

FORMULATION & EVALUTION OF HERBAL MOISTURIZING CREAM WITH UV PROTECTION

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Abstract—The present study was aimed at formulation and evaluation of a herbal moisturizing cream with UV protection using natural herbal ingredients possessing moisturizing, antioxidant, soothing, and photoprotective properties. Herbal cosmetics are becoming increasingly popular due to their safety, effectiveness, biocompatibility, and fewer side effects compared to synthetic cosmetic products. Continuous exposure of skin to sunlight, environmental pollution, and harmful ultraviolet (UV) radiation may cause dryness, premature aging, pigmentation, irritation, and various skin disorders. Therefore, the development of herbal formulations capable of providing both moisturizing and UV protective effects has gained significant importance in cosmetic and pharmaceutical fields.

In the present work, herbal ingredients such as Aloe Vera, Turmeric, Green Tea, Carrot Seed Oil, and Almond Oil were selected because of their beneficial effects on skin. Aloe vera acts as an excellent moisturizer and soothing agent, turmeric possesses antioxidant and anti-inflammatory properties, green tea provides antioxidant and photoprotective activity, carrot seed oil acts as a natural UV protective agent, and almond oil nourishes and softens the skin.

The herbal cream was prepared by fusion method using suitable excipients such as beeswax, stearic acid, glycerin, methyl paraben, and rose water. The prepared formulation was evaluated for various physicochemical parameters including appearance, color, odor, pH, homogeneity, spreadability, viscosity, washability, irritancy, stability, and SPF value. Phytochemical screening was also performed to identify the presence of important chemical constituents such as flavonoids, tannins, phenolic compounds, saponins, terpenoids, and antioxidants.

The evaluation results revealed that the formulated cream showed smooth texture, good consistency, satisfactory spreadability, acceptable pH, easy washability, and good stability without phase separation. The irritancy test indicated that the formulation was non-irritating and safe for topical application. The phytochemical evaluation confirmed the presence of active herbal constituents responsible for antioxidant and UV protective activities. The formulation also demonstrated moderate SPF value due to the presence of antioxidant-rich herbal ingredients.

The study concluded that the formulated herbal moisturizing cream possesses effective moisturizing, antioxidant, and UV protective properties and can be considered a safe, economical, eco-friendly, and effective alternative to marketed synthetic creams for routine skin care and protection against environmental damage.

Index Terms—Herbal moisturizing cream, UV protection, Herbal cosmetics, Antioxidant activity, Photoprotective activity, Moisturizing effect, Herbal formulation, Skin care, Natural cosmetics, Phytochemical evaluation

I. Introduction

Skin is the largest and one of the most important organs of the human body. It acts as a protective barrier between the internal body tissues and the external environment. The skin protects the body from harmful microorganisms, dust, chemicals, environmental pollutants, and ultraviolet (UV) radiation from

sunlight. Healthy skin plays an important role in maintaining body temperature, preventing water loss, and protecting the body from physical and chemical damage. However, continuous exposure to environmental factors such as sunlight, pollution, dry climate, and harsh chemicals may lead to various skin problems including dryness, irritation, inflammation, pigmentation, wrinkles, premature aging, and skin infections.

Among various environmental factors, ultraviolet radiation is considered one of the major causes of skin damage. UV radiation mainly consists of UVA, UVB, and UVC rays. UVC rays are generally absorbed by the ozone layer, while UVA and UVB rays reach the earth's surface and affect the skin. UVB rays are mainly responsible for sunburn and skin tanning, whereas UVA rays penetrate deeper into the skin and cause premature aging, wrinkles, and long-term skin damage. Excessive exposure to UV radiation may also increase the risk of skin cancer. Therefore, protection of skin from UV radiation has become essential in modern skin care therapy.

Moisturizing creams are semisolid cosmetic preparations designed to maintain hydration and softness of the skin. Moisturizers help reduce water loss from the skin surface and improve smoothness and elasticity of skin. They form a protective layer over the skin and prevent dryness, roughness, and irritation. A good moisturizing cream should provide effective hydration without producing greasiness or irritation. Nowadays, moisturizing creams with UV protective activity are widely used to protect skin from both dryness and harmful effects of sunlight.

Commercially available marketed creams often contain synthetic chemicals such as parabens, mineral oils, silicones, artificial colors, and synthetic fragrances. Prolonged use of such products may produce adverse effects including skin irritation, allergy, redness, itching, and sensitivity. Due to these drawbacks, people are becoming more interested in herbal and natural cosmetic products. Herbal cosmetics are formulations containing naturally derived ingredients obtained from plants.

In the present study, herbal ingredients such as Aloe Vera, Turmeric, Green Tea, Carrot Seed Oil, and Almond Oil were selected because of their beneficial properties for skin care.



Aloe vera is widely used as natural moisturizer due to its hydrating, soothing, cooling, and wound healing properties. It contains vitamins, minerals, amino acids, enzymes, and polysaccharides that help maintain moisture balance of skin. Turmeric contains curcumin which possesses strong antioxidant, anti-inflammatory, and antimicrobial properties. It helps protect skin from oxidative damage and improves complexion.



Green tea is rich in polyphenols and catechins which exhibit excellent antioxidant and photoprotective activities. These compounds help protect skin from harmful effects of UV radiation and prevent

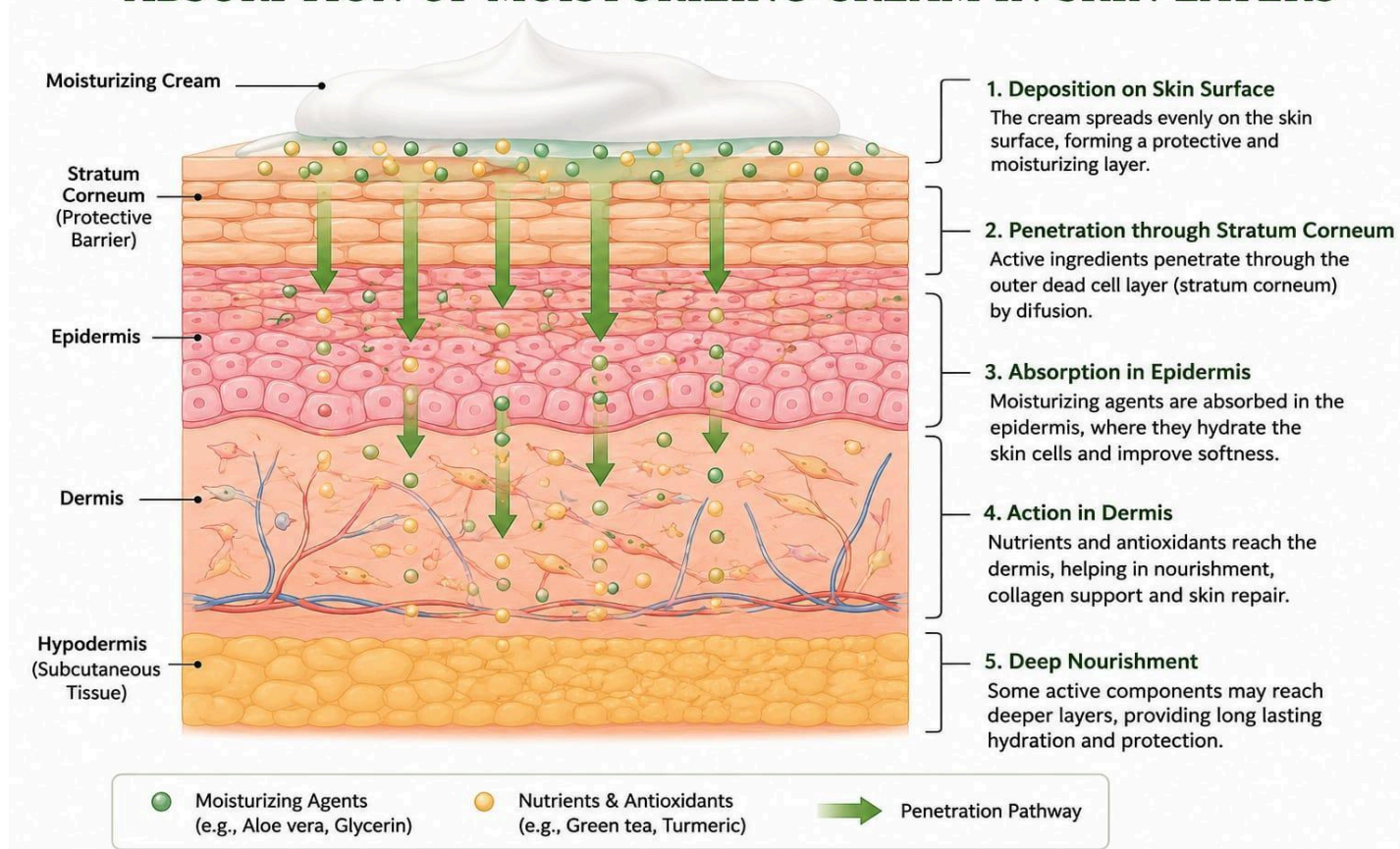
premature aging. Carrot seed oil contains carotenoids and vitamin A which provide natural UV protective and skin rejuvenating effects. Almond oil acts as an emollient and nourishes skin due to the presence of fatty acids and vitamin E.

Creams are generally prepared as emulsions consisting of oil phase and aqueous phase. Depending upon the type of emulsion, creams may be oil-in-water or water-in-oil. Oil-in-water creams are more suitable for cosmetic use because they are non-greasy, easily washable, and provide better patient acceptability. The stability and effectiveness of cream formulations depend upon proper selection of ingredients and preparation method.

Evaluation of herbal creams is necessary to ensure their quality, stability, safety, and effectiveness. Parameters such as appearance, pH, viscosity, spreadability, homogeneity, washability, irritancy, stability, and SPF value are commonly evaluated for cosmetic formulations. Phytochemical screening is also performed to identify active chemical constituents responsible for therapeutic activity.

The present work was therefore undertaken to formulate and evaluate a herbal moisturizing cream with UV protection using natural herbal ingredients possessing moisturizing, antioxidant, soothing, and photoprotective properties. The study aims to develop a safe, effective, economical, and eco-friendly herbal cosmetic formulation suitable for routine skin care and protection against environmental damage and harmful UV radiation.

ABSORPTION OF MOISTURIZING CREAM IN SKIN LAYERS



Moisturizing Cream Works on Skin Layers

1. Action on Stratum Corneum (Outer Layer)

- This is the outermost protective layer of skin.
- Moisturizing cream spreads on this layer and forms a protective film.
- It prevents water loss from the skin surface.
- Ingredients like Aloe Vera and glycerin keep this layer hydrated and soft.

2. Action on Epidermis

- Active ingredients slowly penetrate into the epidermis.
- The cream supplies moisture and nutrients to skin cells.
- Antioxidants from Green Tea and Turmeric protect cells from free radical damage.
- Skin becomes smoother, healthier, and less dry.

3. Action on Dermis

- Some active components reach the dermis layer.
- Almond Oil nourishes skin tissues and improves elasticity.
- Antioxidants support collagen and help reduce wrinkles and premature aging.
- Blood circulation and skin repair improve.

Aim and Objectives

Aim

The main aim of the present study was to formulate and evaluate a herbal moisturizing cream with UV protection using natural herbal ingredients possessing moisturizing, antioxidant, soothing, and photoprotective properties. The study was undertaken to develop a safe, stable, effective, and skin-friendly herbal cosmetic formulation that provides hydration to the skin while protecting it from harmful ultraviolet radiation and environmental damage.

The formulation was designed using herbal ingredients such as Aloe Vera, Turmeric, Green Tea, Carrot Seed Oil, and Almond Oil because of their beneficial effects on skin care, antioxidant activity, and natural UV protective properties. The aim of the study was also to prepare an economical and eco-friendly alternative to synthetic marketed cosmetic creams which may produce adverse effects after long-term use.

Objectives

1. To formulate a herbal moisturizing cream

The primary objective of the study was to prepare a semisolid herbal cream using suitable natural ingredients and excipients by the fusion method.

2. To provide moisturizing effect

The formulation was intended to maintain hydration of the skin, prevent dryness, and improve smoothness and softness of skin.

3. To provide UV protection

Another important objective was to incorporate herbal ingredients possessing natural photoprotective and antioxidant activity to protect skin from harmful ultraviolet radiation.

4. To use natural herbal ingredients

The study aimed to replace harmful synthetic chemicals with natural herbal ingredients that are safer, biodegradable, and more compatible with skin.

5. To evaluate physicochemical properties

The prepared cream was evaluated for various parameters such as:

Appearance Color

Odor pH

Homogeneity Spreadability Viscosity Washability

to ensure quality and acceptability of the formulation.

6. To evaluate stability of formulation

The objective was to determine physical stability of the cream under different storage conditions and observe any changes in texture, color, odor, or phase separation.

7. To perform phytochemical evaluation

Phytochemical screening was carried out to identify active chemical constituents such as flavonoids, tannins, phenolic compounds, saponins, and terpenoids present in the herbal formulation.

8. To evaluate irritancy and safety

The study aimed to ensure that the prepared cream is non-irritating, safe, and suitable for topical application on skin.

9. To determine antioxidant activity

The formulation was evaluated for antioxidant activity because antioxidants help reduce oxidative stress and skin damage caused by UV radiation and environmental pollutants.

10. To develop an economical and eco-friendly product

Another objective was to prepare a cost-effective herbal cosmetic formulation that can serve as an alternative to marketed synthetic creams and reduce environmental impact

11. To improve skin health naturally

II. Literature Review

According to **Pandey Shivanand et al.**, herbal cosmetics have gained significant importance in recent years because they are safer and produce fewer side effects compared to synthetic cosmetic products. Herbal creams prepared using natural ingredients provide better skin compatibility, antioxidant activity, and moisturizing effect. Their study highlighted the growing demand for herbal formulations due to increasing awareness regarding harmful effects of synthetic chemicals.

Mithal B. M. reported that moisturizers play an important role in maintaining skin hydration and preventing

transepidermal water loss. According to the study, creams prepared using natural oils and herbal extracts improve skin smoothness and elasticity without causing irritation. Herbal creams were also found to possess better patient acceptability due to their soothing and nourishing properties.

According to **Kokate C. K.**, medicinal plants contain phytoconstituents such as flavonoids, tannins, alkaloids, phenolic compounds, and terpenoids that exhibit antioxidant, antimicrobial, and anti-inflammatory activities. These phytochemicals are useful in cosmetic formulations because they help protect skin from oxidative stress and environmental damage.

Draelos Zoe Diana explained that continuous exposure to ultraviolet radiation causes skin damage including dryness, premature aging, wrinkles, and pigmentation. The study emphasized the importance of topical formulations containing antioxidants and UV protective agents to minimize harmful effects of sunlight on skin.

According to **Surjushe Amar et al.**, Aloe Vera possesses moisturizing, wound healing, anti-inflammatory, and soothing properties due to the presence of vitamins, enzymes, amino acids, and polysaccharides. Aloe vera gel helps maintain skin hydration and improves skin texture, making it an important ingredient in cosmetic preparations.

Aggarwal Bharat B. reported that Turmeric contains curcumin which exhibits strong antioxidant and anti-inflammatory properties. Curcumin helps neutralize free radicals produced by UV radiation and protects skin from oxidative damage and premature aging.

According to **Cabrera Carmen et al.**, Green Tea is rich in catechins and polyphenols which provide excellent antioxidant and photoprotective activity. Green tea extract was found effective in reducing UV-induced skin damage and improving overall skin health.

Mishra A. P. stated that Carrot Seed Oil possesses antioxidant and natural UV protective properties due to the presence of carotenoids and vitamin A. The oil helps rejuvenate skin and reduce harmful effects of ultraviolet radiation.

According to **Ahmad Z.**, creams prepared as oil-in-water emulsions provide better spreadability, washability, and non-greasy texture compared to water-in-oil formulations. Proper selection of emulsifying agents and excipients improves stability and effectiveness of cosmetic creams.

Herbal Drugs

1. Aloe Vera



Biological Source:

Aloe vera gel is obtained from the fresh leaves of *Aloe barbadensis* Miller belonging to family Liliaceae.

Chemical Constituents:

Aloe vera contains polysaccharides, vitamins (A, C, E, B12), amino acids, enzymes, minerals, lignin, and saponins.

Uses:

Acts as a natural moisturizer

Provides cooling and soothing effect

Helps in wound healing

Reduces skin irritation and inflammation

Protects skin from dryness

Role in Formulation:

Aloe vera was used in the formulation for its moisturizing, soothing, and antioxidant properties. It improves skin hydration and maintains softness of skin.

3.Green Tea:



Biological Source:

Green tea is prepared from the dried leaves of *Camellia sinensis* belonging to family Theaceae.

Chemical Constituents:

Green tea contains catechins, polyphenols, flavonoids, caffeine, tannins, and vitamins.

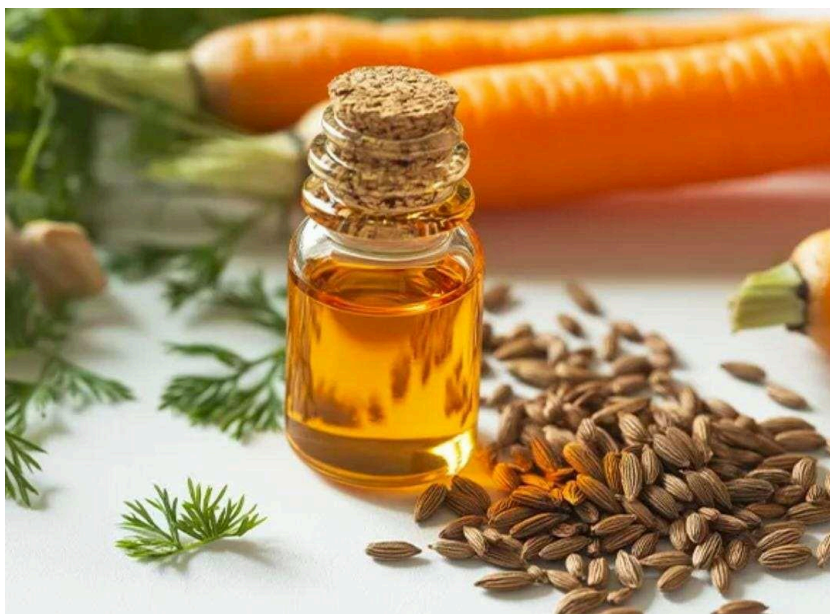
Uses:

Strong antioxidant activity Protects skin from UV radiation Prevents premature aging Reduces inflammation Improves skin health

Role in Formulation:

Green tea extract was used due to its antioxidant and photoprotective properties. Polyphenols present in green tea help neutralize free radicals and reduce UV-induced skin damage.

4.Carrot See Oil



Biological Source:

Carrot seed oil is obtained from seeds of *Daucus carota* belonging to family Apiaceae. Chemical Constituents It contains carotenoids, vitamin A, beta-carotene, flavonoids, and essential oils.

Uses:

- Provides natural UV protection Acts as antioxidant Rejuvenates skin
- Improves skin tone Reduces signs of aging Role in Formulation:
- Carrot seed oil was incorporated for its natural SPF and antioxidant activity. It enhances UV
- protective property of the cream.

[1] Materials and Methodology

Materials Used

Sr. No.	Ingredient	Category	Quantity
1	Aloe vera gel	Moisturizer	12 g
2	Turmeric extract	Antioxidant	1 g
3	Green tea extract	UV protective antioxidant	3 g
4	Carrot seed oil	Natural UV protective agent	4 ml

5	Almond oil	Emollient	8 ml
6	Beeswax	Thickening agent	6 g
7	Stearic acid	Emulsifying agent	5 g
8	Glycerin	Humectant	5 ml
9	Methyl paraben	Preservative	0.2 g
10	Rose water	Perfume vehicle	2 ml
11	Distilled water	Vehicle	q.s to 60 g

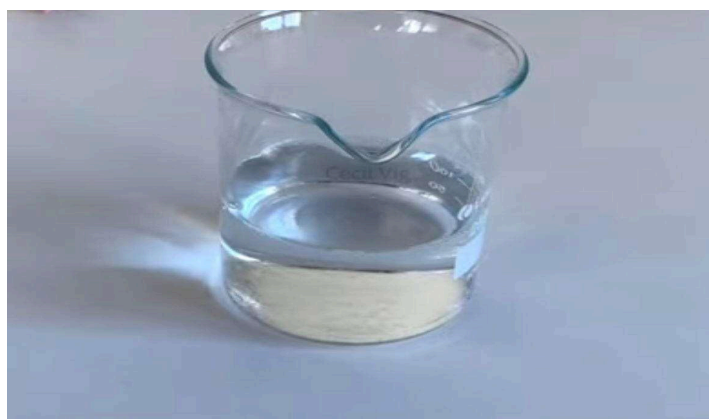
III. Method of Preparation

The herbal moisturizing cream was prepared by the fusion method.

1. Preparation of Oil Phase:

Beeswax, stearic acid, and almond oil were taken in a clean beaker and heated at about 70°C until completely melted.

2. Preparation of Aqueous Phase:



In another beaker, distilled water, glycerin, aloe vera gel, green tea extract, turmeric extract, and methyl paraben were mixed and heated to the same temperature.

3. Mixing Process:

The aqueous phase was slowly added to the oil phase with continuous stirring. Stirring was continued until a smooth and homogeneous cream was formed.



4. Addition of Fragrance:

Rose water and carrot seed oil were added after cooling the cream slightly to preserve their activity and aroma.

5. Packaging:

The prepared cream was transferred into clean and dry containers and stored

Evolution Parameters:

Parameter	Result
1) Physical appearance	White cream colour, smooth texture & thick consistency.
2) pH Determination	Between 5 to 5.5

3) Homogeneity	Cream is homogeneous & uniform
4) Spreadability	Good spreading ability
5) Washability	Easily washed with water
6) Stability study	Stable at room temperature. No phase separation at room temp.

IV. Chemical Constituents Determination Tests

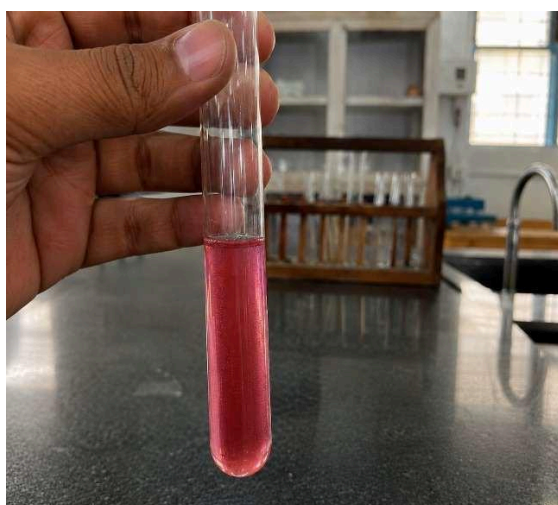
1. Test for Flavonoids (Green Tea and Turmeric)

- Procedure

- Take small quantity of cream in a test tube. Add 2 ml ethanol.
- Add magnesium ribbon and few drops of concentrated HCl.

- Observation

- Pink or red color indicates presence of flavonoids.



2. Test for Phenolic Compounds

● Procedure

- Take small quantity of cream.
- Dissolve in ethanol.
- Add few drops of ferric chloride solution.

● Observation

Blue-green or dark color indicates presence of phenolic compounds.



Difference Between Marketed Moisturizing Cream and Herbal Moisturizing Cream:

Basis	Marketed Moisturizing Cream	Herbal Moisturizing Cream
Ingredients	Contains synthetic chemicals and preservatives	Contains natural herbal ingredients
Safety	May cause irritation or allergy in sensitive skin	Generally safer and skin friendly
Side Effects	Possible redness, itching, dryness	Fewer side effects
Cost	Usually expensive	Economical
Moisturizing Effect	Provides temporary hydration	Provides natural and long-lasting hydration
UV Protection	Uses synthetic sunscreen agents	Uses natural UV protective herbs and oils

Antioxidant Activity	Limited antioxidant effect	Rich in natural antioxidants
Environmental Impact	May contain harmful chemicals	Eco-friendly and biodegradable
Skin Compatibility	May not suit all skin types	Better compatibility with skin
Examples of Ingredients	Parabens, silicones, synthetic fragrance	Aloe Vera, Turmeric, Green Tea
Long-Term Use	Continuous use may damage skin barrier	Suitable for regular use
Fragrance	Artificial fragrance	Natural fragrance
Nourishing Property	Less nourishing	Rich in vitamins and nutrients
Consumer Preference	Commercially popular	Increasing demand due to natural origin

V. Future Scope

The herbal cosmetic industry is growing rapidly due to increasing awareness regarding the harmful effects of synthetic chemicals and the benefits of natural products. Herbal moisturizing creams with UV protection have gained significant importance because they provide skin nourishment, hydration, antioxidant activity, and photoprotection with fewer side effects. The present formulation has good potential for future development and commercial application.

The prepared herbal moisturizing cream can be further improved by increasing its SPF value through incorporation of additional natural UV protective agents such as raspberry seed oil, zinc oxide, sandalwood, cucumber extract, licorice extract, or saffron extract. This may enhance protection against harmful ultraviolet radiation and improve the sunscreen efficiency of the formulation.

Advanced studies can be carried out to evaluate the long-term stability of the cream under different environmental conditions such as temperature, humidity, and light exposure. Microbiological stability studies may also be performed to ensure safety and shelf life of the formulation during storage.

Further clinical and dermatological studies can be conducted on human volunteers to evaluate skin compatibility, moisturizing effect, anti-aging activity, UV protection efficiency, and consumer acceptability on a larger scale. These studies may help establish the therapeutic and cosmetic effectiveness of the formulation scientifically.

Nanotechnology-based delivery systems such as nanoemulsions, liposomes, and herbal nanoparticles may be used in future to improve penetration of active ingredients into deeper skin layers and enhance bioavailability of herbal constituents. This may increase effectiveness and stability of the formulation.

The formulation may also be modified into different cosmetic dosage forms such as:

- Herbal sunscreen lotion
- Herbal cold cream
- Anti-aging cream
- Day cream
- Night cream
- Herbal body lotion
- Gel-based moisturizer
- Herbal face serum
- depending upon consumer requirements and skin types.

VI. Results and Discussion

Sr.No	Parameter	Result	Discussion
1	Appearance	Smoothcream	Suitable for topical application
2	Color	Light yellow	Due to herbal ingredients
3	Odor	Pleasant	Acceptable herbal fragrance
4	pH	6.2 – 6.8	Suitable for skin
5	Homogeneity	Uniform	No lumps or phase separation
6	Spreadability	Good	Easy to apply on skin
7	Washability	Good	Easily washable with water
8	Viscosity	Moderate	Proper consistency obtained
9	Irritancy Test	No irritation	Safe for skin application
10	Stability Study	Stable	No major changes during storage
11	Flavonoids Test	Positive	Shows antioxidant activity
12	Phenolic Test	Positive	Helps in UV protection
13	Tannins Test	Positive	Provides protective effect
14	Terpenoids Test	Positive	Supportsphotoprotectiveactivity
15	Antioxidant Activity	Positive	Reduces free radical damage

Sr.No	Parameter	Result	Discussion
16	Moisturizing Effect	Excellent	Skin remained soft and hydrated
17	UV Protection	Moderate	Herbal ingredients provided natural UV protection

VII. Conclusion

The present study successfully focused on the formulation and evaluation of a herbal moisturizing cream with UV protection using natural herbal ingredients such as Aloe Vera, Turmeric, Green Tea, Carrot Seed Oil, and Almond Oil. The formulation was prepared successfully by the fusion method and evaluated for various physicochemical and stability parameters.

The prepared cream showed smooth texture, good homogeneity, pleasant appearance, and acceptable consistency suitable for topical application. The pH of the formulation was found to be within the acceptable range of skin pH, indicating that the cream is safe and non-irritating. The cream also showed satisfactory spreadability, washability, and stability during storage studies.

The phytochemical evaluation confirmed the presence of important chemical constituents such as flavonoids, tannins, phenolic compounds, terpenoids, and antioxidants which are responsible for therapeutic and cosmetic benefits of the formulation. The antioxidant activity of the cream was mainly due to the presence of green tea polyphenols and curcumin from turmeric.

The formulation exhibited good moisturizing activity because aloe vera and almond oil helped maintain skin hydration and softness. Carrot seed oil, turmeric, and green tea contributed to the UV protective effect of the cream due to their natural antioxidant and photoprotective properties. The cream therefore helps protect skin from harmful ultraviolet radiation, oxidative stress, dryness, and premature aging.

The irritancy test showed no redness, itching, or inflammation, confirming that the formulation is skin friendly and suitable for regular use. Compared to marketed synthetic creams, the herbal formulation provides better skin compatibility with fewer side effects because of the use of natural ingredients.

Thus, the formulated herbal moisturizing cream can be considered safe, effective, economical, and eco-friendly for routine skin care. The study concludes that herbal ingredients can be successfully incorporated into cosmetic formulations to provide moisturizing, antioxidant, and UV protective benefits naturally. Further studies may be carried out to improve SPF value, enhance long-term stability, and evaluate clinical effectiveness on a larger scale.

References

- [1] Dutra EA, Oliveira DAGC, Hackmann KERM, Santoro MIRM. Determination of sun protection factor (SPF) of sunscreens by ultraviolet spectrophotometry, Brazilian Journal of Pharmaceutical Sciences. 2004;40(3):381-385.
- [2] Moyal D, et al. The revised COLIPA in vitro UVA method. International Journal of Cosmetic Science; c2012, 1-6.
- [3] COLIPA method for the in vitro determination of UVA protection provided by sunscreen products, COLIPA Guidelines; c2007.
- [4] Tuchinda C, Srivannaboon S, Lim HW. Photo protection by window glass, automobile glass, and sunglasses. Journal of the American Academy of Dermatology. 2006 May 1;54(5):845-54.
- [5] Bhatia S, Sharma K, Namdeo AG, Chaugule BB, Kavale M, Nanda S. Broad-spectrum sun-protective action of Porphyra-334 derived from Porphyra vietnamensis. Pharmacognosy Research. 2010;2(1):45.
- [6] Bhalke RD, Giri MA, Gangarde PB, Priyanka G. Ethnobotanical assessment of indigenous knowledge of plants used as sunscreen : A Comprehensive Review. 2021;10(2):1460-4.
- [7] Cefali LC, Ataide JA, Moriel P, Foglio MA, Mazzola 2016, 346-53.
- [8] Rai R, Deep A, Tasduq S. Journal of Ayurveda and Integrative Medicine Herbal products as skincare therapeutic agents against ultraviolet radiation-induced skin disorders. J Ayurveda Integr Med [Internet]. 2022;13(1):100500.
- [9] Tønnesen HH. Solubility, chemical and photochemical stability of curcumin in surfactant solutions. Studies of curcumin and curcuminoids, XXVIII. Die Pharmazie. 2002 Dec 1;57(12):820-4.
- [10] Leung AY. Encyclopedia of common natural ingredients used in food, drugs, and cosmetics. Wiley; c1980.
- [11] Manthey JA. Fractionation of orange peel phenols in ultra-filtered molasses and mass balance studies of their antioxidant levels. Journal of Agricultural and Food Chemistry. 2004 Dec 15;52(25):7586-92.
- [12] Vogler BK, Ernst E. Aloe Vera: A systematic review of its clinical effectiveness. British journal of general practice. 1999 Oct 1;49(447):823-8.
- [13] West DP, Zhu YF. Evaluation of Aloe Vera gel gloves in the treatment of dry skin associated with occupational exposure. American Journal of infection control. 2003 Feb 1;31(1):40-2.
- [14] Rajpal V. Standardization of botanicals: Testing and extraction methods of medicinal herbs. New Delhi, India: Eastern Publishers; c2002.
- [15] Daud FS, Kulkarni SB. Comparative evaluation of photo protective effect of Aloe Vera Tourn ex. Linn on UV damage in different Asian hair types. Indian Journal of Natural Products and Resources. 2011;2(2):179-183
- [16] Nevin KG, Rajamohan T. Beneficial effects of virgin coconut oil on lipid parameters and in vitro LDL oxidation. Clinical biochemistry. 2004;37(9):830-5.
- [17] Herzog B, Sohn M. The formula for best sunscreen performance: Beer-Lambert's law under the microscope. Challenges in Sun Protection. 2021;55:133-43.
- [18] Afaq F, Mukhtar H. Botanical antioxidants in the prevention of photo carcinogenesis and photo

- [19] .Wang ZY, Huang MT, Ferraro T, Wong CQ, Lou YR,Reuhl K, et al. Inhibitory effect of green tea in the drinking water on tumor genesis by ultraviolet light and 12-O-tetradecanoylphorbol-13-acetate in the skin of SKH-1 mice. *Cancer Research*. 1992 Mar 1;52(5):1162-70.
- [20] Rowe CR, Sheskey PJ, Owen SC. *Handbook of Pharmaceutical Excipients*, Fifth Edition,Pharmaceutical Press Publications division of the RoyalPharmaceutical Society of Great Britain UK; c2006
- [21] Mukherjee PK. *Quality control of herbal drugs: An approach to evaluation of botanicals*. Business Horizons; c2002.
- [22] Soni HK, Gandhi VJ, Bhatt SB, Shah UD, Shah VN. Evaluation of safety and efficacy of polyherbal fairness cream. *Int. Res. J. Pharm*. 2011;2(1):99-103.
- [23] Handali S, Hosseini H, Abdulghani A, Moghimipour E. Formulation and evaluation of an antibacterial cream from *Oxalis corniculata* aqueous extract. *Journal of -Microbiology* 2011; 4(4):255-260.
- [24] Smaoui S, Hlima HB, Chobba IB, Kadri A. Development and stability studies of sunscreen cream formulations containing three photo-protective filters. *Arabian Journal of Chemistry*. 2017;10:S1216-22.
- [25] Alanen E, Nuutinen J, Nicklén K, Lahtinen T, Mönkkönen J. Measurement of hydration in the stratum corneum with the Moisture Meter and comparison withthe Corneometer. *Skin Research and Technology*. 2004 Feb;10(1):32-7.
- [26] Ashwini K, Pandurangappa C. Solvothermal synthesis, characterization and photoluminescence studies of ZnS: Eu nanocrystals. *Optical Materials*. 2014;37:537-42.
- [27] Boonme P, Amnuaikit T. Effect of cream formulas on SPF values of sunscreen creams containing bemotrizinol and titanium dioxide as the actives. *Isan Journal of Pharmaceutical Sciences*. 2013;9(1):218.
- [28] Dutra EA, Oliveira DA, Hackmann KER, Santoro MI.Determination of sun protection factor (SPF) of sunscreens by ultraviolet spectrophotometry. *Revista Brasileira de Ciências Farmacêuticas*. 2004;40:381-5.
- [29] Kaur CD, Saraf S. In vitro sun protection factor determination of herbal oils used in cosmetics. *Pharmacognosy Research*. 2010 Jan;2(1):2.
- [30] Kanaze FI, Termentzi A, Gabrieli C, Niopas I, Georgarakis M, Kokkalou E. The phytochemical analysis and antioxidant activity assessment of orange peel (*Citrus sinensis*) ultivated in Greece-Crete indicates a new commercial source of hesperidin. *Biomedical Chromatography*. 2009 Mar;23(3):239-49