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Review Paper

Innovative Antioxidant Poly-Herbal Face Serum for Skin Brightening, Acne Management and UV Defence

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ABSTRACT

The growing demand for natural and safe cosmetic products has encouraged the development of herbal-based skincare formulations. The present study aimed to formulate and evaluate an innovative antioxidant poly-herbal face serum for skin brightening, acne management, and UV protection. The formulation was prepared using herbal extracts such as Glycyrrhiza glabra (Licorice), Curcuma longa (Turmeric), and Aloe barbadensis (Aloe vera), which are well known for their antioxidant, anti-inflammatory, and antimicrobial properties.The prepared formulations were evaluated for physicochemical parameters including colour, odour, texture, pH, spreadability, washability, viscosity, and greasiness. Phytochemical screening was performed to detect the presence of bioactive compounds such as alkaloids, flavonoids, carbohydrates, and phenolic compounds. Antioxidant activity of the formulation was determined using the DPPH radical scavenging assay.The results revealed that the formulated serum possessed suitable physicochemical properties with acceptable pH and viscosity. Phytochemical analysis confirmed the presence of important bioactive constituents responsible for therapeutic activity. The antioxidant study showed significant free radical scavenging activity, indicating its potential in protecting the skin from oxidative stress.The study concludes that the developed poly-herbal face serum can serve as an effective and safe natural formulation for improving skin brightness, reducing acne, and protecting the skin from UV-induced damage.

INTRODUCTION

Skin is the largest organ of the human body and serves as the primary protective barrier against environmental factors such as ultraviolet (UV) radiation, pollutants, microorganisms, and oxidative stress. Continuous exposure to these

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external factors can lead to various skin problems including dryness, premature aging, acne, pigmentation, inflammation, and loss of skin elasticity. Among these factors, oxidative stress caused by free radicals plays a significant role in skin damage and aging. Free radicals are unstable molecules that can damage cellular components such as lipids, proteins, and DNA, ultimately leading to deterioration of skin structure and function.In recent years, there has been a growing interest in herbal cosmetics due to their safety, effectiveness, and minimal side effects compared to synthetic cosmetic products. Herbal formulations utilize plant-derived ingredients rich in bioactive compounds such as flavonoids, phenols, alkaloids, and antioxidants that provide therapeutic benefits to the skin. These natural compounds possess antioxidant, anti-inflammatory, antimicrobial, and skin-protective properties which help maintain healthy skin and prevent various dermatological disorders.

Face serums are lightweight cosmetic formulations that contain concentrated active ingredients designed to penetrate deeper layers of the skin. Compared to conventional creams and lotions, serums have a thinner consistency and better absorption, allowing the active components to act more effectively. Face serums are widely used for multiple skin care purposes such as skin hydration, brightening, acne control, and protection against environmental damage.Polyherbal formulations combine extracts from multiple plants to enhance therapeutic efficacy through synergistic effects. The presence of various phytoconstituents in polyherbal preparations can provide multiple skin benefits such as antioxidant protection, improvement of skin tone, reduction of acne-causing bacteria, and prevention of premature aging. Antioxidants present in herbal extracts help neutralize free radicals and reduce oxidative damage to the skin cells.Phytochemical constituents such as flavonoids and phenolic compounds are particularly important in skin care formulations because of their strong antioxidant properties. These compounds can scavenge free radicals, protect skin cells from oxidative stress, and improve overall skin health. Additionally, alkaloids and carbohydrates present in herbal extracts may contribute to antimicrobial activity and skin nourishment.

The evaluation of herbal cosmetic formulations involves various physicochemical tests such as organoleptic evaluation, pH determination, viscosity measurement, spreadability, washability, and greasiness assessment. These parameters help determine the stability, usability, and compatibility of the product with human skin. Phytochemical screening is also important to identify the active constituents present in the extract. Furthermore, antioxidant activity can be determined using the DPPH radical scavenging assay, which is commonly used to evaluate the free radical scavenging potential of plant extracts.Considering the increasing demand for natural cosmetic products and the beneficial properties of herbal extracts, the present study was undertaken to formulate and evaluate an innovative polyherbal antioxidant face serum. The developed formulations were assessed for their physicochemical characteristics, phytochemical composition, and antioxidant activity. The aim of this research is to develop a safe and effective herbal serum that can contribute to skin brightening, acne management, and protection against oxidative stress and environmental damage.

2.MATERIALS AND METHODS

2.1 Materials

The herbal ingredients and other excipients used for the preparation of the polyherbal face serum were obtained from reliable sources and were of

analytical grade. Fresh plant materials were collected and processed to obtain the extracts used in the formulation. Distilled water was used as the solvent during extraction and formulation procedures.



Figure 1. Plant materials used in formulation

The main ingredients used in the formulation included herbal extracts possessing antioxidant, antimicrobial, and skin-protective properties along with suitable cosmetic base ingredients such as humectants, stabilizers, and preservatives. All chemicals and reagents used in the phytochemical analysis, including Dragendorff's reagent, Mayer's reagent, Wagner's reagent, Fehling's solution A and B, Benedict's reagent, ferric chloride, lead acetate solution, and DPPH reagent, were of laboratory grade.

2.2 Preparation of Herbal Extract

The selected plant materials were washed thoroughly with distilled water to remove dirt and impurities. The cleaned plant materials were then shade-dried at room temperature for several days until complete drying was achieved. The dried materials were pulverized using a mechanical grinder to obtain a coarse powder.

The powdered plant material was subjected to extraction using a suitable solvent by maceration method. In this process, the powdered material was soaked in an appropriate volume of solvent and kept for 24–48 hours with occasional shaking to facilitate extraction of bioactive compounds. The extract was then filtered using Whatman filter paper to remove solid particles.

The filtrate obtained was concentrated by evaporating the solvent to obtain a semi-solid extract. The extract was stored in an airtight container and used for further formulation studies.



Figure 2. Extraction of herbal ingredients

2.3 Formulation of Polyherbal Face Serum

Four different formulations of polyherbal face serum (F1, F2, F3, and F4) were prepared by varying the concentration of ingredients.

The preparation procedure involved the following steps:

1. Required quantities of herbal extracts were accurately weighed.
2. The base ingredients such as humectants and stabilizing agents were dissolved in distilled water with continuous stirring.
3. The herbal extracts were gradually added to the base solution and mixed thoroughly to ensure uniform distribution.
4. The mixture was stirred continuously using a magnetic stirrer until a homogeneous serum was obtained.
5. Preservatives and fragrance (if required) were added at the final stage of formulation.
6. The prepared serum was transferred into clean, airtight containers and labeled as F1, F2, F3, and F4.



Figure 3. Preparation of carbopol gel base



Figure 4. Mixing of herbal extracts



Figure 5. Final polyherbal face serum

3. Evaluation of Polyherbal Face Serum

3.1 Organoleptic Evaluation

The prepared formulations were evaluated for their physical characteristics including colour, odour, state, consistency, and texture. The evaluation was carried out by visual inspection and manual examination to determine the aesthetic properties of the serum.

3.2 Determination of pH

The pH of each formulation was measured using a calibrated digital pH meter. A small quantity of serum was diluted with distilled water and the electrode of the pH meter was immersed in the sample. The pH readings were recorded once the values stabilized. The measurements were performed to ensure compatibility of the formulation with the natural pH of the skin.

3.3 Spreadability Test

Spreadability of the serum was evaluated to determine its ease of application on the skin. A small amount of the formulation was placed between two glass slides and a specific weight was placed on the upper slide. The degree to which the formulation spread between the slides was observed and recorded as good or not good based on the spreading behavior.

3.4 Washability Test

Washability was determined by applying a small amount of the formulation on the skin and washing it with water. The ease with which the formulation was removed from the skin surface was observed and recorded.

3.5 Viscosity Determination

The viscosity of the prepared formulations was measured using a viscometer. The serum sample was placed in the viscometer and the viscosity was measured in centipoise (cp). Viscosity evaluation helps determine the thickness and flow characteristics of the formulation.

3.6 Greasiness Test

The greasiness of the formulation was evaluated by applying a small quantity of serum to the skin and observing the oily or greasy residue left on the surface. The formulations were assessed for their ability to absorb into the skin without leaving a greasy film.



Figure 6. Evaluation tests

4. Phytochemical Screening of Extract

Preliminary phytochemical screening was performed to identify the presence of various bioactive compounds in the herbal extract.

4.1 Detection of Alkaloids

Dragendorff's Test

The acidified extract was treated with a few milliliters of Dragendorff's reagent (potassium bismuth iodide solution). The formation of an orange-red precipitate indicated the presence of alkaloids.

Mayer's Test

The acidified extract was treated with Mayer's reagent (potassium mercuric iodide solution). The appearance of a white precipitate confirmed the presence of alkaloids.

Wagner's Test

The extract was treated with Wagner's reagent (iodine in potassium iodide solution). The formation of a reddish-brown precipitate indicated the presence of alkaloids.

4.2 Detection of Carbohydrates

Fehling's Test

One milliliter of filtrate was treated with Fehling's solution A and Fehling's solution B and heated in a water bath for one minute. Formation of a reddish-brown precipitate indicated the presence of carbohydrates.

Benedict's Test

Few drops of the filtrate were treated with Benedict's reagent and heated in a boiling water bath for two minutes. The formation of a red colour confirmed the presence of carbohydrates.

4.3 Detection of Flavonoids

Ferric Chloride Test

The extract was treated with neutral ferric chloride solution. Development of a green colour indicated the presence of flavonoids.

Lead Acetate Test

The extract was treated with 10% lead acetate solution. Formation of a yellow precipitate indicated the presence of flavonoids.

4.4 Detection of Phenols

Ferric Chloride Test

The extract was treated with 5% ferric chloride solution. The formation of a red colour confirmed the presence of phenolic compounds.

5. Antioxidant Activity

DPPH Radical Scavenging Assay

The antioxidant activity of the extract was determined using the DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay method. In this method, the extract sample was mixed with DPPH solution and incubated for a specific time period in the dark. The decrease in absorbance was measured using a spectrophotometer. The reduction in DPPH radical intensity indicated the free radical scavenging ability of the sample.
The presence of antioxidant activity suggested that the herbal extract may help in protecting the skin from oxidative damage caused by free radicals.

Preparation of Polyherbal Face Serum

The polyherbal face serum was formulated using a gel-based dispersion technique, which is commonly employed in cosmetic formulations to ensure uniform distribution of active ingredients and enhance the stability of the final product. This method helps in achieving a smooth consistency, proper hydration, and effective incorporation of herbal extracts.

Table No :1-Formulation of face serum

S.NO	INGREDIENTS	F1	F2	F3	F4
1.	Pomegranate peel extract (ml)	7.5	10.0	9.0	12.0
2.	Cape gooseberry leaf extract (ml)	7.5	5.0	6.0	3.0
3.	Aloe vera gel(g)	1.0	1.0	1.0	1.0
4.	Olive oil (ml)	2.5	2.5	2.5	2.5
5.	Rose oil (ml)	10.0	10.0	10.0	10.0
6.	Coconut oil (ml)	0.1	0.1	0.1	0.1
7.	Vitamin E oil(ml)	0.2	0.2	0.2	0.2
8.	glycerin (ml)	20	20	20	20
9.	Tween 20	1.2	1.2	1.2	1.2
10.	Sodium benzoate and potassium sorbate	0.3	0.3	0.3	0.3
11.	De- mineralized water	qs	qs	qs	qs

Methodology

Preparation of Gel Base

Initially, the gel base was prepared using Carbopol 940, a widely used polymer in cosmetic formulations due to its excellent thickening and stabilizing properties. The required quantity of Carbopol 940 was slowly dispersed in an adequate amount of distilled water under continuous stirring using a mechanical stirrer. Slow addition was maintained to avoid the formation of lumps and ensure uniform dispersion. After complete addition, the mixture was allowed to hydrate for approximately 30 minutes. During this period, Carbopol absorbed water and swelled to form a clear and consistent gel base, which serves as the foundation of the serum formulation.

Addition of Humectant

After the formation of the gel base, glycerin was incorporated into the dispersion. Glycerin acts as an effective humectant, which helps retain

moisture in the skin by attracting water from the environment and deeper layers of the skin. The addition of glycerin enhances the moisturizing and hydrating properties of the serum. It was added slowly to the gel base with continuous stirring to ensure proper mixing and uniform distribution.

Incorporation of Herbal Extracts

Following the addition of glycerin, the measured quantities of selected herbal extracts were gradually introduced into the gel base. These herbal extracts provide the therapeutic and cosmetic benefits of the formulation, such as antioxidant, anti-inflammatory, and skin-nourishing effects. The extracts were added slowly under continuous stirring to ensure even distribution of active constituents throughout the formulation and to prevent phase separation.

pH Adjustment

Once all the active ingredients were incorporated, the pH of the formulation was adjusted to make it suitable for skin application. Triethanolamine was added dropwise while continuously stirring the mixture. This neutralizes the Carbopol dispersion and converts it into a stable gel structure. The pH of the serum was carefully adjusted to a skin-compatible range of 5.0–6.5, which helps maintain the natural acid mantle of the skin and prevents irritation.

Addition of Preservatives and Fragrance

To ensure the microbiological stability of the product during storage and usage, suitable preservatives were added to the formulation. These preservatives help prevent the growth of microorganisms such as bacteria, fungi, and molds. After the addition of preservatives, a small quantity of fragrance was incorporated into the serum to enhance its cosmetic appeal and improve user acceptability.

Homogenization

The entire formulation was then subjected to homogenization for approximately 15–20 minutes using a homogenizer. This process ensured thorough mixing of all ingredients, resulting in a smooth, uniform, and stable polyherbal face serum with desirable consistency and texture.

Packaging and Storage

Finally, the prepared polyherbal face serum was carefully transferred into clean, dry, airtight containers to prevent contamination and moisture loss. The containers were properly sealed and stored at room temperature until further evaluation studies such as stability testing, pH analysis, viscosity measurement, and skin compatibility assessment were performed.

RESULTS AND DISCUSSION

Phytochemical Analysis of Extract

Preliminary phytochemical screening of the herbal extract was carried out to identify the presence of important bioactive constituents such as alkaloids, carbohydrates, flavonoids, and phenolic compounds. These phytochemicals are known to possess various biological activities including antioxidant, anti-inflammatory, and antimicrobial properties, which contribute to the therapeutic effectiveness of herbal cosmetic formulations such as face serums.

Detection of Alkaloids

Alkaloids are nitrogen-containing compounds that are widely distributed in medicinal plants and are known for their pharmacological activities, including antimicrobial and antioxidant effects.Three standard qualitative tests were performed for the detection of alkaloids, namely Dragendorff's test, Mayer's test, and Wagner's

test.In Dragendorff's test, the acidified extract was treated with Dragendorff's reagent (potassium bismuth iodide). The formation of an orange-red color indicated the presence of alkaloids in the extract.In Mayer's test, the acidified extract was treated with Mayer's reagent (potassium mercuric iodide), which produced a white precipitate, confirming the presence of alkaloids.Similarly, in Wagner's test, the extract was treated with Wagner's reagent (iodine solution in potassium iodide), resulting in the formation of a reddish-brown precipitate, which further confirmed the presence of alkaloids.The positive results obtained in all three tests indicate that the extract contains alkaloidal compounds, which may contribute to the biological activity of the formulation.

Detection of Carbohydrates

Carbohydrates play an important role in plant extracts and may contribute to skin hydration and nourishment when used in cosmetic formulations.The presence of carbohydrates was tested using Fehling's test and Benedict's test.

In Fehling's test, the filtrate was treated with Fehling's solution A and B and heated on a water bath for one minute. The formation of a reddish-brown color indicated the presence of reducing sugars.

In Benedict's test, the filtrate was treated with Benedict's reagent and heated in a boiling water bath for two minutes. The appearance of a red-colored solution confirmed the presence of carbohydrates in the extract.

These results demonstrate that the extract contains carbohydrate compounds, which may enhance the moisturizing and nourishing properties of the polyherbal face serum.

Detection of Flavonoids

Flavonoids are an important group of plant secondary metabolites known for their strong antioxidant activity, which helps protect the skin from oxidative stress and environmental damage.The presence of flavonoids in the extract was evaluated using Ferric Chloride test and Lead Acetate test.In the Ferric Chloride test, the addition of neutral ferric chloride solution to the extract resulted in the formation of a green color, indicating the presence of flavonoids.In the Lead Acetate test, the addition of 10% lead acetate solution produced a yellow coloration, which also confirmed the presence of flavonoids.The presence of flavonoids in the extract suggests that the formulation may provide antioxidant and skin-protective benefits, which are desirable properties in cosmetic products.

Detection of Phenols

Phenolic compounds are widely recognized for their antioxidant properties and their ability to protect the skin against free radical damage.The presence of phenols in the extract was determined using the Ferric Chloride test. When 5% ferric chloride solution was added to the extract, the appearance of a red color indicated the presence of phenolic compounds.The presence of phenolic compounds is significant because they contribute to the antioxidant potential of the extract, which may help in reducing oxidative stress and promoting healthy skin.

The preliminary phytochemical screening confirmed the presence of alkaloids, carbohydrates, flavonoids, and phenolic compounds in the herbal extract used for the preparation of the polyherbal face serum. These bioactive constituents are known for their beneficial effects on the skin, including antioxidant, antimicrobial, moisturizing, and protective activities.The presence of these phytochemicals supports the potential use of the extract as an active ingredient in cosmetic formulations. The antioxidant properties of flavonoids and phenolic compounds may help

protect the skin from free radical damage and environmental stress, while carbohydrates contribute to skin hydration.Overall, the phytochemical analysis indicates that the selected herbal extract possesses valuable bioactive compounds, which may enhance the effectiveness and therapeutic potential of the prepared polyherbal face serum. The polyherbal face serum formulations (F1, F2, F3, and F4) were successfully prepared using the Carbopol 940 gel base method. The formulations were evaluated for physicochemical parameters to ensure their suitability for topical application. Among the different evaluation parameters, the pH of the formulations was determined because it is an important factor that influences the stability of the formulation as well as skin compatibility.

pH Evaluation

The pH values of the prepared polyherbal face serum formulations were measured using a calibrated digital pH meter. The obtained results are presented in Table below.

Table No: 2- pH of Polyherbal Face Serum Formulations

Formulation	pH
F1	5.2
F2	5.5
F3	5.8
F4	6.0

The results showed that the pH values of all formulations ranged from 5.2 to 6.0. This range is considered suitable for topical cosmetic preparations because the normal pH of human skin is slightly acidic, typically between 4.5 and 6.5. Maintaining a pH within this range is essential to preserve the natural protective barrier of the skin and prevent irritation or dryness.Among the four formulations, F1 exhibited the lowest pH value (5.2), whereas F4 showed the highest pH value (6.0). The slight increase in pH from F1 to F4 may be attributed to variations in the concentration of ingredients and the amount of neutralizing agent used during the formulation process. The addition of triethanolamine played a significant role in neutralizing the Carbopol gel and adjusting the pH to an acceptable range. Formulations F3 and F4 showed pH values closer to the optimal skin-compatible range, indicating better suitability for topical application. The pH values also suggest that the prepared serum formulations are stable and safe for cosmetic use. Proper pH adjustment is important because highly acidic or highly alkaline formulations can disrupt the skin's natural barrier and lead to irritation.Overall, the pH evaluation confirms that all the prepared polyherbal face serum formulations possess acceptable physicochemical characteristics and are appropriate for skin application. The results indicate that the formulation method used in this study was effective in producing a stable and skin-friendly herbal cosmetic product.In conclusion, the prepared polyherbal face serum formulations demonstrated satisfactory pH values within the acceptable range for topical preparations, suggesting that the formulations are suitable for further evaluation and potential cosmetic applications.

Organoleptic Evaluation

The prepared polyherbal face serum formulations (F1, F2, F3, and F4) were evaluated for their organoleptic and physical characteristics, including colour, odour, state, consistency, and texture. These parameters are important in cosmetic formulations because they influence the appearance, stability, and user acceptability of the product.

The observations of different formulations are presented in the table below.

Table No:3- Organoleptic Evaluation of Polyherbal Face Serum Formulations

Ingredients/Parameters	F1	F2	F3	F4
Colour	Golden yellow	Pale yellow	Pale yellow	Crystal yellow
Odour	Pleasant odour	Pleasant odour	Pleasant odour	Pleasant odour
State	Liquid	Liquid	Liquid	Liquid
Consistency	Liquid	Liquid	Liquid	Liquid
Texture	Non-greasy	Non-greasy	Greasy	Greasy

The evaluation of the prepared formulations showed that all the polyherbal face serums were obtained in a liquid state with uniform liquid consistency, indicating proper mixing and dispersion of ingredients during the formulation process. The liquid consistency is desirable for face serums as it allows easy spreading, rapid absorption, and smooth application on the skin.

The colour of the formulations varied slightly among the different batches. Formulation F1 exhibited a golden yellow colour, while F2 and F3 showed pale yellow colour, and F4 appeared crystal yellow. These variations in colour may be attributed to differences in the concentration of herbal extracts and other formulation components. However, all the formulations maintained a visually acceptable appearance suitable for cosmetic products.All formulations exhibited a pleasant odour, which indicates that the fragrance used in the formulation was effective in masking any undesirable smell of herbal extracts. Pleasant fragrance is an important factor that enhances consumer acceptance and overall cosmetic appeal of the product.

Regarding texture, formulations F1 and F2 showed a non-greasy texture, which is considered highly desirable for face serums because it provides a light feel on the skin and allows quick absorption without leaving an oily residue. On the other hand, F3 and F4 exhibited a slightly greasy texture, which may be due to higher concentrations of certain ingredients such as humectants or oily components in the formulation.Overall, the organoleptic evaluation demonstrated that all formulations possessed acceptable physical characteristics, including pleasant odour, suitable colour, and uniform consistency. However, based on texture and cosmetic elegance, F1 and F2 were found to be more preferable due to their non-greasy nature, making them more suitable for topical facial application.

These results indicate that the prepared polyherbal face serum formulations have good physical stability and cosmetic acceptability, which are essential qualities for herbal cosmetic products.

Spreadability Test

Spreadability is an important parameter for topical formulations as it determines the ease with which the serum can be applied and distributed over the skin surface. Good spreadability ensures uniform application of the formulation and enhances patient or consumer compliance.The spreadability of the prepared polyherbal face serum formulations (F1, F2, F3, and F4) was evaluated and the results are presented in the table below.

Table No: 4 – Spreadability of Polyherbal Face Serum Formulations

Formulation	Specification
F1	Not good
F2	Good
F3	Not good
F4	Not good

The spreadability test results revealed variations among the different formulations. Among the four formulations, F2 exhibited good spreadability, indicating that the formulation spreads easily on the skin surface with minimal effort. Good

spreadability is desirable for cosmetic products such as face serums because it ensures uniform distribution of active ingredients and better skin coverage.On the other hand, formulations F1, F3, and F4 showed poor or not good spreadability. This may be due to differences in the concentration of gelling agents, humectants, or other formulation components that influence the viscosity and texture of the serum. Higher viscosity or slightly greasy texture may reduce the ability of the formulation to spread smoothly on the skin.

The better spreadability observed in F2 may be attributed to the optimal balance between the gel base, humectant, and herbal extracts, which resulted in a suitable consistency and improved application properties. In contrast, the other formulations might have comparatively thicker or less balanced compositions, leading to reduced spreadability.Overall, the results indicate that F2 formulation showed superior spreadability compared to the other formulations, making it more suitable for topical application as a face serum. Good spreadability enhances the cosmetic acceptability, ease of use, and effectiveness of the product.Thus, based on the spreadability test, F2 can be considered the most acceptable formulation among the prepared

Washability Test

Washability is an important parameter in evaluating cosmetic formulations, as it determines how easily the product can be removed from the skin using water. A formulation with good washability ensures convenience for the user and prevents residue buildup on the skin surface.

The washability of the prepared polyherbal face serum formulations (F1, F2, F3, and F4) was evaluated by applying a small quantity of each formulation on the skin and observing how easily it could be removed with water. The results obtained are presented in Table

Table No: 5 -Washability of Polyherbal Face Serum Formulations

Formulation	Specification
F1	Not good
F2	Good
F3	Good
F4	Easily washable (Good)

The results of the washability test indicated differences in the removal properties of the prepared formulations. Formulation F1 showed poor washability, meaning it was comparatively difficult to remove completely with water. This may be due to the presence of certain components in the formulation that increased its adherence to the skin.Formulations F2 and F3 demonstrated good washability, indicating that these formulations could be removed from the skin with relative ease using water. This suggests a balanced composition of ingredients that allows the formulation to remain stable during application while still being easily washable.

Among all the formulations, F4 exhibited the best washability, as it was easily removed from the skin without leaving any residue. This property is desirable for cosmetic formulations because it enhances user convenience and ensures that the product does not accumulate on the skin surface.Overall, the washability evaluation showed that F2, F3, and F4 possess acceptable washability properties, with F4 showing the most favorable result. Good washability contributes to improved cosmetic acceptability, user comfort, and ease of product removal, which are important factors in the development of topical herbal cosmetic formulations.

Viscosity Test

Viscosity is an important parameter in the evaluation of topical formulations such as face serums. It determines the flow property, consistency, and ease of application of the product on the skin. Appropriate viscosity ensures that the

formulation spreads easily while remaining stable during storage and use.The viscosity of the prepared polyherbal face serum formulations (F1, F2, F3, and F4) was measured using a viscometer, and the results are presented in Table

Table No: 6 -Viscosity of Polyherbal Face Serum Formulations

Formulation	Viscosity (cp)
F1	2100
F2	2180
F3	2320
F4	2400

The viscosity results indicated that the prepared formulations exhibited viscosity values ranging from 2100 to 2400 cp, which is suitable for serum-based topical formulations. The viscosity gradually increased from F1 to F4, suggesting that slight variations in ingredient concentration influenced the thickness of the formulation.Among the formulations, F1 showed the lowest viscosity (2100 cp), indicating a relatively thinner consistency. In contrast, F4 exhibited the highest viscosity (2400 cp), which indicates a comparatively thicker formulation. The increase in viscosity may be attributed to differences in the concentration of the gelling agent (Carbopol 940) and other components present in the formulations.

Formulation F2 and F3 showed moderate viscosity values (2180 cp and 2320 cp respectively), which may provide a good balance between flowability and stability. Appropriate viscosity is important because very low viscosity may lead to excessive flow and poor retention on the skin, while very high viscosity may reduce spreadability and ease of application.Overall, the viscosity evaluation demonstrated that all the prepared polyherbal face serum formulations possess acceptable viscosity values suitable for topical application. The results also indicate that the formulation process was successful in producing serums with stable and uniform consistency. Among the formulations, F2 and F3 showed balanced viscosity characteristics, which may contribute to better application properties and overall cosmetic acceptability.

Greasiness Test

Greasiness is an important parameter in evaluating topical cosmetic formulations, particularly face serums, as it influences the skin feel, absorption, and overall user acceptability of the product. A non-greasy formulation is generally preferred because it provides a light feel on the skin and allows faster absorption without leaving an oily residue.The greasiness of the prepared polyherbal face serum formulations (F1, F2, F3, and F4) was evaluated by applying a small amount of each formulation on the skin and observing the presence or absence of any oily or greasy film. The results are presented in Table.

Table No: 7 -Greasiness of Polyherbal Face Serum Formulations

Formulation	Specification
F1	Non greasy
F2	Non greasy
F3	Non greasy
F4	Non greasy

The results of the greasiness test indicated that all the formulations (F1, F2, F3, and F4) exhibited a non-greasy nature. This suggests that the prepared polyherbal face serums are light in texture and do not leave any oily residue on the skin after application.The non-greasy property of the formulations may be attributed to the use of appropriate concentrations of gelling agents and humectants, which help maintain a balanced consistency without producing an oily feel. Non-greasy formulations are highly desirable in cosmetic products, particularly face serums, because they enhance skin comfort, improve absorption, and increase consumer acceptability.

Furthermore, the absence of greasiness indicates that the formulations are suitable for different skin types, including normal, oily, and combination skin. A non-greasy serum also allows the skin to

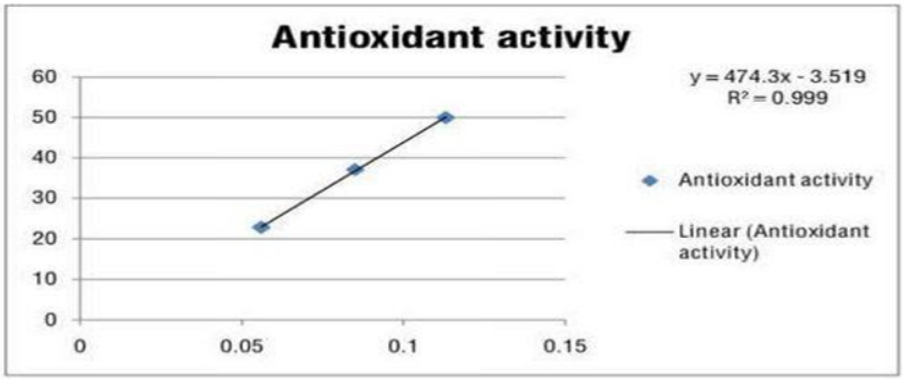
feel fresh and smooth without clogging pores or causing heaviness on the skin surface.Overall, the greasiness evaluation confirmed that the prepared polyherbal face serum formulations possess excellent cosmetic properties with a light, non-greasy texture, making them suitable for regular topical application.

Antioxidant Test (DPPH Assay Method)

The antioxidant activity of the formulated poly-herbal face serum was evaluated using the DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay method. This method is widely used to determine the free radical scavenging ability of plant extracts and herbal formulations. The principle of the assay is based on the reduction of the deep purple coloured DPPH radical to a yellow coloured compound when it reacts with antioxidant molecules present in the sample.

During the experiment, the DPPH solution showed a noticeable colour change from deep purple to yellow after the addition of the formulated serum sample. This colour change indicates the presence of antioxidant activity in the formulation. The reduction in colour intensity confirms that the active phytoconstituents present in the herbal extracts were capable of scavenging free radicals.The observed antioxidant activity can be attributed to the presence of bioactive phytochemicals such as flavonoids, phenols, and other polyphenolic compounds detected during phytochemical screening. These compounds are well known for their ability to donate hydrogen atoms or electrons to free radicals, thereby neutralizing them and preventing oxidative damage.

Sl. No.	Parameters	Unit	Result	Test Method
1	Antioxidant Activity			
	IC 50 Value	%	51.11	CKL/ANL/UV-004



The herbal ingredients used in the formulation, particularly pomegranate peel extract and Physalis peruviana leaf extract, are reported to contain high levels of phenolic compounds and flavonoids. These phytochemicals play an important role in protecting the skin from oxidative stress caused by environmental factors such as UV radiation, pollution, and free radicals. Oxidative stress is one of the major causes of premature skin ageing, hyperpigmentation, inflammation, and acne formation.

CONCLUSION

The present study focused on the formulation and evaluation of a polyherbal face serum using selected herbal extracts incorporated into a gel-based system. The serum was successfully prepared using the Carbopol 940 gel dispersion method, which ensured uniform distribution of the active herbal ingredients and provided a smooth, stable formulation suitable for topical application. During the preparation process, Carbopol 940 was used as the gelling agent to form a stable base,

while glycerin acted as a humectant to enhance the moisturizing properties of the formulation. The herbal extracts were incorporated carefully to ensure even distribution of their active constituents, which are responsible for providing beneficial effects such as skin nourishment, hydration, and protection. The pH of the formulations was adjusted using triethanolamine to maintain a skin-compatible range, which is essential for avoiding irritation and maintaining the natural balance of the skin.

The evaluation of the prepared formulations showed that the pH values ranged from 5.2 to 6.0, which falls within the acceptable range for skin application (5.0–6.5). This indicates that all the formulations are suitable for topical use and are unlikely to cause skin irritation. Among the formulations, F3 and F4 showed pH values closer to the natural pH of the skin, suggesting better compatibility and stability compared to the other formulations.

Overall, the prepared polyherbal face serum demonstrated good physicochemical characteristics, appropriate pH, and satisfactory consistency, indicating that the formulation method used in this study is effective for developing herbal cosmetic products. The use of natural herbal ingredients in the serum may provide additional benefits such as antioxidant, moisturizing, and skin-soothing effects, making it a promising cosmetic preparation for improving skin health.

In conclusion, the study successfully formulated a stable and skin-friendly polyherbal face serum that meets the basic quality requirements for cosmetic application. Further studies such as stability testing, skin irritation studies, and efficacy evaluation may be carried out to confirm the long-term safety, effectiveness, and commercial potential of the formulation.

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