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PREPARATION AND PRIMARY EVALUATION OF WOUND HEALING CREAM FROM ANDROGRAPHIS ECHIOIDES NEES

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ABSTRACT

The present study focused on the formulation and evaluation of a herbal skin cream incorporating an aqueous extract of *Andrographis echioides Nees*. A preliminary phytochemical screening of the extract revealed the presence of carbohydrates, steroids, glycosides, flavonoids, proteins, terpenoids, phenolic compounds, and tannins, confirming its potential therapeutic properties. Various cream formulations (F1 to F5) were prepared using different gelling agents and excipients. The physical and chemical characteristics of the creams—including pH, viscosity, spreadability, washability, greasiness, and thermal stability—were assessed. All formulations demonstrated homogeneity, good consistency, non-greasiness, and easy washability. Importantly, no irritancy or microbial growth was observed, and FT-IR analysis confirmed the compatibility of the plant extract with various excipients. Stability studies conducted over three months under accelerated conditions (40 ± 2 °C/75 ± 5% RH) showed no significant variations in appearance, pH, or other critical parameters. Overall, the study suggests that the developed herbal creams, particularly formulation F4, are stable, safe, and effective for topical application.

KEYWORDS: *Andrographis echioides Nees,* Herbal Cream, Wound Healing.

1. INTRODUCTION

Cosmetics are the substances intended to be applied to the human body for cleansing, beautifying, promoting attractiveness, and altering the appearance without affecting the body's structure or functions. But the usage of synthetic products becomes very harmful from long time for the youth as well as our environment. Various synthetic compounds, chemicals, dye and their derivative proved to cause various skin diseases having numerous side effects. Thus we are using herbal cosmetics as much as possible. The basic idea of skin care cosmetic lies deep in the Siddha, Ayurveda, Unani and Homeopathic system of medicine. These are the products in which herbs are used in crude or extract form.

1.1 TOPICAL DRUG DELIVERY SYSTEMS

Topical preparations are used for the localized effects at the site of their application by virtue of drug penetration into the underlying layers of skin or mucous membranes. The main advantage of topical delivery system is to bypass first pass metabolism. Avoidance of the risks and inconveniences of intravenous therapy and of the varied conditions of absorption, like pH changes, presence of enzymes, gastric emptying time are other advantage of topical preparations. Semi-solid formulation in all their diversity dominate the system for topical delivery, but foams, spray, medicated powders, solution, and even medicated adhesive systems are in use.

The topical drug delivery system is generally used where the others system of drug administration fails or it is mainly used in pain management, contraception, and urinary incontinence. Over the last decades the treatment of illness has been accomplished by administrating drugs to human body via various routes namely oral, sublingual, rectal, parental, topical, inhalation etc. Topical drug delivery can be defined as the application of a drug containing formulation to the skin to directly treat cutaneous disorders (e.g. acne) or the cutaneous manifestations of a general disease (e.g. psoriasis) with the intent of confining the pharmacological or other effect of the drug to the surface of the skin or within the skin. Topical activities may or may not require intra-cutaneous penetration or deposition. Topical drug delivery systems include a large variety of pharmaceutical dosage form like semisolids, liquid preparation, sprays and solid powders. Most widely used semisolid preparation for topical drug delivery includes gels, creams and ointments.

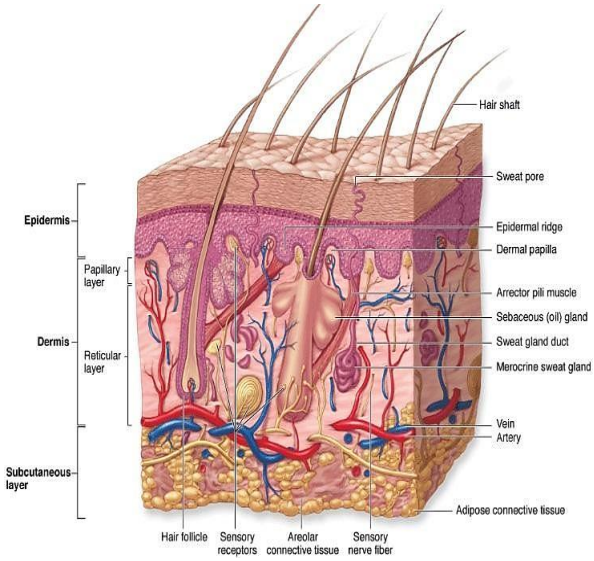


Fig. 1: Human Skin.

1.2 CREAM

Creams are semi-solid emulsions which contain mixtures of oil and water. Their consistency varies between liquids and solids. Salve (medical ointment for soothing purpose) and unguent (soothing products) preparations in earlier days led to the development of cleansing and cold creams. With the help of additives such as emulsifying agents and newer techniques, the preparation of creams has become easy.

Classification

Creams are classified according to their functions. They are:

1. Cleansing and Cold Creams.
2. Foundation and Vanishing Creams.
3. Night and Massage Creams.
4. Hand and Body Creams.
5. All-purpose Creams is Cleansing and Cold Creams.

Fig. 2: Wound Healing Cream.

2. PLANT PROFILE

Scientific classification of plant can be defined as "The arrangement of entities of that plant" in a hierarchical series of nested classes, in which similar or related classes at one hierarchical level are combined comprehensively into more inclusive classes at the next higher level. The scientific classification of *Andrographis echioides* is as follows.

Andrographis echioides Nees is an important medicinal plant which belongs to the family Acanthaceae. Some of the species under this family are having similar morphological characters, growth habits, phytochemical constituents, and their pharmacological activity etc. The different parts of plants in this family consist of flavones and diterpenes as major active constituents. Andrographis echioides have been reported for their analgesic, anti-inflammatory and antipyretic activity, hepato-protective activity, anti-oxidant and anti-

microbial activities. Flavones and flavanoids are the responsible active constituents for mentioned activities.

2.1 TAXONOMICAL CLASSIFICATION

- **Botonical Name** : Andrographis echioides (L) Nees
- **Synonyms**: Justicia echioides, Indoneesiella echioides
- **Domain** : Eukaryota
- **Kingdom** : Plantae
- **Subkingdom** : Viridaeplantae
- **Phylum** : Tracheophyta (Vascular Plants)
- **Subphylum** : Euphyllophytina
- **Infraphylum** : Radiatopses
- **Class** : Magnoliopsida (Dicotyledons)
- **Subclass** : Lamiidae
- **Superorder** : Lamianae
- **Order** : Scrophulariales
- **Family** : Acanthaceae - Acanthus Family
- **Subfamily** : Acanthoideae
- **Genus** : Andrographis
- **Species** : echioides
- **Botanical name** : Andrographis echioides Nees

2.2 VERNACULAR NAMES

A vernacular name of a species can be defined as name that is used generally within a community. It is differentiated with the scientific name for the same species. The synonyms for vernacular names are common name, colloquial name, and popular name. The various vernacular names of the plant *Andrographis echioides* are as follows.

- **English :** False Water willow
- **Tamil :** Gopuram tangi
- **Hindi :** Charayetah
- **Malayalam :** Pitumba, Mala kulukki
- **Telugu :** Chalavala puri kada
- **Marathi :** Ranchimani
- **Oriya :** Lavalata
- **Gujarati :** Kalukariyatun

2.3 CHEMICAL CONSTITUENTS

Andrographis echioides (a plant belonging to the Acanthaceae family) is known for its traditional medicinal uses and is reported to contain several bioactive phytochemical constituents. While it's less studied than *Andrographis paniculata*, some important chemical constituents identified in *Andrographis echioides* include:

Phytochemical Constituents of *Andrographis echioides*

1. **Flavonoids**
   - Quercetin
   - Kaempferol
   - Apigenin

   (Antioxidant, anti-inflammatory properties)
2. **Phenolic Compounds**
   - Tannic acid
   - Gallic acid

   (Antioxidant, antimicrobial)
3. **Steroids and Sterols**
   - β-sitosterol

   (Anti-inflammatory, cholesterol-lowering effects)
4. **Glycosides**
   - Iridoid glycosides

   (Hepatoprotective, anti-inflammatory)
5. **Terpenoids and Triterpenoids**
   - Lupeol
   - Ursolic acid

   (Anti-inflammatory, wound healing)
6. **Saponins**
7. **Proteins and Amino Acids**
8. **Alkaloids**
9. **Carbohydrates.**

2.4 MEDICINAL USES

Anti-inflammatory Activity

- Used in the treatment of swelling, joint pain, and other inflammatory conditions.
- Helps in reducing redness and edema when applied topically in creams or pastes.

Wound Healing

- Promotes tissue regeneration and wound closure.
- Traditionally applied on cuts, burns, and ulcers.

Antimicrobial and Antibacterial

- Effective against certain bacterial strains.
- Used in treating minor skin infections and preventing microbial growth.

Antioxidant

- Neutralizes free radicals, preventing oxidative stress and skin aging.
- Useful in skin-care formulations for anti-aging purposes.

Hepatoprotective *(Liver-protective)*

- Traditionally used in herbal combinations for liver disorders.
- Protects liver cells from toxins and supports detoxification.

Antidiabetic Activity

- Some studies suggest it may help reduce blood glucose levels.
- Requires further clinical validation.

Antipyretic and Analgesic

- Used to reduce fever and relieve mild pain.
- Decoctions made from the plant were traditionally given during fever.

Skin Disorders

- Used to treat eczema, boils, acne, and rashes.
- Often included in herbal creams or ointments for dermal issues.

Immune Modulation

- Supports the immune system; may enhance resistance to infections.
- Often used in general tonics.

Fig. 3: Andrographis Echioides.

3. MATERIALS AND METHODS

3.1 SOXHLET EXTRACTION OR HOT CONTINUOUS EXTRACTION

In this method, finely ground sample was placed in a porous bag or "thimble" made from a strong filter paper or cellulose. Extraction solvent i.e. aqueous was heated in the bottom flask, vaporizes into the sample thimble, condenses in the condenser and drip back. When the liquid content reaches the siphon arm, the liquid contents emptied into the bottom flask again and the process was continued. The final aqueous extract is collected.

Fig. 4: Extract.

3.2 Formulation Of *Andrographis Echioides Nees* Herbal Cream.

Table No. 1: Formulation Of Herbal Cream.

S.NO	INGREDIENT	F1	F2	F3	F4	F5
1	EXTRACT	5	5	5	5	5
2	CMC	2	-	-	-	-
3	AGAR	-	2.5	-	-	-
4	CARBAPOL	-	-	1.5	-	-
5	METHYL CELLULOSE	-	-	-	1	-
6	LIQUID PARAFFIN	5	5	5	5	5
7	STEARIC ACID	3	3	4	4	8
8	BEES WAX	5	5	6	6	7

9	STEARYL ALCOHOL	10	10	10	10	10
10	TWEEN – 80	8	8	7	7	3
11	METHYL PARABEN	0.12	0.12	0.12	0.12	0.12
12	SORBITOL	5	5	5	5	7
13	POTASSIUM HYDROXIDE	5	5	5	5	5
14	COLORING AGENT	Q.S	Q.S	Q.S	Q.S	Q.S
15	WATER	52	51	51	51	50

PROCEDURE: The formulation were done as per formula given in table No.14. The formulation containing *Andrographis echioides nees*, extract was formulated. The aqueous and oil phases were taken into beakers and heated to 75ºC over a water bath. The oil phase was comprised of extracts of *Andrographis echioides nees*, liquid paraffin, bees wax, stearyl alcohol, Tween-80 and stearic acid while the aqueous phase was composed of Polymers, methyl parabens, sorbitol solution and potassium hydroxide. Drop wise addition of the aqueous phase to the oil phase was done with constant stirring at 2000 rpm in a homogenizer for a period of 15 min. The homogenizer speed was then reduced to 1000 rpm and homogenization was continued for another 5 min. The speed was further reduced to 500 rpm and the homogenization extended for 5 min. Herbal skin cream containing *Andrographis echioides nees*, extract was formulated.

F1 AGAR

F2 CMC

F3 CARBOPOL

F4 METHYL CELLULOSE

F5 WITHOUT POLYMER

Fig. 5: Herbal Creams.

3.3 EVALUATION OF HERBAL CREAM

3.3.1 PHYTOCHEMICAL TEST

The Aqueous extracts of *Andrographis echioides nees* were subjected to the following preliminary phytochemical analysis.

- Test for Carbohydrates.
- Test for Alkaloids.
- Test for Steroids and Sterols.
- Test for Glycosides.
- Test for Saponins.
- Test for Flavonoids.
- Test for Tri-terpenoids.
- Test for Terpenoids.
- Tests for Tannins.
- Tests for Phenolic Compounds.
- Test for Gums and Mucilage.
- Test for Proteins and Amino acids.
- Test for Fixed Oils and Fatty acids.

3.3.2 PHYSICAL EVALUATION OF THE FORMULATION

The formulations were inspected visually for their appearance, colour and odour.

3.3.3 MEASUREMENT OF PH

The pH was measured using a pH meter, which was calibrated before each use with standard buffer solutions at pH 4, 7, 9. The electrode was inserted into the sample 10 minutes prior to taking the reading at room temperature.

3.3.4 VISCOSITY

The viscosity of the formulations was checked using a Brookfield Viscometer. The creams were rotated at 0.3, 0.6, 1.5 rotations per minute. The viscosity of the creams was obtained by multiplying the corresponding dial reading with the factor given in the Brookfield Viscometer catalogue.

3.3.5 TEST FOR THERMAL STABILITY

Thermal stability of the formulation was determined by the humidity chamber controlled at 60- 70% RH and 37 ± 1°C.

3.3.6 PATCH TEST

About 1-3gm of material to be tested was placed on a piece of fabric or funnel and applied to the sensitive part of the skin e.g. skin behind ears. The cosmetic to be tested was applied to an area of 1sq.m.of the skin. Control patches were also applied. The site of patch is inspected after 24 hrs.

3.3.7 SPREADABILITY

Spreadability is measured in terms of time in seconds taken by two slides to slip off from the cream when placed in between the slides under the direction of a certain load. The excess amount of sample was placed between the two glass slides and a definite amount of weight was placed on these glass slides to compress the glass slides of uniform thickness.

A weight of 70 g was added and the time required to separate the two slides was noted. Spreadability was calculated using the formula

S = M.L / T

Where,
M = wt tied to upper slide,
L = length of glass slides,
T = time taken to separate the slides.

3.3.8 TEST FOR MICROBIAL GROWTH IN FORMULATED CREAMS

Anti-Inflammatory Activity

Inhibition of albumin denaturation, anti-proteinase activity, human red blood cell membrane stabilization method and heat induced hemolysis assay were done according to standard positive control diclofenac sodium & negative control triton-x 100, with minor modifications.

3.3.9 IRRITANCY

Mark 1cm2 area on left hand dorsal. Cream was applied on that area and note that time. After interval up to 24 hours it is checked for irritant effect, erythema and edema if any then reported.

3.3.10 WASHABILITY

Apply small amount of cream on hand and wash it under running tap water.

3.3.11 PHASE SEPARATION

Prepared cream is kept in tightly closed container at room temperature away from sunlight and observed for 24 hours for 30 days for phase separation.

3.3.12 GREASINESS

The cream is applied in the form of smear on the surface of skin and observed if smear was oily or grease like. According to result, we can say that all 5 formulations.

3.3.13 HOMOGENEITY

It was found that the cream was homogeneous and smooth and consistent in nature.

3.3.14 DETERMINATION OF TYPE OF EMULSION

Dilution Test

In this test the emulsion is diluted either with oil or water. If the emulsion is o/w type and it is diluted with water, it will remain stable as water is the dispersion medium" but if it is diluted with oil, the emulsion will break as oil and water are not miscible with each other. Oil in water emulsion can easily be diluted with an aqueous solvent, whereas water in oil emulsion can be diluted with an oily liquid.

Dye Solubility Test

In this test an emulsion is mixed with a water soluble dye (amaranth) and observed under the microscope. If the continuous phase appears red, it means that the emulsion

is o/w type as the water is in the external phase and the dye will dissolve in it to give color. If the scattered globules appear red and continuous phase colorless, then it is w/o type. Similarly, if an oil soluble dye (Scarlet red C or Sudan III) is added to an emulsion and the continuous phase appears red, then it is w/o emulsion.

3.3.15 FOURIER TRANSFORM INFRARED SPECTROSCOPY (FTIR)

In order to check the integrity (Compatibility) of drug in the formulation, FT-IR spectra of the formulations along with the drug and other excipients were obtained and compared using FT-IR spectrophotometer.

In the present study, Potassium bromide (KBr) pellet method was employed. The samples were thoroughly blended with dry powdered potassium bromide crystals. The mixture was compressed to form a disc. The disc was placed in the spectrophotometer and the spectrum was recorded. The FT-IR spectra of the formulations were compared with the FT-IR spectra of the pure drug and the polymers.

An infrared spectrum of pure drug, mixture of drug with each retardant and physical mixture of optimized formulation was recorded using FTIR Spectrophotometer. The scanning range was 500–4000 cm^{-1} and the IR spectra of samples were obtained using KBr disc method. Any change in spectrum pattern of drug due to presence of polymers was investigated to identify any chemical interaction.

3.3.16 STABILITY

Stability testing of drug products begins as a part of drug discovery and ends with the demise of the compound or commercial product. To assess the drug and formulation stability, stability studies were done according to ICH guidelines. The stability studies were carried out as per ICH guidelines. The cream filled in bottle and kept in humidity chamber maintained at 40 ± 2°C / 75 ± 5 % RH for Three months. At the end of studies, samples were analyzed for the physical properties, pH and viscosity.

4. RESULTS AND DISCUSSION

4.1 Preliminary Phyto Chemical Investigation of Aqeuos Extract of Plants

Table No. 2: Phytochemical Analysis.

S. NO	CHEMICAL TEST	HERBAL CREAM
1	Carbohydrates	+
2	Alkaloids	-
3	Steroids and Sterols	+
4	Glycosides	+
5	Flavonoids	+
6	Saponins	-
7	Amino acid	-
8	Protein	+
9	Tri-terpenoids	-
10	Terpenoids	+
11	Gums and Mucilage	-
12	Phenolic compound	+
13	Tannins	+
14	Fixed Oils and Fatty acids	-

Alkaloids

Glycosides

Proteins

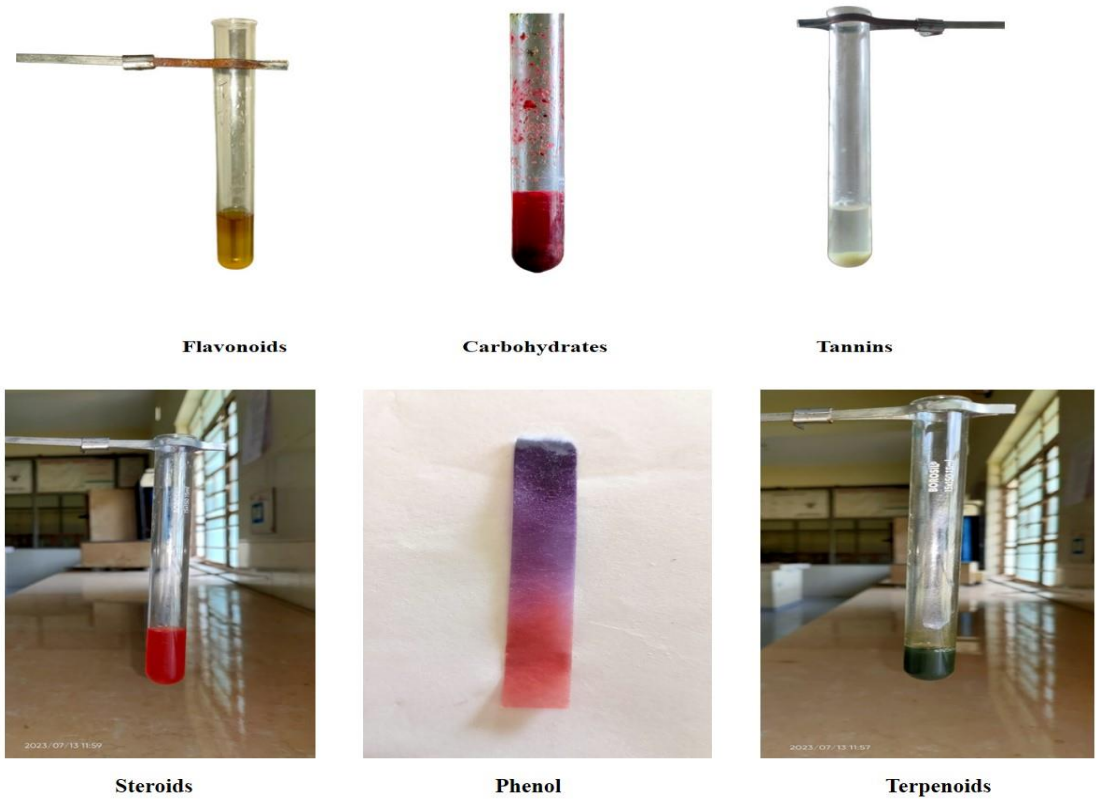


Fig. 6: Chemical Test.

4.2 PHYSICAL PROPERTIES OF CREAM

Table No. 3: Physical Properties Of Cream.

S.NO	F	COLOR	ODOUR	APPEARANCE	pH
1	F1	Dark pink	Characteristic	Semi-solid	6.5
2	F2	Light brown	Characteristic	Semi-solid	6.1
3	F3	Pale violet	Characteristic	Semi-solid	6.2
4	**F4**	**Milky white**	**Characteristic**	**Semi-solid**	**6.4**
5	F5	Pale yellow	Characteristic	Semi-solid	5.8

4.3 PHYSICAL EVALUATION OF CREAM

Table No. 4: Physical Evaluation Of Cream.

S.NO	F	THERMAL STABILITY	PHASE SEPARATION	GREASINESS	HOMOGENEITY
1	F1	Stable, No Separation	No phase separation	Non-greasy	Homogeneous
2	F2	Stable, No Separation	No phase separation	Non-greasy	Homogeneous
3	F3	Stable, No Separation	No phase separation	Non-greasy	Homogeneous
4	**F4**	**Stable, No Separation**	**No phase separation**	**Non-greasy**	**Homogeneous**
5	F5	Stable, No Separation	No phase separation	Non-greasy	Homogeneous

4.4 PHYSICAL PROPERTIES OF CREAM

Table No. 5: Physical Properties of Cream.

S.NO	FORMULATION	WASHABILITY	DILUTION TEST	DYE TEST
1	F1	Easily Washable	No Separation	O / W Type
2	F2	Easily Washable	No Separation	O / W Type
3	F3	Easily Washable	No Separation	O / W Type
4	**F4**	**Easily Washable**	**No Separation**	**O / W Type**
5	F5	Easily Washable	No Separation	O / W Type

4.5 SPREADABILITY

Table No. 6: Spreadability Of Cream.

S.NO	FORMULATION	TIME (Sec)	SPREADABILITY (g cm / sec)
1	F1	15	13.3
2	F2	14	13.5
3	F3	15	13.8
4	**F4**	**15**	**14.6**
5	F5	7	10.3

4.6 VISCOSITY

Table No. 7: Viscosity Of Cream.

S.NO	FORMULATION	VISCOSITY (RPM)		
		0.3	0.6	1.5
1	F1	7442	3976	1976
2	F2	7337	3853	1786
3	F3	7313	3906	1993
4	**F4**	**7531**	**3991**	**1885**
5	F5	6832	2893	1634

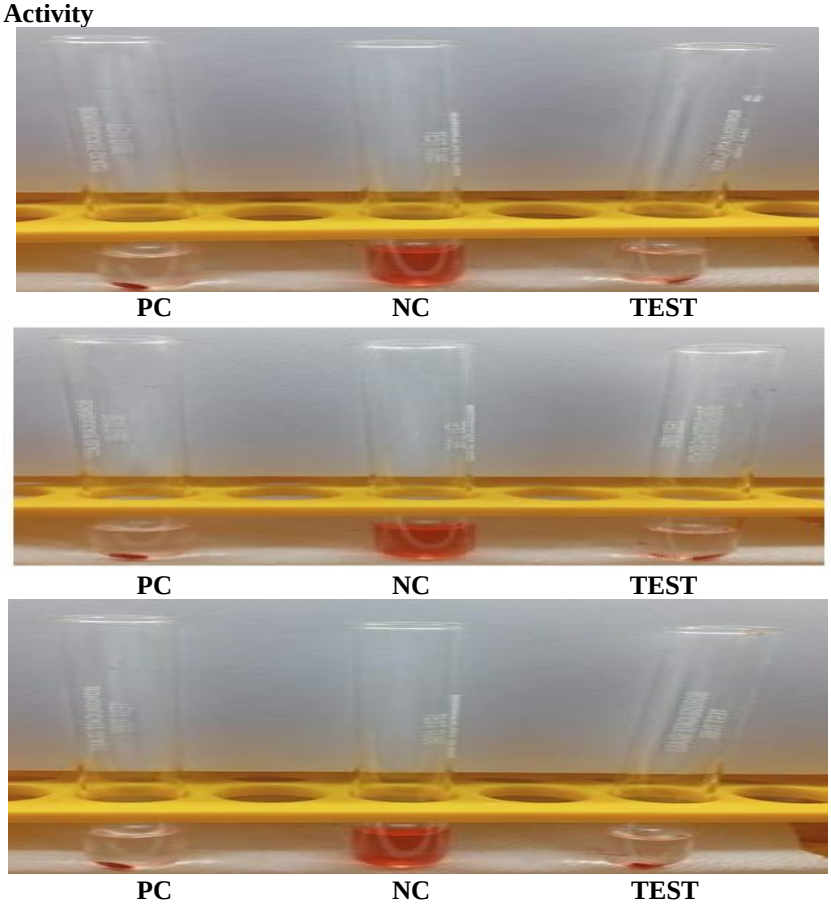
4.7 IRRITANCY

Table No. 8: Skin Irritation Study.

S.NO	FORMULATION	IRRITANT EFFECT	EDEMA	ERYTHYMA
1	F1	Nil	Nil	Nil
2	F2	Nil	Nil	Nil
3	F3	Nil	Nil	Nil
4	**F4**	**Nil**	**Nil**	**Nil**
5	F5	Nil	Nil	Nil

4.8 TEST FOR MICROBIAL GROWTH IN FORMULATED CREAMS

Anti-Inflammatory Activity



PC NC TEST

PC NC TEST

PC NC TEST

Fig. 7: Anti-Inflammatory.

Table No. 9: Anti-Inflammatory Activity

ANTI-INFLAMMATORY ACTIVITY

% Stabilization on HRBC (Human RBC) membrane of

Concentration	Compound	Positive Control (Diclofenac sodium)	Negative Control Triton X-100
25µg/mL	53.65	22.40	8.30
250µg/mL	66.15	33.07	5.02
500µg/mL	82.03	51.56	2.52

4.9 STABILITY STUDIES

Accelerated Stability Studies (After 1 Month)

Table No. 10: Accelerated Stability Studies (After 1 Month)

S. NO	F	COLOR	ODOUR	APPEARANCE	pH
1	F1	Dark pink	Characteristic	Semi-solid	6.5
2	F2	Light brown	Characteristic	Semi-solid	6.1
3	F3	Pale violet	Characteristic	Semi-solid	6.2
4	**F4**	**Milky white**	**Characteristic**	**Semi-solid**	**6.4**
5	F5	Pale yellow	Characteristic	Semi-solid	5.8

Accelerated Stability Studies (After 2 Month)

Table No. 11: Accelerated Stability Studies (After 2 Month).

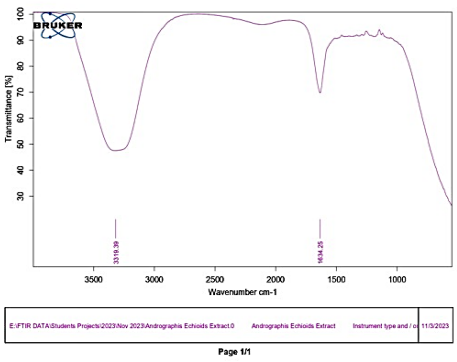
S.NO	F	COLOR	ODOUR	APPEARANCE	pH
1	F1	Dark pink	Characteristic	Semi-solid	6.4
2	F2	Light brown	Characteristic	Semi-solid	6.1
3	F3	Pale violet	Characteristic	Semi-solid	6.2
4	**F4**	**Milky white**	**Characteristic**	**Semi-solid**	**6.4**
5	F5	Pale yellow	Characteristic	Semi-Liquid	5.5

Accelerated Stability Studies (After 3 Month)

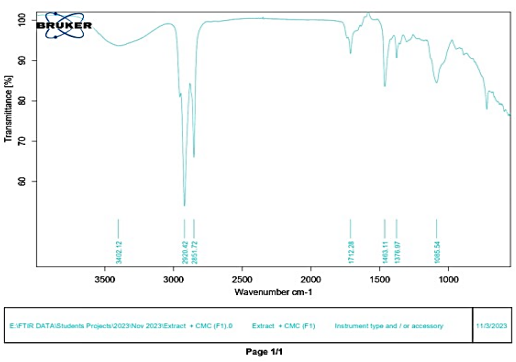
Table No. 12: Accelerated Stability Studies (After 3 Month).

S.NO	F	COLOR	ODOUR	APPEARANCE	pH
1	F1	Dark pink	Characteristic	Semi-solid	6.2
2	F2	Light brown	Characteristic	Semi-solid	6.1
3	F3	Pale violet	Characteristic	Semi-solid	6.0
4	**F4**	**Milky white**	**Characteristic**	**Semi-solid**	**6.4**
5	F5	Pale yellow	Characteristic	Semi-Liquid	5.3

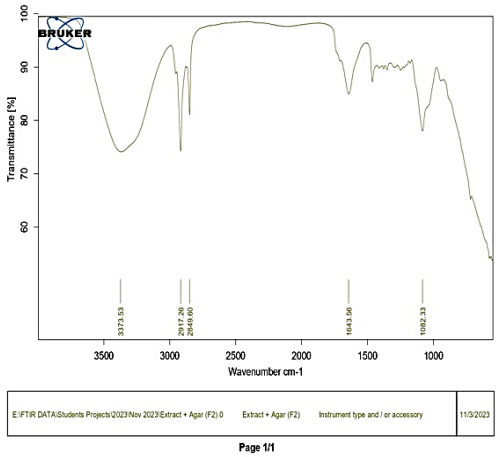
4.10 FT-IR



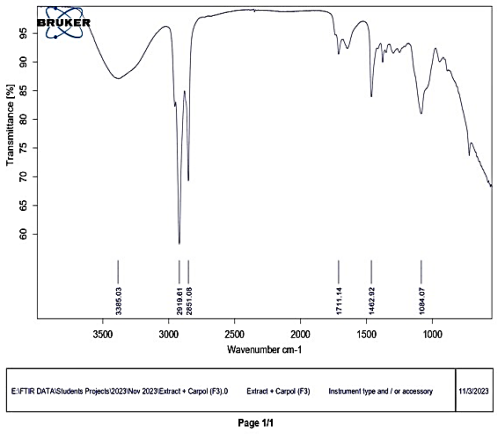
IR Spectrum of Andrographis Echioids Extract



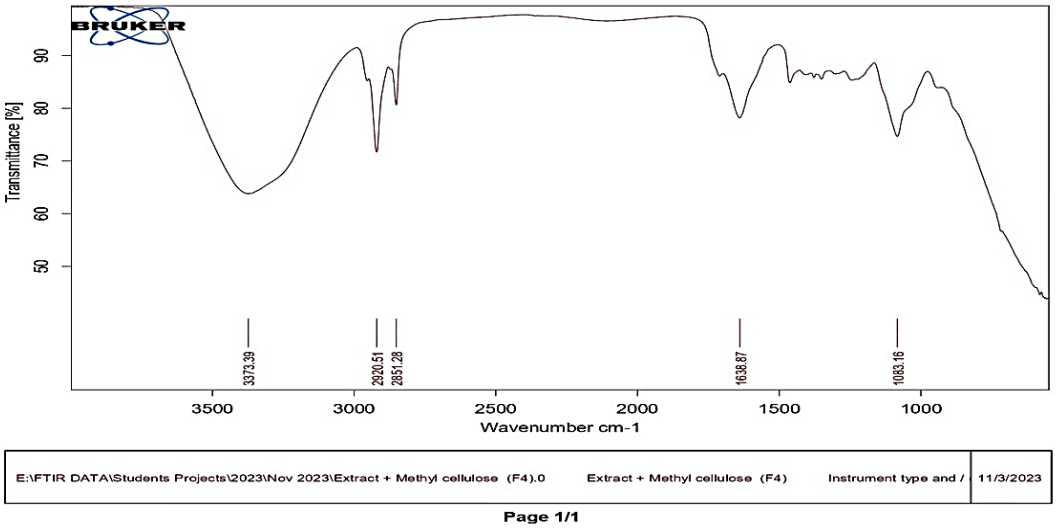
IR Spectrum of Extract + CMC F1



IR Spectrum of Extract + Agar F2



IR Spectrum of Extract + Carbopol F3



IR Spectrum of Extract + Methyl cellulose F4

Fig. 8: FT-IR.

5. CONCLUSION

The research successfully developed and evaluated herbal skin cream formulations using *Andrographis echioides* extract. All formulations met the required pharmaceutical standards and demonstrated desirable physical and chemical properties without any signs of instability or irritancy. Among the tested formulations, F4 exhibited the best performance in terms of spreadability, stability, and physical characteristics. The study supports the feasibility of incorporating herbal extracts into cosmetic formulations for skin protection, highlighting their compatibility, safety, and effectiveness. Thus, herbal-based creams can serve as natural, non-irritating alternatives to synthetic skin care products.

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