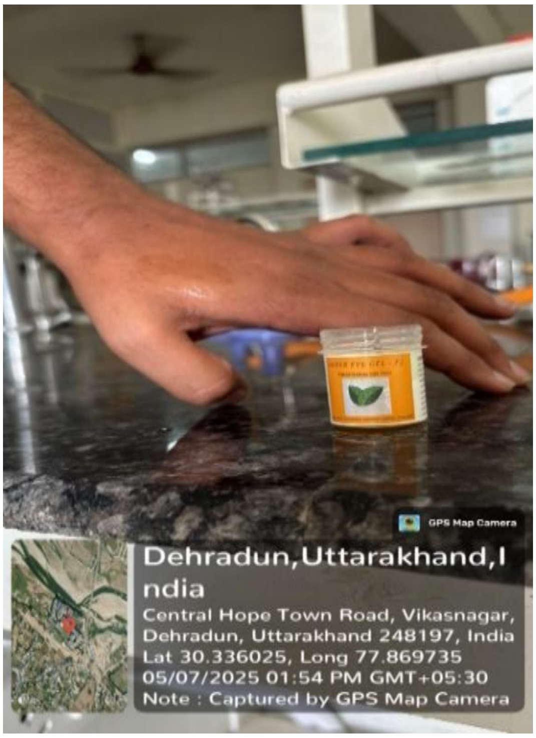

Fig D: Irritancy

Fig F: Spread Ability

Fig E: Wash Ability

Results

The evaluation of five under-eye gel formulations (F1-F5) revealed distinct properties. F4, with 0.3% Carbopol 934 and orange oil, showed optimal characteristics: a smooth, semi-solid texture, orange color, and pleasant odor. It recorded a pH of 6.36, viscosity of 5573.9 mPa.s, no irritancy or edema, and excellent wash ability. Spread ability was 25.00 g/cm^3, indicating good applicability. F4 was the most stable and effective formulation.

Conclusion

The study successfully formulated and evaluated an under-eye gel, with formulation F4 demonstrating superior stability, safety, and efficacy. Incorporating neem, tulsi, and aloe-vera, F4 effectively addressed dark circles, puffiness, and skin hydration without irritation. These findings highlight the potential of herbal under-eye gels as safe, eco-friendly alternatives to synthetic cosmetics, warranting further exploration for commercial applications.

References

1. Saraf S, Saraf S. Cosmetoceuticals: A review. International Journal of PharmTech Research. 2007;1(2):1-15.
2. Semwal A, *et al.* Formulation and evaluation of a novel herbal gel of *Equisetum arvense* extract. Journal of Pharmacognosy and Phytochemistry. 2013;1(5):80-86.
3. Dweck AC. Herbal medicine for the skin: Natural choices for skincare and cosmetic products. Pharmaceutical Journal. 2002;268:741-744.
4. Mukherjee PK, Maity N, Nema NK, Sarkar BK. Bioactive compounds from natural resources against skin aging. Phytomedicine. 2011;19(1):64-73.
5. Rai M, Ingle AP, Pandit R. Natural products for the management of aging: The future of anti-aging therapy. Future Science OA. 2019;5(4):FSO413.
6. Negi A, Ghildiyal P, Suyal J, Dobhal K, Semwal A. Pharmacognostical studies and preliminary phytochemical investigation on the bark of *Bauhinia variegata* (Caesalpiniaceae). International Journal of Research in AYUSH and Pharmaceutical Sciences. 2017:155-161.
7. Bhatia R, Thapliyal K, Kumar D. Phytochemical and therapeutic aspects of *Morinda citrifolia* L. (Noni Plant): A review. Research Journal of Pharmacognosy and Phytochemistry. 2015;7(3):167-174.
8. Shriya P, Jahnavi Reddy B, Srilakshmi D, Professor A. Formulation and evaluation of poly herbal under eye derma gel. International Journal of Pharmaceutical Research and Applications. 2022;9:2249-7781.
9. Parmar RM, Khan MS. Formulation and evaluation of poly herbal under eye gel. International Journal of Research Trends and Innovation. 2023;8.
10. Park SR, Kim HJ, Park HK, Kim JY, Kim NS, Byun KS, *et al.* Classification by causes of dark circles and appropriate evaluation method of dark circles. Skin Research and Technology. 2016;22(3):276-283.
11. Magagnin Freitag F, Ferreira Cestari T. Parting thoughts: What causes dark circles under the eyes? Journal of Cosmetic Dermatology. 2007;6:211-217.
12. Singh S, Tiwari S, Maurya N. Formulation and evaluation of herbal under eye cream for dark circles reduction. International Journal of Pharmacy and Pharmaceutical Research. 2024;30.
13. Patil VS, Yadav SM, Zende NS, Murgude MM, Vakhariya RR, Magdum CS. Formulation and evaluation of poly herbal under eye cream. International Journal of Creative Research Thoughts. 2022.
14. Scherer GW. Structure and properties of gels. Cement and Concrete Research. 1999;29(8):1149-1157.
15. Mizuno H, Hachiya M, Ikeda A. Structural, mechanical, and vibrational properties of particulate physical gels. Journal of Chemical Physics. 2021;155(23):234903.
16. Valentin D, Ratnasari D, Az-zahraa A, Cahyani TN, Shella TP, Adzkia MA. Antioxidant activity of gel formulations containing various plant leaf extracts: A review. Jurnal Pijar Mipa. 2025;20(1):141-147.
17. Hamie H, Yassine R, Shoukfeh R, Turk D, Huq F, Moossavi M. A review of the efficacy of popular eye cream ingredients. International Journal of Women's Dermatology. 2024;10(2):e156.
18. Kawee-ai A. Advancing gel systems with natural extracts: Antioxidant, antimicrobial applications, and sustainable innovations. Gels. 2025;11(2):125.

19. Abdalla Gadien L, Karim Abdel Karim AM, Suliman E, Tajeldeinn Ahmaed D. Formulation, characterization and stability study of *Azadirachta indica* (Neem) fruits extract. World Journal of Pharmacy and Pharmaceutical Sciences. 2019;8(1):209-221.
20. Islas JF, Acosta E, G-Buentello Z, Delgado-Gallegos JL, Moreno-Treviño MG, Escalante B, *et al.* An overview of neem (*Azadirachta indica*) and its potential impact on health. Journal of Functional Foods. 2020;74:104171.
21. Shendage RB, Chikkodi PB. Formulation and evaluation of herbal soap. International Journal of Advanced Research in Science, Communication and Technology. 2024;30 May:211-217.
22. Pradhan D, Biswasroy P, Haldar J, Cheruvanachari P, Dubey D, Rai VK, *et al.* A comprehensive review on phytochemistry, molecular pharmacology, clinical and translational outfit of *Ocimum sanctum* L. South African Journal of Botany. 2022;150:342-360.
23. Ahmed IA, Mikail MA, Zamakshshari N, Abdullah ASH. Natural anti-aging skincare: Role and potential. Biogerontology. 2020;21(3):293-310.
24. The therapeutic action of Queen of Herb (*Ocimum tenuiflorum*). American Journal of Pharmacy and Health Research. 2021;9(12).
25. Liu C, Cui Y, Pi F, Cheng Y, Guo Y, Qian H. Extraction, purification, structural characteristics, biological activities and pharmacological applications of acemannan, a polysaccharide from *Aloe vera*: A review. Molecules. 2019;24:1554.
26. Sánchez M, González-Burgos E, Iglesias I, Gómez-Serranillos MP. Pharmacological update properties of *Aloe vera* and its major active constituents. Molecules. 2020;25:1324.
27. VL V, Kumar SM. Formulation and evaluation of herbal under eye derma gel. International Journal of Recent Scientific Research. 2021;12(12):6352.
28. Sandeep DS, Nayak P, Jose J, Rishal Relita M, Sumana DR. Formulation and evaluation of antibacterial herbal gels of *Murraya koenigii* leaves extract. Research Journal of Pharmacy and Technology. 2017;10(6):1798-1801.