Formulation and Evaluation of Polyherbal Skin Cream for Wound Healing

Shivam Tiwari[1], Naveen Tripathi[2], Ravindra Mishra[3]*, Vinay Jain[4]

1 Scholar M. Pharma, Pharmaceutics, Shriram College of Pharmacy
2. Associate Professor Department of Pharmaceutical Chemistry, Shriram College of Pharmacy
3. Associate Professor Department of Pharmacology, Shriram College of Pharmacy.
4. Principal, Shriram College of Pharmacy, Banmore, Morena

***Corresponding author: Mr. Ravindra Mishra**
Associate professor, Department of Pharmacology, Shriram College of Pharmacy. Banmore, Morena, M.P -476444, Email. Ravindra.mishra1412@gmail.com

KEYWORDS
herbal cream, wound healing, methylparaben, Azadirachta indica, Sarca indica, Curcuma longa, Glycyrrhiza glabra, & Aloe vera .

ABSTRACT:
This study sought to develop & assess a herbal skin cream for wound healing, utilizing the inherent restorative qualities of botanical components. Notwithstanding the presence of numerous wound-healing creams, the pace of tissue regeneration continues to be constrained. This study combined contemporary cosmetic technologies with traditional medicinal herbs, including plant extracts such as Azadirachta indica, Sarca indica, Curcuma longa, Glycyrrhiza glabra, & Aloe vera to create a safe & effective product.

The formulation process entailed adjusting the amounts of excipients including sorbitol solution, potassium hydroxide, methylparaben, stearic acid, beeswax, stearyl alcohol, Tween-80, & deionized water. The resultant compositions underwent evaluations of their physical characteristics, encompassing pH, viscosity, spreadability, & stability. The results indicated that the formulations exhibited good consistency, superior spreadability, & no presence of phase separation. The stability measures, such as pH (~6), viscosity, & appearance, exhibited no alterations throughout the three-month testing period done under ICH conditions (40 ± 2 °C & 75 ± 5% RH). The research validated the viability of formulating herbal creams as protective barriers for the skin, exhibiting compatibility with cutaneous secretions. This research underscores the capacity of plant-based formulations to improve wound healing owing to their inherent ability to facilitate tissue repair mechanisms. Subsequent research will further assess the wound-healing effectiveness of these herbal lotions.

INTRODUCTION

Creams are semisolid formulations intended for topical application to the skin, or ocular surface, or for nasal, vaginal, or rectal use for therapeutic or protective purposes. They may also fulfill an aesthetic function. Such preparations are employed for the localized effects resulting from the drug's infiltration into the underlying layers of the skin or mucous membranes at the site of application. The skin serves as the target organ for the pharmaceutical delivery systems of these devices, designed to address cutaneous disorders.

Wound & Wound Healing Mechanism

A wound can be defined as a loss or disruption of the cellular, anatomical, or functional continuity of the deep skin tissue or living tissues. Wounds can arise from physical, chemical, thermal, viral, microbial, or immunological stress to the skin's surface. Wounds adversely affect both the patient's physical & mental well-being, can incur significant costs, & may result in enduring scars. A wound is a physical damage that disrupts or breaches the skin. Following skin damage or injury, cells undergo contraction, migration, & readhesion in a process termed wound healing. Platelet aggregation, hemostasis, fibrinogenesis, inflammatory responses to injury, alterations in ground substances, angiogenesis, & re-epithelialization all contribute to wound healing. The impaired surface must be diligently sutured by collagen & ultimately concluded by scar formation for the healing process to be finalized. The existence of free radicals, which damage adjacent skin tissues, may hinder wound healing. A variety of factors, including infections, nutrition, drugs, hormones, the type & location of the wound, & particular medical problems, influence the wound-healing process.

MATERIALS & METHODS

Plants material

a)Azadirachta indica

Botanical Name(s): Azadirachtaindica

Traditional medicinal use

For more than two millennia, neem tree products have been utilized in India for their therapeutic qualities. Ayurvedic & Siddha practitioners consider neem compounds to be sedative, antifungal, antidiabetic, antibacterial, antiviral, contraceptive, & anthelmintic. It is specifically recommended for skin conditions & is regarded as a key ingredient in Siddha, Ayurvedic, & Unani treatments. Neem oil is also used to control blood sugar levels, purify the blood, enhance liver function, & promote healthy hair. Additionally, neem leaves have been used to treat skin conditions like psoriasis & eczema.However, not enough research has been done to evaluate the alleged advantages of neem. Neem is safe for short-term usage in adults but can damage the liver or kidneys over time in young children, neem oil is toxic & can lead to death. Neem may also cause miscarriages, infertility, & low blood sugar.

Figure 1 : Azadirachta indica

b) Saraca indica,

Botanical Name(s):*Saraca indica,*

Traditional medicinal use

Ashoka, another name for Saraca indica, contains a variety of pharmacological qualities, such as: Antimicrobial: Against a range of strains, extracts from Saraca indica stem bark exhibit antibacterial & antifungal properties.

Anti-cancer: A flavonoid component found in Saraca indica flowers may help stop the development of skin cancer. It has also been demonstrated that an ethanolic extract of Saraca indica helps prevent breast cancer.

Anti-inflammatory: The characteristics of Saraca indica are anti-inflammatory.

Saraca indica possesses antioxidant qualities.

Saraca indica possesses anti-ulcer qualities.

Antimicrobial: The plant Saraca indica possesses antimicrobial qualities.

Figure 2: *Saraca indica*

c) Curcuma longa

Botanical name: Curcuma longa

Traditional medicinal use

Turmeric has been applied topically to heal wounds or soothe skin sores & has been tried as a remedy for several internal conditions in Ayurvedic medicine, including indigestion, throat infections, colds, & liver problems.

Figure 3: Curcuma longa

d) Glycyrrhiza galbraith

Botanical name: Glycyrrhiza galbraith

Traditional medicinal use

It was used traditionally for treating a variety of conditions, including lung, liver, circulatory, & kidney disorders. Today, licorice root is promoted as a dietary supplement for conditions such as digestive problems, menopausal symptoms, cough, & bacterial & viral infections.

Figure 4: Glycyrrhiza galbraith

e) Aloe vera

Botanical name: Aloe barbadensis

Traditional medicinal use

Traditional medicine uses aloe vera to cure skin conditions. It & agave extracts are referred to as kathalai in Ayurvedic treatment. Dioscorides' De Materia medica & Pliny the Elder's Natural History, both published in the middle of the first century AD, as well as the Ebers Papyrus from the 16th century BC, have early accounts of the usage of aloe vera. The Juliana Anicia Codex from 512 AD also mentions it. Many nations use the plant extensively in their traditional herbal treatment. One of the most important medicinal plants for skin protection & treatment is aloe vera. When applied externally, it works wonders for sunburns & burns as well as many skin conditions like psoriasis, acne, eczema, & pruritus. it is extremely constructive & protective.

Aloe vera is beneficial for skin that is irritated or swollen. Even the most delicate wounds can be healed with aloe vera. Burns & other wounds heal more quickly when aloe vera is used. Aloe vera helps to tone, rejuvenate, & hydrate your skin. Your skin is softened & moisturized by aloe vera.

Figure 5: Aloe vera

Other chemicals

Stearic acid

Figure 6: Structure of stearic acid

Table No.1: Properties of stearic acid

Form	White solid
Odor	Pungent, oily
Density	0.9408 g/cm^3 (20 °C)
Melting point	69.3 °C (156.7 °F; 342.4 K)
Boiling point	361 °C (682 °F; 634 K)

Uses of stearic acid

Products are treated with stearic acid to reduce their transparency. Stearic acid, when used for this purpose, can enhance the look of a lotion, gel, or cream to increase consumer appeal.
They are also employed as lubricants, emollients, & emulsifiers.

Liquid paraffin

Table No.2: Properties of liquid paraffin

Form	Liquid
Color	Colourless
Odor	Odourless
Melting point	Undetermined
Boiling point	degrees C>300

Uses of liquid paraffin

- By creating an oily coating on the skin's surface, liquid paraffin acts as a barrier cream, keeping water from evaporating off the skin's surface.
- Sometimes referred to as skin lubricant, it is an emollient.
- It is applied to the skin to nourish, smooth, & soothe it.
- This medication generally softens, hydrates, & protects the skin while also reducing irritation, particularly in patients with dry skin.
- One advantage of using this medication is that it helps the skin retain moisture, which can restore its softness, flexibility, & smoothness.
- A highly refined mineral oil used in cosmetics & medicine, liquid paraffin is also referred to as paraffinum liquidum.

Bees wax

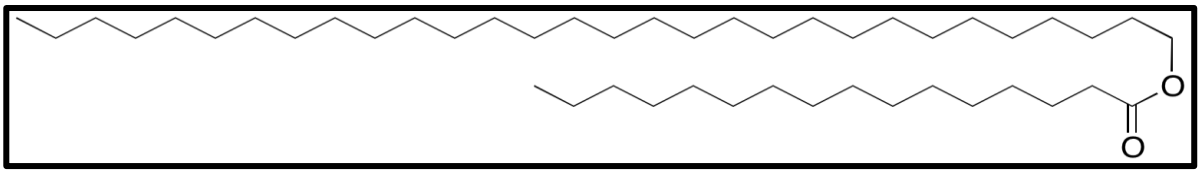


Figure 7: Structure of Triacontanyl palmitate, a wax ester.

Table No.3: Properties of beeswax

Form	Solid
Colour	Yellow to Brown
Odor	Characteristic
Melting point	62-64°C
Solubility	Insoluble in water

Uses of beeswax

The antiviral, anti-inflammatory, & antibacterial qualities of beeswax are crucial in the fight against bacterial infections & chapped skin, which typically afflict us most during the dry, winter months. By retaining moisture in our skin without suffocating or clogging the pores, it creates a barrier of defense.

Considering its anti-inflammatory qualities, beeswax has been shown to promote wound healing. Research has even shown that it works well for hemorrhoids. Hospitals are also using it to treat chemotherapy-induced ulcers & sores.

Stearyl alcohol

Figure 8: Structure of stearyl alcohol

Table No.4: Properties of stearyl alcohol

Form	Waxy flakes
Colour	Unctuous white flakes
Odour	Faint
Melting point	59.5°c
Boiling point	366°c

Uses of stearyl alcohol

Stearyl alcohol is utilized as an alternative to cetyl alcohol & antifoaming agents in surface-active agents, lubricants, emulsions, resins, & USP ointments.

Tween-80

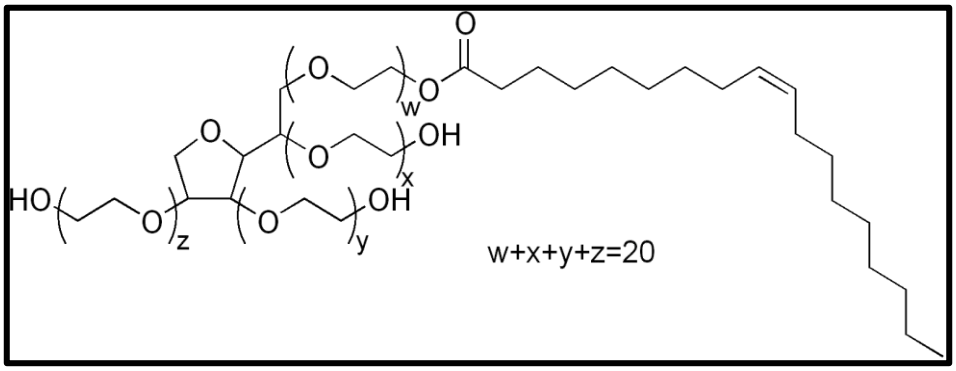


Figure 9: Structure of Tween-80

Table No.5: Properties of Tween 80

Form	Liquid
Color	Amber
Odor	Characteristic
Boiling point	100°C
Flash point	148°C

Uses of Tween-80

Mostly utilized as an emulsifier & surfactant in cosmetics & beauty products due to its capacity to support other components.

Methyl paraben

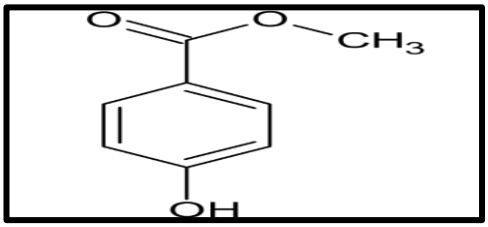


Figure 10: Structure of methylparaben

Table No.6: Properties of methylparaben

Form	Crystal
Colour	Colourless
Odour	Odourless
Melting point	125 - 128°C
Boiling point	270 - 280°C

Uses of methyl paraben

A common antifungal ingredient in cosmetics & personal hygiene products, methylparaben also serves as a food preservative.

In Drosophila food medium, methylparaben is frequently employed as a fungicide.

Sorbitol solution

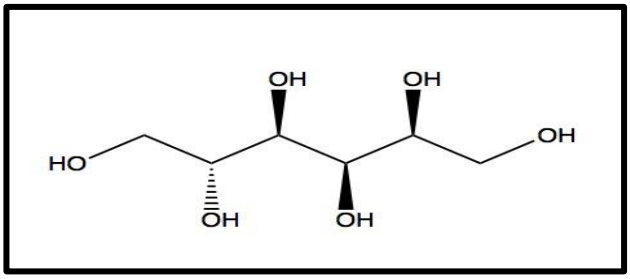


Figure 11: Structure of sorbitol

Table No.7: Properties of sorbitol

Form	DryPowder, Liquid
Colour	White crystalline powder
Odour	Odourless
Melting point	111 ℃
Boiling point	295°C

Uses of sorbitol solution

It functions as a humectant in skin care products, which attract water from the surrounding air to the skin's surface when the air is sufficiently moist.

Potassium hydroxide

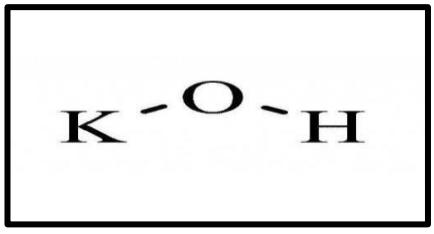


Figure 12: Structure of potassium hydroxide

Table No.8: Properties of potassium hydroxide

Form	Solid pellets
Colour	White or colorless
Odour	Odourless
Melting point	380°C
Boiling point	1324°C

Uses of potassium hydroxide

Because of its special ability to draw water molecules from its surroundings & then dissolve into the water it had initially absorbed, potassium hydroxide is used as a pH adjuster or buffer in the cosmetic & skin care industry, balancing the formula without adding extra weight or altering its composition.

Soxhlet extraction or hot continuous extraction:

In this process, a finely ground substance was put in a porous bag, also referred to as a "thimble," made of strong filter paper or cellulose. The extraction solvent, methanol, evaporated into the sample thimble, condensed in the condenser, & then dripped back after being heated in the bottom flask. Once the liquid content reached the siphon arm & flowed into the bottom flask again, the process was repeated. The final methanolic extract is collected by them. First phytochemical examination of the methanolic extract of the plants.

The methanolic extract of the plants is subjected to a first phytochemical examination using an HPTLC chromatogram.

Figure 13: Soxhlet extractor

Formulation & evaluation of the cream.

Formulation of the herbal skin cream using the extracts

The Formula provided in Table No. 10 was followed for creating the Formulation trails. The Formulation was created using the Nazir et al. method & contained Aloe vera extract, Glycyrrhiza galbraith, Curcuma longa, Azadirachta indica, & Saraca indica. After being placed in beakers, the oil & aqueous phases were heated to 75ºC over a water bath. Azadirachta indica, Saraca indica, Curcuma longa, Glycyrrhiza galbraith, & Aloe vera extracts, liquid paraffin, beeswax, stearyl alcohol, Tween-80, & stearic acid made up the oil phase, while sorbitol solution, potassium hydroxide, & methyl parabens made up the aqueous phase. In a homogenizer, the aqueous phase was added dropwise to the oil phase while being continuously stirred for 15 minutes at 2000 rpm.

After lowering the homogenizer speed to 1000 rpm, homogenization was carried out for a further five minutes. The homogenization process was prolonged for five minutes while the speed was

further decreased to 500 rpm. A herbal skin lotion was created with extracts from Aloe vera, Glycyrrhiza galbraith, Curcuma longa, Azadirachta indica, & Saraca indica.

Table No.9: Formula for preparation of cream

S.No	Ingredient	Formula1 (%)	Formula2 (%)	Formula3 (%)	Formula4 (%)	Formula5 (%)	Formula6 (%)
1	A. indica Ext.	5.0	5.0	5.0	5.0	5.0	5.0
2	S. indica Ext.	5.0	5.0	5.0	5.0	5.0	5.0
3	C. longa Ext.	5.0	5.0	5.0	5.0	5.0	5.0
4	G. galbraith Ext	5.0	5.0	5.0	5.0	5.0	5.0
5	Aloe vera Ext	5.0	4.0	3.0	3.0	3.0	4.0
6	Liquid Paraffin	5.0	5.0	5.0	5.0	5.0	5.0
7	Stearic Acid	3.0	3.0	5.0	5.0	4.0	5.0
8	Bees Wax	5.0	6.0	5.0	4.0	6.0	5.0
9	Stearyl Alcohol	10.0	10.0	10.0	8.0	8.0	7.0
10	Tween-80	8.0	5.0	5.0	5.0	5.0	6.0
11	Methyl Paraben	0.12	0.12	0.12	0.12	0.12	0.12
12	Sorbitol Solution	6.0	6.0	5.0	5.0	5.0	5.0
13	Pot. Hydroxide	5.0	5.0	5.0	5.0	5.0	5.0
14	De-ionize Water	33.0	36.0	37.0	40.0	39.0	38.0

Evaluation of Cream

a) Physical evaluation of the Formulation

The Formulations were inspected visually for their appearance, color, & odor.

b) pH Measurement

A pH meter calibrated with standard buffer solutions at pH 4, 7, & 9 was used to measure the pH before each use. Ten minutes before taking the room temperature reading, the electrode was placed into the sample.

c) Viscosity

A Brookfield viscometer was used to measure the Formulation's viscosity (DV-I PRIME, USA). At 0.3, 0.6, & 1.5 revolutions per minute, the gels were rotated. The appropriate dial measurement was multiplied by the factor listed in the Brookfield Viscometer catalog to get the gel's viscosity.

d) Spreadability

The duration in seconds it takes for two slides to separate from the gel when positioned b/w each other & subjected to a specific force is known as spreadability. To compress the glass slides of uniform thickness, an amount of weight was placed on them & the extra sample was placed between the two glass slides. The time needed to separate the two slides was recorded when a 70 g weight was applied. The Formula was used to determine the spreadability:

$$S = M.L / T \text{ where,}$$

M = weight tied to upper slide,
L = length of glass slides,
T = Time taken to separate the slides.

e) Stability

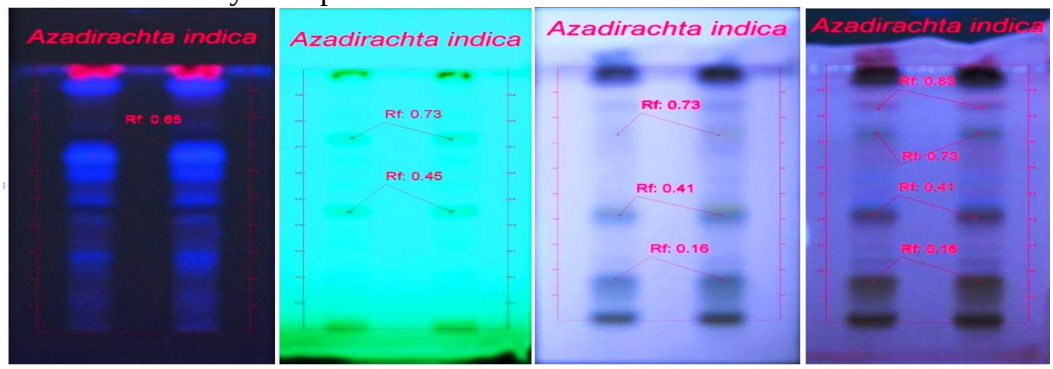
Drug product stability testing starts during the drug discovery process & concludes when the chemical or commercial product degrades. Stability studies were conducted following ICH recommendations to evaluate the stability of the medication & Formulation. The ICH guidelines were followed for conducting the stability investigations. For three months, the cream was stored in a humidity chamber at 40 ± 2°C & 75 ± 5% relative humidity. Samples were examined for physical characteristics, pH, & viscosity after the research.

RESULTS & DISCUSSIONS

Preliminary phytochemical investigation of methanolic extract of plants

HPTLC chromatogram of Azadirachta indica

Mobile phase: Ethyl acetate: n-Butanol: Formic acid: Water (25:15:5:5)
Tank saturation: 20 min
Sample applied: 7µl & 9 µl
Solvent front: 85mm
Drying: 5min
Detection/visualization: At 366nm, 254nm& after derivatization
Derivatization: An is aldehyde sulphuric acid

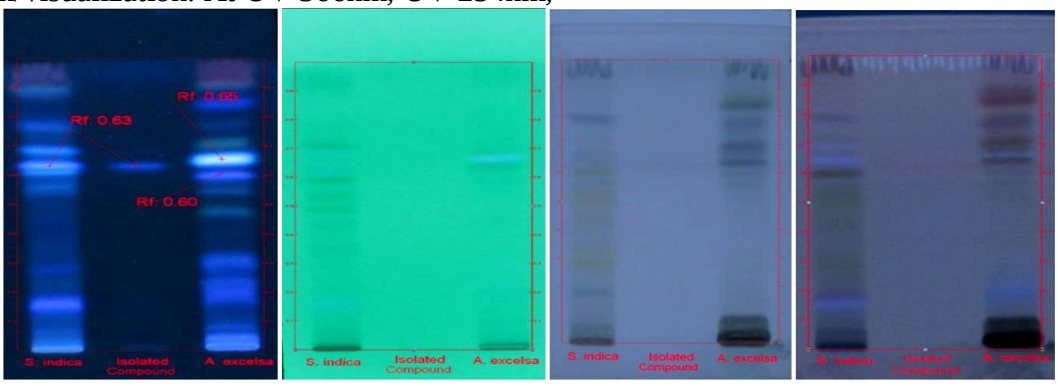


UV 366 nm UV 254 nm Under visible light Under UV 366 nm

Figure 14: HPTLC Chromatogram of Azadirachta indica

HPTLC chromatogram of Saraca indica,

Mobile phase : Chloroform: Toluene: Methanol (4:4:2)
Tank saturation: 25 min
Solvent front: 85mm
Drying: 5min
Detection/visualization: At UV 366nm, UV 254nm,



UV 366 nm UV 254 nm under visible light Under UV 366 nm

Figure 15: HPTLC Chromatogram of Saraca indica,

HPTLC chromatogram of Glycyrrhiza glabra

Mobile phase: Butyl alcohol: Water: Acetic acid (7:2:1)
Tank saturation: 20 min
Solvent front: 85mm
Drying: 5min
Detection/visualization: At UV 366nm, UV 254nm,

Figure 16: HPTLC chromatogram of Glycyrrhiza glabra

HPTLC Chromatogram of Curcuma longa

Mobile phase: Chloroform: Benzene: Methanol (8: 1.5: 0.5)
Tank saturation: 20 min
Sample applied: 7µl for each spot
Solvent front: 85 mm
Drying: 5min
Detection/visualization: At UV 254nm & UV 366nm

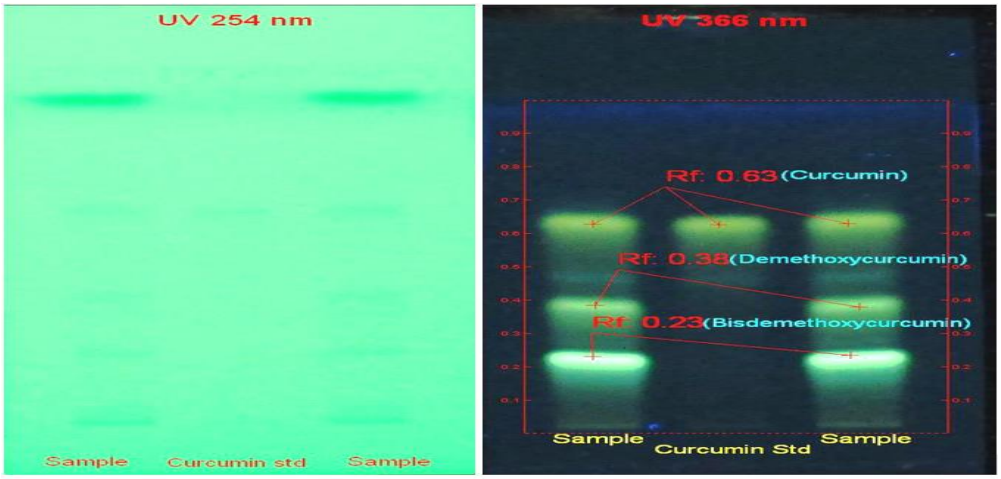


Figure 17: HPTLC Chromatogram of Curcuma longa

HPTLC chromatogram of Aloe vera

Mobile phase : Toluene: Methanol: Diethyl amine (8:1:1)
Tank saturation: 20 min
Solvent front: 85mm
Drying: 5min
Detection/visualization: At UV 366nm, UV 254nm,

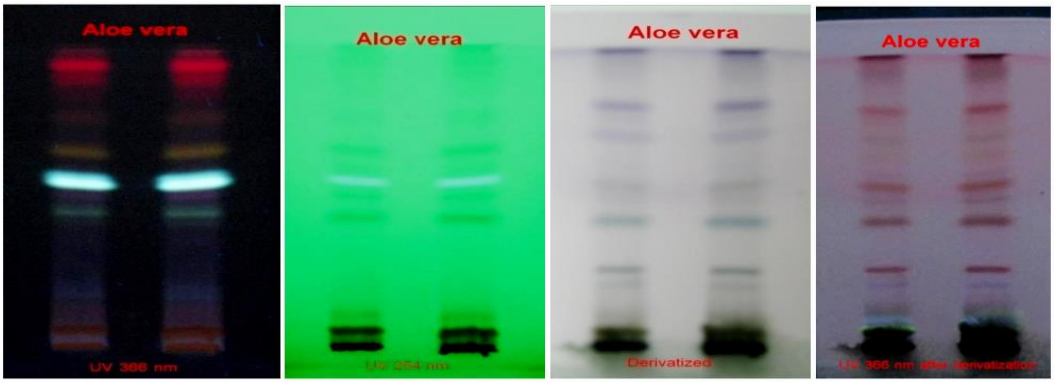


Figure 18: HPTLC chromatogram of Aloe vera

Evaluation of skin care cream

Table No. 10: Physical Properties of Cream

Properties	Formula 1	Formula 2	Formula 3	Formula 4	Formula 5	Formula 6
Appearance	Semisolid	Semisolid	Semisolid	Semisolid	Semisolid	Semisolid
Odor	Characteristic	Characteristic	Characteristic	Characteristic	Characteristic	Characteristic
Color	Brown	Brown	Brown	Brown	Brown	Brown

Table no.11: Thermal stability of cream (At room temperature & 65% ± 5% RH)

Formula 1	Formula 2	Formula 3	Formula 4	Formula 5	Formula 6
Stable, no separation	Stable, no separation	Stable, no separation	Stable, no separation	Slight oily separation	Slightly oil separation

Table no. 12: pH of the cream

Formula 1	Formula 2	Formula 3	Formula 4	Formula 5	Formula 6
6.05	5.89	6.11	6.02	5.97	5.94

Table no.13: Viscosity of the cream

rpm	Formula 1	Formula 2	Formula 3	Formula 4	Formula 5	Formula 6
0.3	7332	7413	7534	7241	7187	7216
0.6	3856	3906	3987	3456	3187	3296
1.5	1876	1893	1956	1785	1863	1816

Table no.14: Spreadability of the cream

	Formula 1	Formula 2	Formula 3	Formula 4	Formula 5	Formula 6
Spreadability (cm/sec)	14.2	14.1	14.4	13.8	13.7	14.0

Accelerated Stability Studies of Cream

Table no.15: Physical Properties of the Cream (Initial)

Properties	Formula 1	Formula 2	Formula 3	Formula 4	Formula 5	Formula 6
Appearance	Semisolid	Semisolid	Semisolid	Semisolid	Semisolid	Semisolid
Odor	Characteristic	Characteristic	Characteristic	Characteristic	Characteristic	Characteristic
Color	Brown	Brown	Brown	Brown	Brown	Brown

Table no.16: Physical Properties of the Cream (After 3 months)

Properties	Formula 1	Formula 2	Formula 3	Formula 4	Formula 5	Formula 6
Appearance	Semisolid	Semisolid	Semisolid	Semisolid	Semisolid	Semisolid
Odor	Characteristic	Characteristic	Characteristic	Characteristic	Characteristic	Characteristic
Color	Brown	Brown	Brown	Brown	Brown	Brown

Table no.17: pH of the cream (Initial & after 3 months)

pH	**Formula 1**	**Formula 2**	**Formula 3**	**Formula 4**	**Formula 5**	**Formula 6**
Initial	6.05	5.89	6.11	6.02	5.97	5.94
After 3 months	6.02	5.91	6.11	5.98	5.97	5.91

Table no.18: Viscosity of the cream (Initial)

rpm	Formula 1	Formula 2	Formula 3	Formula 4	Formula 5	Formula 6
1.5	1876	1893	1956	1785	1863	1816

Table no.19: Viscosity of the cream (after 3 Months)

rpm	Formula 1	Formula 2	Formula 3	Formula 4	Formula 5	Formula 6
1.5	1789	1810	1914	1721	1803	1765

Accelerated stability testing of prepared Formulations was conducted at 40° ± 2°C temperature & 75± 5% relative humidity & studied for 90 days.

7. SUMMARY

Formulating & assessing a skin cream for wound healing was the aim of this effort. Even when several kinds of cream are taken into consideration for wound healing, their rate of tissue regeneration still seems to be restricted. Due to their innate ability to support the repair mechanism, plants are more effective healers. Modern cosmetic technology is being combined with the understanding& practice of using herbs to create safe & effective products. Herbal herbs like Azadiracta indicia, Sarca indica, Curcuma longa, Glycyrrhiza galbraith, & Aloe vera were used to make skin cream in the current study. The research project began with a comprehensive & extensive review of the literature. The amount of excipients, such as sorbitol solution, potassium hydroxide, methyl paraben, stearic acid, beeswax, stearyl alcohol, tween-80, & deionized water, was varied to create different Formulations. It was successfully possible to formulate a herbal skin cream that complied with the necessary pharmaceutical requirements for wound healing. After that, factors including physical characteristics, pH, viscosity, spreadability, & cream stability are assessed for the created Formulations. Throughout the study period, the produced Formulations demonstrated high consistency, good spreadability, & no signs of phase separation. The formulations' stability properties, including their pH, viscosity, & appearance, did not alter noticeably during the investigation. The produced formulations' appropriate pH range, which is roughly pH 6, validates their suitability for use with skin secretions. According to ICH criteria, the creams were confirmed to be stable for three months at 40 ± 2 °C & 75 ± 5% relative humidity. It is feasible to create creams with herbal extracts that may be applied as a barrier to protect skin, according to the current study.

CONCLUSION

It was successfully possible to formulate an herbal skin cream that complied with the necessary pharmaceutical requirements for wound healing. Throughout the study period, the produced Formulations demonstrated high consistency, good spreadability, & no signs of phase separation. The stability characteristics of the Formulations, such as their pH, viscosity, & appearance, showed no discernible change throughout the study. The produced Formulations exhibited the appropriate

pH range, which is roughly pH 6; this indicates that the Formulations are compatible with skin secretions. During the three-month stability assessment, the creams were determined to be stable at 40 ± 2 °C/ 75 ± 5% RH, by ICH requirements. Based on the current study, it is feasible to create creams that include plant extracts & that can be applied as a skin-protective barrier. Due to their innate ability to support the repair mechanism, plants are more effective healers. Future experiments will be conducted to investigate the herbal skin cream's ability to heal wounds.

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