Research Article

Preparation And Evaluation Of Gel For Anti-Bacterial Activity Using Herbal Extract Of *Acalypha indica* With *Aloe vera* For The Treatment Of Psoriasis

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ABSTRACT: *The study aimed to develop and evaluate an herbal gel combining extracts from Acalypha indica and Aloe vera for managing psoriasis, a persistent inflammatory skin disorder marked by scaly and inflamed lesions. Conventional synthetic treatments often cause adverse effects, motivating the search for safer herbal alternatives. Leaves of Acalypha indica and Aloe vera were collected, authenticated, and dried in the shade. Ethanol extraction by the Sechelt method was carried out to obtain photochemical-rich extracts. These extracts were then incorporated into gel formulations labelled F1, F2, and F3. Carbopol 934 served as the gelling agent, supplemented by excipients were used. The gel formulation was evaluated for several parameters such as pH to ensure it is suitable for the skin, spreadability for easy application, homogeneity for uniform consistency, wash ability, viscosity, and drug content. Phytochemical analysis identified important bioactive compounds like alkaloids, flavonoids, phenols, and tannins. Techniques such as TLC and FTIR confirmed the presence of functional groups and active components, supporting the gel's therapeutic potential. The gel demonstrated excellent physicochemical qualities, including ideal viscosity and spreadability, as well as strong antibacterial activity. Overall, this herbal gel shows promise as a natural and safe topical treatment for psoriasis, providing controlled release and antimicrobial effects without adverse side effects. However, further clinical trials are necessary to confirm its effectiveness and safety in humans.*

Keywords: Psoriasis, Herbal gel, *Acalypha indica*, *Aloe vera*, Inflammatory skin disorder, Gel formation (F1,F2,F3), Antibacterial activity, Natural treatment and safety

1. Introduction

Psoriasis is a long-lasting, non-infectious skin condition marked by red, scaly areas that are commonly covered with silvery-white plaques. It impacts about 2–3% of people worldwide and usually begins between 15 and 25, even though it can cause at any age. The condition can involve the scalp, elbows, knees, and lower back, and in severe cases, it may spread across large areas of the body. While psoriasis is not life threatening, it significantly affects a person's quality of life and can lead to complications such as psoriatic arthritis, cardiovascular diseases, and emotional distress. Conventional treatment options for psoriasis include topical corticosteroids, coal tar, emollients, systemic drugs such as methotrexate and cyclosporine, and immunomodulatory. While these therapies may offer symptomatic relief, they are often associated with adverse effects such as liver toxicity, kidney damage, bone marrow suppression, high blood pressure, and increased susceptibility to infections and skin cancers.

Herbal medicine has emerged as a promising approach due to its holistic benefits and minimal side effects. Plants like *Acalypha indica* and *Aloe vera* have been used in traditional medicine for treating various skin conditions. *Acalypha indica* is familiar for its antimicrobial, anti-inflammatory, and antioxidant properties, while *Aloe vera* possesses wound-healing, moisturizing, and soothing effects on the skin. In recent years, topical gels have become popular for dermatological applications due to their ease of use, non-greasy nature, and ability to deliver active agents effectively. Gels offer advantages such as enhanced drug release, better skin absorption, and increased patient compliance. This study aims to develop and evaluate a novel herbal gel

contain *Acalypha indica* and *Aloe vera* extracts for the treatment of psoriasis. The objective is to develop a stable, effective, and patient-friendly formulation that combines traditional herbal knowledge with modern pharmaceutical technology.[1-25]

2. MATERIALS AND METHODS:

2.1.Materials

Table 1. Ingredient and trader name

S.NO	INGREDIENT	TRADER NAME
1	*Acalypha indica* extract	Plant source
2	*Aloe vera* extract	Plant source
3	Carbopol 934	SD LABS
4	Lecithin	SD LABS
5	Potassium sorbate	SD LABS
6	Menthol	SD LABS
7	Glycerine	SD LABS
8	Distilled water	SD LABS

2.2.Method of extraction:

2.2.1.Cold Method:

A method of gel formulation in which the gelling agent is dispersed in a suitable solvent at room temperature without the application of heat, followed by the addition of active ingredients, preservatives, and other excipients to achieve a uniform gel consistency.[3][8][12]

3.Extraction Procedure:

Leaves were washed, shade-dried, and powdered. The powder was placed in a thimble of the Soxhlet apparatus, with ethanol (1:10 ratio) as the solvent in a round-bottom flask. Under gentle reflux at 25 °C, the solvent repeatedly extracted the bioactive compounds, leaving insoluble residue in the thimble, while the

enriched solvent in the flask contained the desired phytochemicals[8][17].

Figure 1.Powder Extract Of Leaves

3.1.Formulation 1

Disperse Carbopol 934 (1.15 g) slowly into distilled water in a glass beaker while stirring continuously at room temperature to avoid lumps. Add **Potassium Sorbate (0.15 g)** and stir until dissolved. Add **Menthol (0.2 g)** and **Glycerine (2 g)**, mix well .Add **Lecithin (0.1 g)**, **Acalypha indica extract (0.5 g)**, and ***Aloe vera***

gel (1.0 g). Stir thoroughly to form a uniform gel. Transfer the gel into a clean, labelled container and store it properly.[2][4][[6][8]

3.2.Formulation 2

Start by slowly sprinkling **1.15 g of Carbopol 934** into distilled water in a glass beaker at room temperature, stirring gently to avoid lumps. Once fully mixed, add **0.15 g of Potassium Sorbate**, continuing to stir. Next, mix in **0.2 g of Menthol** and **2 g of Glycerine**, stirring until smooth. Then, add **0.1 g of Lecithin**, followed by **1 g each of Acalypha indica extract** and ***Aloe vera* gel**. Stir well until a clear gel forms. Finally, transfer the gel into a clean, airtight container and label it appropriately.[1-9]

3.3.Formulation 3

To prepare the herbal gel, slowly add **1.15 g of Carbopol 934** to distilled water at room temperature, stirring gently to avoid lumps. Once it's fully mixed, add **0.15 g of Potassium Sorbate**, continuing to stir. Then mix in **0.2 g of Menthol** and **2 g of Glycerine**, blending until smooth. Add **0.1 g of Lecithin**, followed by **1.5 g of *Acalypha indica* extract** and **1 g of *Aloe vera* gel**. Stir everything well until a clear, consistent gel forms. Finally, transfer the gel to a clean, tightly sealed container and label it.[2]

4.Evaluation:

4.1 Evaluation for Phytochemical Herbal extract:[2]

Preliminary Phytochemical Screening of solvent extract from *Acalypha indica* Leaves and *Aloe vera* Gel:

The ethanol extracts *Acalypha indica* leaves and *Aloe vera gel* were subjected to a phytochemical evaluation using standard procedures to identify major classes of phytoconstituents such as alkaloids, flavonoids, glycosides, phenolics, tannins, carbohydrates, proteins, terpenoids, sterols, and saponins.

4.1.1.Alkaloids: The extract was processed with calcium hydroxide and chloroform, and then add diluted HCL. The alkaloids which is present was confirmed through the development of characteristic precipitates with different reagents: cream color with Mayer's test, orange-brown with Dragendorff's, it shows reddish-brown with Wagner's, and yellow with Hager's.

4.1.2.Carbohydrates And Reducing Sugars: Carbohydrates were proved by Molisch's test by showing purple ring, while at the existence of reducing sugars was demonstrated by Fehling's and Benedict's tests (formation of brick-red precipitates).

4.1.3.Glycosides: Anthraquinone glycosides: Borntrager's and modified Borntrager's tests gave a pink coloration in the ammonification zone.

A) Cardiac glycosides: Confirmatory tests included Keller-Killiani (layered color reaction), Legal's (pink/red color), and Raymond's test (violet color with dinitrobenzene in alkaline medium). The Keller-Killiani test did not indicate deoxy sugars.

B) Cyanogenetic glycosides: Presence was evidenced by the brick-red color formed on sodium picrate paper.Coumarin glycosides: Fluorescence on ammonia treatment and violet coloration with $FeCl_3$ confirmed their presence.

4.1.4.Sterols And Triterpenoids: Salkowski's and Liebermann-Burchard's tests produced red, green, and brown color rings, indicating sterols. Triterpenoids were confirmed by reddish-violet coloration after treated with acetic anhydride and concentrated sulfuric acid.

4.1.5.Flavonoids: Several tests confirmed flavonoids: Shinoda's test (red), alkali test (yellow), lead(II) acetate test (white color precipitate), and concentrated acid test (yellowish-orange coloration).

4.1.6.Terpenoids: A pink coloration on reaction with thionyl chloride and tin confirmed the presence of terpenoids.

4.1.7.Gums And Mucilage: Gums were indicated by a white precipitate on addition of alcohol, while mucilage was confirmed by a red coloration with ruthenium red solution.

4.1.8.Protiens And Aminoacid: Proteins were indicated by Millon's test (red precipitate on heating) and by the Biuret test (violet color). Amino acids gave a positive reaction with ninhydrin (purple coloration).

4.1.9.Saponins: The foam test, which produced stable frothing, confirmed the saponins are present.

4.1.10.Phenols And Tannins: Phenolic compounds and tannins were detected by ferric chloride test (bluish-black color), lead(ll) acetate test (precipitate will formed), catechin test (positive reaction with HCl), and vanillin-HCl test (characteristic color development).

5.Evaluation Of (Ethanolic Extract Of *Acalypha Indica*)EEAI And (*Aloe Vera*)Av By TLC : [1-15]

Sample is prepared by taking 5mg of extract and dissolved in the solvent (1:1). Then on the silica gel coated TLC plate, 10µl of sample is placed and the migration is carried out using suitable solvents for each desired chemical group.

Stationary phase: Silica(silicon dioxide) gel

Mobile phase: Toluene: Ethyl acetate : Acetic acid : Methanol (2.5 : 7:0 . 25:0.25)

The compound colour can be detected by visualizing in UV florescence chamber in 254nm and 365nm. The colour of the spots is recorded.

Fourier Transformer-Infra Red Spectroscopy (FTIR) Analysis: FTIR was used to identify the extracts and the gel mixture. Samples were analyzed using the potassium bromide pellet technique across a spectrum range from 4000 to 400 cm^{-1}.

Determination of calibration curve: For the calibration curve, stock solutions in the range of 2–5 µg/ml were prepared in distilled water, and absorbance had been measured at 265 nm with a UV spectrophotometer.

6.EVALUATION FOR HERBAL GEL[1-15]:

1. Organoleptic characteristics: The gel was observed for colour, odour and appearances[5].

2. pH Measurement: pH measurement using a digital pH meter after dissolving 0.5 gm gel in 50 ml distilled water and resting for 2 hours.[5].

3. Irritancy test: A small amount of gel was applied on the marked area of the skin and irritation on the skin is observed in 24hr interval[8]

4. Spreadability : Spreadability measured by placing 1 g gel between two glass plates (5×2 cm), pressing, and calculated by the spreadability formula.[5][8]

5. Homogeneity: the testing of the formulation for homogeneity is done by visual appearance and by touch.

6. Washability: the wash ability is determine by applying the gel on the hand and wash with running water.

7. Viscosity: it is determined using Brookfield viscometer[8].

8. Drug content: Drug content analysis by dissolving 1 gm of gel in 100 millilitre of distilled water, filtering, and measuring absorbance of the filtrate at 264 nm via UV-visible spectrophotometer.

9. In-vitro diffusion study: the diffusion study is conducted using Franz diffusion cells with approximately 1 g gel placed on a membrane, maintained at 37°C in distilled water as receptor medium. 5 milliliter of sample were withdrawn at the time intervals of 30 min and replaced with fresh medium to maintain the sink conditions; absorbance measured at 264 nm.

10. Anti-bacterial study: Antibacterial activity tests used Gram-negative for Klebsiella pneumoniae and Gram-positive for Staphylococcus aureus strains cultured on Muller Hinton Agar and incubated at 37°C for 24 hours. Sensitivity to the gel was assessed and recorded.

7.Results For Herbal Extarct:

7.1.Preliminary Phytochemical Screening Of Ethanolic Extract Of Acalypha India Leaves And *Aloe vera* Gel :

The ethanol extract of Acalypha indica leaves and *Aloe vera* gel were analyzed. A series of chemical tests were conducted on these extracts to identify the presence of phytochemicals and secondary metabolites, with the outcomes summarized in the accompanying table:

Table 2. Result for the tested compounds

S.NO	COMPOUNDS	RESULTS	
		***Acalypha indica* extract**	***Aloe vera* gel**
1	Carbohydrates	-	-
2	Alkaloids	+	-
3	Flavanoids	+	+
4	Steroids	+	-
5	Cardiac Glycosides	+	-
6	Phenols	+	-
7	Tannis	+	+
8	Amino Acid	-	-
9	Terpenoids	-	+
10	Saponins	-	+

8.Chromatographic Studies

8.1.Thin Layer Chromatography:

TLC was used for analyse the quality of ethanol extracts from the powdered leaves. The spots which areobtained from the extracts were observed below a day pale and UVpale.

Figure.2 TLC Result For Flavanoids

Table 3 The Result For Flavanoids

Mobile Phase	Sample	Detector	Observation	Rf	Result
Toluene: Ethyl acetate: Acetic acid:Methanol(2.5:7:0.25:0.25)	EEAI	Iodine vapour	Brown colour spots	0.87	Presence of flavanoids
	AV		Faint yellow colour Spots	0.90	Presence of glycoproteins

RESULT FOR FTIR:

Fourier transformer-infrared red spectroscopy (FTIR) analysis:

1. Acalypha Indica extract:

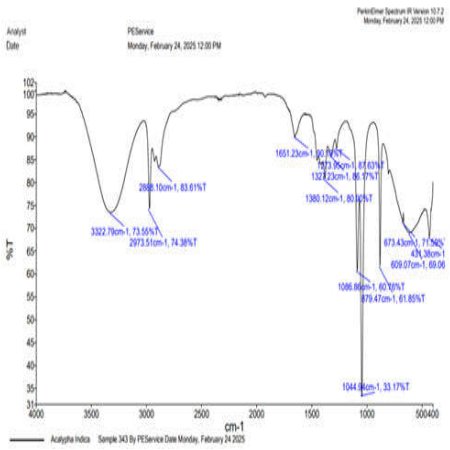

Figure 3 Ft-Ir Spectrum Of *Acalypha Indica* Extract

The FTIR spectrum of Acalypha indica indicates the presence of multiple functional groups, suggesting a complex chemical composition. The strong O-H stretching band around 3322.79 cm^{-1} confirms the presence of alcohols or phenols, which are often found in plant-based compounds. The C=O stretch at 1651.23 cm^{-1} suggests the presence of carbonyl-containing compounds such as flavonoids, ketones, or aldehydes. The peaks in the C-O stretching region (1086.60 cm^{-1} and 1044.69 cm^{-1}) indicate the presence of alcohols, ethers, or esters. Additionally, the aromatic peaks around 879.47 cm^{-1} and 673.43 cm^{-1} suggest the presence of benzene rings, which are common in plant secondary metabolites. These findings support the presence phytochemicals, which contribute to the medicinal properties of Acalypha indica.

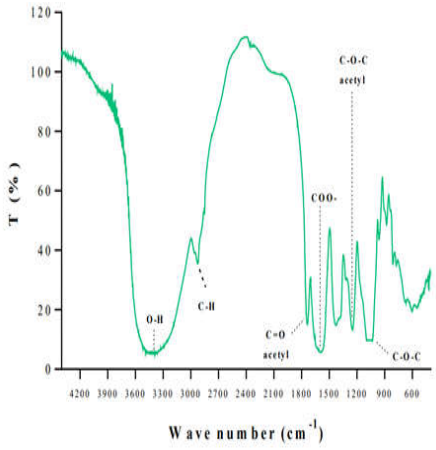

Figure 4 FTIR Spectrum Of *Aloe Vera* Gel

The FTIR spectrum of *Aloe vera* confirms its complex chemical composition, revealing the presence of hydroxyl (-OH), carbonyl (-C=O), ether (C-O-C), and glycosidic linkages. These functional groups indicate the presence of acemannan, glycoprotein, flavonoids, and carboxylic acids, which contribute to its antioxidant, wound-healing, and immunomodulatory properties. The presence of glycoprotein suggests enhanced cellular activity and tissue regeneration, further supporting *Aloe vera* pharmaceutical and cosmetic applications. Future studies can explore advanced analytical techniques to quantify and optimize its bioactive compounds for therapeutic use.

9. Determination Of Absorbance :

1 Acalypha indica **extract** : It was analyzed by scanning its solution over a wavelength range from 200 to 400 nm, revealing the highest absorbance at 265 nm, which was selected as the λmax. with the extract, a

calibration curve was created by preparing different concentrations of the extract with distilled water and measuring their absorbance at this specific wavelength..[14][16][19][18][24]

Table 4 Absorbance At 265 Nm

Concentration	Absorbance
0	0
5	0.113
10	0.223
15	0.314
20	0.418
25	0.511

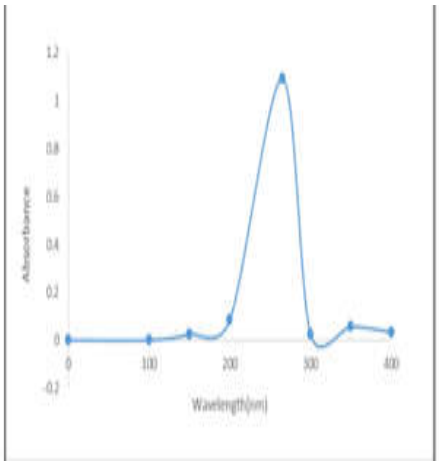

Figure 5 Absorbance Peak Of Acalypha Indica Extract

2. *Aloe vera* gel: The **λmax of gel from *Aloe vera*** was identified by scanning its solution within the wavelength range from **270–425 nm**, where the maximum absorbance was observed at **276 nm**. A **calibration curve** for *Aloe vera* gel was then prepared by the sample in distilled water and measuring the absorbance the selected wavelength by dissolving them both

TABLE 5 ABSORBANCE OF *ALOE VERA* GEL

Concentration	Absorbance at 276nm
0	0
2	0.056
4	0.124
6	0.183
8	0.234
10	0.318

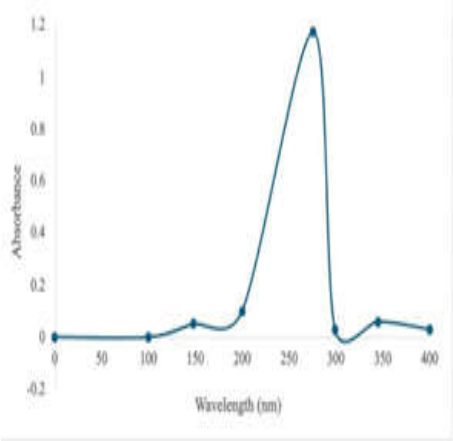

FIGURE 2 Absorbance peak of *Aloe vera* gel

Results For Herbal Gel:

Organoleptic properties:

The organoleptic properties of the formulated gel was observed and noted they are:

Table 6 The Result For The Following Properties

S.NO.	EVALUATIONS	F1	F2	F3
1	COLOUR	Pale green	Pale green	Pale green
2	APPERANCE	Smooth, Appealing	Smooth, Appealing	Smooth, Appealing
3	ODOUR	Pleasant	Pleasant	Pleasant
4	PH TEST	6.43	6.40	6.43
5	IRRITANCY TEST	No irritation	No irritation	No irritation
6	HOMOGENEITY	Appealing	Appealing	Appealing
7	SPREADABILITY	(4.5 cm) good	(4.7 cm) good	(4.3 cm) good
8	WASHABILITY	Easily washable	Easily washable	Easily washable
9	VISCOSITY(cP)	12697	13497	17996

FIGURE 7 THREE DIFFERENT FORMULATIONS

In Vitro Drug Release: The formulation exhibited drug release was found to be[18][20][22][24]

Table 7 Result for Drug release

FORMULATION	DRUG RELEASE ABSORBANCE							
	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	7 hr	8 hr
F1	0.04	0.05	0.1	0.14	0.15	0.18	0.28	0.30
F2	0.06	0.08	0.16	0.19	0.25	0.26	0.28	0.38
F3	0.07	0.09	0.18	0.23	0.27	0.32	0.37	0.42

Figure 8 Franz diffusion cell

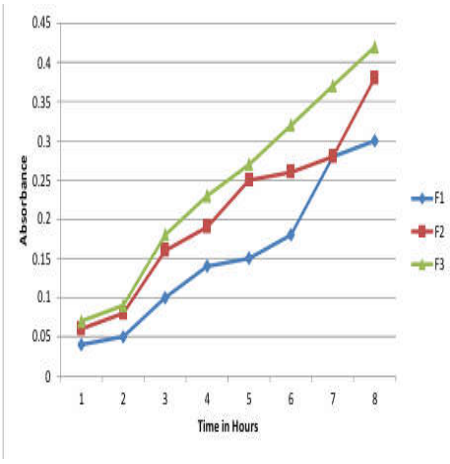

Figure 9 graph of drug release

Drug Content:
The drug content was determined for all three formulations are:

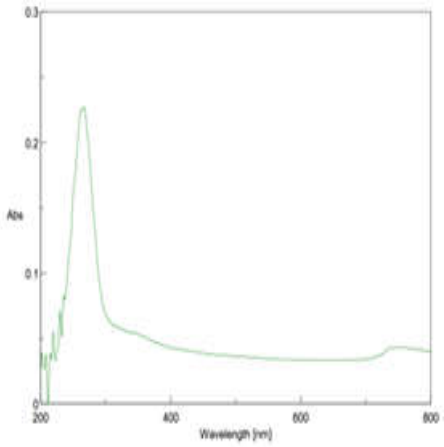

Figure 10

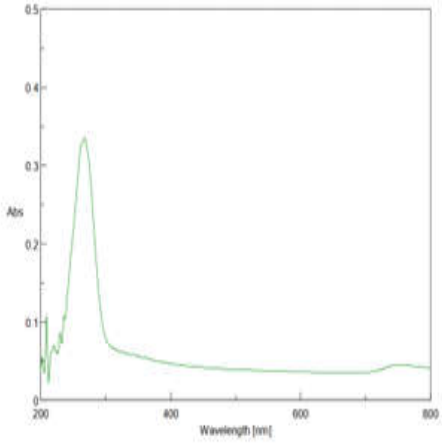

Figure 11

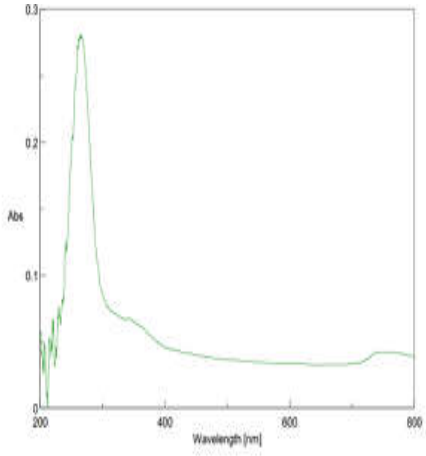

Figure 12

All three spectra (F1, F2, and F3) show peaks in the 250–400 nm range, which suggests the presence of bioactive compounds like flavonoids, phenolics, or alkaloids commonly found in plant extracts. F2 exhibits the more absorbance (~0.35), followed by F1 (~0.30), and F2 (~0.25).This suggests that F3 has a high concentration of the absorbing species or a spale structural variation. The shift in λmax (peak absorbance wavelength) from F1 to F2 might indicate changes in molecular structure, solvent effects, or interactions with other compounds. Further analysis (e.g., FTIR, HPLC, Mass Spectrometry) is needed to confirm the exact nature of these compounds.

Anti-Bacterial Activity:

The anti-bacterial activity was of the gel was found to be STAPHYLOCOCCUS AUREUS[6][10][12]

Table 1 Zone Of Inhibition

FORMULATION	ZONE OF INHIBITION
F1	14mm
F2	16mm
F3	18mm

Figure 13 Staphylococcus Auresus

Klebsiella Pneumoniae

Table 2 Result For Zone Of Inhibition Of Klebsiella Pneumoniae

FORMULATION	ZONE OF INHIBITION
F1	14mm
F2	17mm
F3	21mm

Figure 3 F1

Figure 4 F2

Figure 5 F3

SUMMARY

Due to customer concerns about eco-friendly products, pharmaceutical companies have invested in the research and development of new products, particularly in the herbal category. However, creating herbal medications requires a formulator's experience and competence and poses several technical difficulties. Additionally, there were restrictions on the usage of natural medications. The product might alter chemically and physically throughout this time. The primary causes of the formulation's instability are temperature and storage conditions. Acalypha indica extract (0.5g, 1.0g, and 1.5g) and *Aloe vera* gel (1.0g) were added in varying amounts to three different herbal gel compositions. The following are the evaluation parameters for the F3 formulation: pH 6.43, Pale green color, nice odour, no Skin irritation, Appealing Washability , Appealing Spreadability (4.7cm), Viscosity (17996 cP), Drug content (Higher concentration), Diffusion study (Higher drug release), and Anti bacterial (Staphylococcus aureus-18mm and Klebsiella pneumonia-21mm) .

CONCLUSION

It was successfully possible to generate three herbal gel formulations with different concentrations of active ingredients. Using Carbopol as a substrate, the extract from the plant *Acalypha indica* was transobserved into the gel. *Acalypha indica* and *Aloe vera* gel have numerous therapeutic properties. • In vitro drug release, homogeneity, drug content, pH, viscosity, spredability, organoleptic characteristics and skin irritation test all showed positive findings. • S. Aureus and K. pneumonia was susceptible to the antibacterial action of the herbal gel. • The usage of the herbal gel in the treatment of psoriasis can be inferred. • When

comparing the three formulations, it is found that formulation F3 yields better results. Based on evaluation criteria, the best formulation is selected.

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