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Research Paper

Formulation And Evaluation of Polyherbal Gel for Skin Diseases

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ABSTRACT

Allium sativum, Curcuma longa, Aloe barbadensis, and Azadirachta indica ethanolic extracts have been used to create gel mixtures. Allium sativum buds, Curcuma longa rhizomes, Aloe barbadensis and Azadirachta indica leaves have been used to cure a variety of bacterial illness. Create a Polyherbal gel and test its antibacterial efficacy against P.aeruginosa and E. coli using ethanolic extracts of Allium sativum, Curcuma longa, Aloe barbadensis, Azadirachta indica. The plant material was first extracted using an ethanolic solvent utilizing the maceration method of extraction. The extract was evaluated for antibacterial activity against P. aeruginosa, and E. coli. The last phase involves the creation and assessment of polyherbal gel. The effective antimicrobial activity of polyherbal gel against P. aeruginosa and E. coli was reported. The antimicrobial activity observed is attributed to the active compounds found in the plant material. The antimicrobial efficacy was evaluated using the disc diffusion method, along with the gels pH, viscosity, spreadability, homogeneity and skin irritancy test. The results demonstrated that the developed formulation is effective in treating skin diseases

INTRODUCTION

For the treatment of numerous skin conditions about 80% of the world's population still heavily relies on traditional remedies. Earlier reports said that herbal medicines are safe and have few side effects, particularly when compared to the modern pharmaceuticals. There has been a slow growth of interest in the use of medicinal plants in developing nations in recent years. Due to its

widespread use and benefit ratio of topical herbal therapies of have attracted a lot of research focus . Topical administration of gels at pathological locations offers significant advantages in terms of the quicker release of a medicine straight to the site of the action[1].Different Formulations, ranging from solid to liquid dosage form, have been employed by medical professionals to treat dermatological infections. Polyherbal gel is most

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widely used formulation among all of these because of high efficacy against skin infection[2]. Polyherbal formulations exhibit enhanced efficacy and potency against various human dermatological disorders due to active phytochemicals-such as steroids, alkaloids, tannins, triterpenes, flavonoids and glycosides derived from *Allium sativum*, *Curcuma longa*, *Aloe barbadensis* and *Azadirachta indica* which possess proven antibacterial, antimicrobial, antioxidant and wound healing properties.

Skin Diseases:-

A skin diseases is any condition that affects the skins appearance, structure or function. It can be caused by infections, allergies, autoimmune

disorders, genetics, environmental factors and irritation.

some common skin diseases include:-

1. Scabies – The commonest skin disease and it transmitted by direct contact.
2. Superficial mycoses – This group of infection was usually reported as one of the three commonest diseases.
3. Pyoderma – This disease was often , but not invariably, associated with scabies.
4. Eczema or dermatitis – This disease was usually unclassified, irritant dermatitis and chronic lichen simplex were often cited.
5. Acne – This disease was reported as an emerging and common problem[3].



Fig.No.1:- Skin Diseases

Kumar et al. (2025): Developed a herbal antibacterial gel in which they studied physiochemical characteristics and stability. Manoj A. Suva et al. (2024): Reported that hydroalcoholic extract exhibits antimicrobial, anti-inflammatory, antioxidant and antiacne activities. Salwa M. Raweh et al. (2024) Evaluated the antimicrobial activity of *Azadirachta indica* extract against *Pseudomonas aeruginosa* and *Escherichia coli*. Dalia A. Pondini et al. (2023): Reported that ethanolic extract of *Curcuma longa* possesses antioxidant, anti-inflammatory and antimicrobial activities beneficial for skin healing. Gurning Kaste et al. (2023): Rhizomes of *Curcuma longa* were found to contain phytochemicals such

as alkaloids and tannins with performed antimicrobial activity. Femy Safri et al. (2020): Reported that Carbopol 940 is a suitable gelling agent and significantly identified gel pH, viscosity and spreadability. Although individual plant extracts have been studied extensively, there is limited research on polyherbal gels that combine multiple extracts into one formulation. The synergistic potential of combining *Curcuma longa*, *Azadirachta indica*, *Aloe barbadensis* and *Allium sativum* in a Carbapol-based gel has Carbopol-based gel has not been systematically explored. Most studies focus on single herbs or isolated compounds, leaving a gap in developing and evaluating a comprehensive polyherbal gel for

skin diseases. That's why my aim of this research paper is To Formulate and Evaluate Polyherbal gel for Skin Diseases and objectives are to identify components required for making the polyherbal gel, to develop the polyherbal gel, to determine the Physiochemical properties, pH, Viscosity, Spreadability of polyherbal gel.

Plant Profile:-

1) Garlic^[4]:-

One of the traditional medicines that can be used to treat skin diseases. Garlic (*Allium sativum*)

contains essential chemical compounds which are good for the body.

Organoleptic Properties:-

Colour: Pinkish white

Odour: Odoriferous

Taste: Soft, Sweet buttery flavour

Size: 1.5-2.5 cm

Biological Functions:-

- Antioxidant Activity
- Anti-inflammatory Activity
- Antimicrobial Activity
- Modulating Immunity System

T

able No.1:- Taxonomical classification of *Allium sativum*

Kingdom	Plantae
Division	Mangnoliophyta
Class	Liliopsida
Order	Asparagales
Family	Alliaceae
Subfamily	Alliodeae
Tribe	Allieae
Genus	<i>Allium</i>
Species	<i>A. sativum</i>



Fig.No.2:- Garlic

2) Turmeric^[5]:-

Turmeric (*Curcuma longa*) is also a traditional medicine which is used in the various skin diseases. It uses as an antiseptic for cuts, burns & brises and as an antibacterial agent.

Organoleptic Properties:-

Colour: Yellow

Odour: Earthy, Woody

Taste: Bitter

Size: 1m

Biological Functions:-

- Antioxidant Activity
- Anti-inflammatory Activity
- Antimicrobial Activity



- Modulating Immune System

Table No.2:- Taxonomical classification of *Curcuma longa*

Kingdom	Plantae
Division	Magnoliophyta
Class	Liliopsida
Order	Zingiberales
Family	Zingiberaceae
Genus	Curcuma
Species	Curcuma longa



Fig.No.3:- Turmeric

3) Aloe Vera^[6]:-

Aloe Vera (*Aloe barbadensis*) is a semi-tropical with a broad range of applications in the foods, drugs and cosmetic industries. The aloe vera contains various health benefits which are important for the human body.

Organoleptic Properties:-

Colour: Green

Odour: None

Taste: Bitter

Size: 60-100 cm

Biological Functions:-

- Anti-Cancer Activity
- Antiulcer Activity
- Antifungal Activity
- Antidiabetic Activity

Table No.3:- Taxonomical classification of *Aloe barbadensis*

Kingdom	Plantae
Clade	Tracheophytes
Clade	Angiosperms
Clade	Monocots
Order	Asparagales
Family	Asphodelaceae
Subfamily	Asphodeloideae
Tribe	Aloaeae
Genus	Aloe



Fig.No.4:- Aloe Vera

4) Neem^[7]:-

The Neem is one of the most versatile medicinal plant known for its numerous health benefits. The Neem tree is used for skin care and improve the skins beauty.

Organoleptic Properties:-

Colour: Yellowish Green

Odour: Indistinct

Taste: Bitter

Size: 15-20 m

Biological Functions:-

- Anti-Cancer Activity
- Antiulcer Activity
- Antifungal Activity
- Antidiabetic Activity

Table No.4:- Taxonomical classification of Azadirachta indica

Kingdom	Plantae
Class	Dicotyledonae
Order	Rutales
Family	Meliaceae
Subfamily	Mellioideae
Tribe	Meliceae
Genus	Azadirachta
Species	Indica



Fig.No.5:- Neem

MATERIALS AND METHODOLOGY

Materials:-

Ethanol, Nutrient agar, Carbopol-940, Propylene glycol., Methyl paraben, Propyl Paraben,

Triethanolamine, Plant extracts (Allium sativum, Curcuma longa, Aloe barbadensis and Azadirachta indica), Rose water, Distilled Water.

Instruments:-



Digital pH meter (alpha-01d), Digital Brookfield Viscometer (DV-E)

Methodology:-

Collection

Leaves of Aloe barbadensis, Azadirachta indica was collected from college premises and dried rhizomes of Curcuma longa and fresh buds of Allium sativum was brought from market of Warthi, Bhandara.

Authentication

Authentication of leaves of Aloe barbadensis, Azadirachta indica, buds of Allium sativum and dried rhizomes of Curcuma longa was done by Dr. Mrs Sayeda Qureshi, Associate Professor and Head of Botany Department, J. M, Patel College, Bhandara.

Extraction:-

By using the process of maceration, the extract of Aloe vera, Garlic, Neem and Turmeric was prepared.

1. Aloe vera

Aloe vera leaves were washed and homogenized using a blender. The homogenate was dissolved in a ratio of 1:1 of distilled water and methanol respectively for 48 hours. The solutions were filtered and the filtrate was evaporated at 45°C in an obtain aqueous and methanol extract of Aloe vera[8].

2. Turmeric

The Turmeric rhizome was cleaned and cut into small pieces. Samples of black rice bran and turmeric dried in an oven at 35-40°C to a constant weight, then ground and sieved through a 40- mesh sieve. 500 g of rice bran and 60g of turmeric powder soaked in a 96% ethanol solvent (1:10 weight/volume) for 2 days samples (24h) with occasional stirring. The filtrate with Whatman paper No. Yield (%) of evaporated dried extracts was calculated as Distilled Water

extracts/Distilled Water $\times 100\%$ Where Distilled Water sample is the dry weight of the sample and Distilled Water is the weight of the extracts after drying[9].

3. Neem

Neem extraction of mature fresh neem leaves collected from farm in Warthi. The fresh neem leaves were washed under tap water to remove the dust and foreign particles then dried in shade for 4 hours and then in oven at 50°C for 1 hr. The dried leaves were used to make neem powder. 30 g of neem powder was extracted with 95% ethanol, methanol or distilled water. The solutions were incubated for 24 h in shaker incubator. Subsequently, the mixture was boiled in hot water bath for 30 min and further incubated in shaker incubator for 24 h. After incubation the solution was filtered under vacuum through Whatman No. 1 filter paper. The organic solvents were removed by rotary evaporator under reduced pressure at 40°C to give crude extract. The aqueous extract was evaporated by freeze dry machine to remove the solvent[10]

4. Garlic

The garlic was first dried then grind into a fine mash. This mash was soaked in 96% ethanol at a ratio of 1:10 and left to macerate for 24 hours. The process was repeated three times to ensure thorough extraction. Afterward, the liquid extract was concentrated using a rotary vacuum evaporator, leaving behind a thick garlic extract. To prepare different strengths the concentrated extract was diluted with distilled water to create solutions of 20%, 40%, 60% and 80%. These preparations were then examined for their organoleptic properties such as colour, smell and subjected to phytochemical screening to identify the presence of secondary metabolites in a qualitative manner[11].



Preparation of Polyherbal Gel

Polyherbal gel formulations are made by combining Carbopol-940, Propylene glycol, Methyl paraben, Propyl paraben and Triethanolamine. After that the dried crude extract

of all Four plant ingredients was added and the mixture was stirred continuously to ensure the extracts blended evenly throughout the gel resulting in consistent formulation[12].

Table No.5:- Composition of Polyherbal Gel

Ingredients	Gel 1 (gm)	Gel 2 (gm)	Gel 3 (gm)
Carbopol-940	0.5	0.5	0.5
Plant extract	0.05	0.15	0.2
Propylene glycol	0.1	0.1	0.1
Methyl paraben	0.02	0.02	0.02
Propyl paraben	0.01	0.01	0.01
Triethanolamine	0.2	0.2	0.2
Rose water	4 drops	4 drops	4 drops
Distilled water	To make 50 gm	To make 50 gm	To make 50 gm

Phytochemical Screening for Extracts:-

1) Test for Garlic (Flavonoids)

Ferric chloride Test: Add extract and 2ml of ferric chloride which develops black colour and it shows positive test.

2) Test for Turmeric (Alkaloids)

Mayer Test: Add extract and 2 ml of Mayer reagent which develops cream colour precipitate and it shows positive test.

Hager Test: Add extract and 2 ml of Hager Reagent which gives white precipitate and it shows positive test.

3) Test for Aloe vera (Glycoside)

Modified Borntrager Test: Add extract and 2 ml of ferric chloride, 2 ml of dilute Hydrochloric acid and heat it for 5 minutes for boiling then filter, cool and add benzene which separates organic layer and due to ammonia, it develops pink colour it shows positive result.

4) Test for Neem

Biuret Test: Add extract and water, 2ml of 1% potassium hydroxide, few drops of copper

sulphate which develops violet colour and it gives positive test[13].

Anti-microbial Activity of Extract:-

Test Micro-organisms

In this work, two prevalent pathogenic micro-organisms the gram-negative bacteria *Pseudomonas aeruginosa* and *Escherichia coli* were employed. Antibacterial activity was assessed using both bacterial strains that were acquired from an Anurag College of Pharmacy in Warthi, Bhandara.

Anti-microbial Activity Screening

The anti-microbial activity of the four extracts was determined according to the agar well diffusion method. In this method pure isolates of micro-organisms were subcultured on the recommended specific medium at 37°C for 24 hours. One hundred microliters of inoculum of each test organism was spread onto the specific media plates (containing Mueller Hinton Agar) and 6 mm diameter wells were bored with a sterile borer in the inoculated agar plates 100 microliters of each



extract were injected directly into wells (in triplicates) of inoculated specific media agar plates for each test organism. The plates were left to stand for 10 minutes to allow diffusion of the extract and incubated at 37°C for 24 hours. Sterile Distilled water and 20% DMSO were used as negative controls and 0.2% Chlorhexidine as a positive control. The antimicrobial activity was indicated by the presence of an inhibition zone around the well containing the extract. The zone of inhibition was measured in millimeters by means of vernier caliper[14].

Evaluation of Polyherbal Gel:-

1. Visual Appearance:-

The prepared polyherbal gels were inspected for their colour, greasiness, consistency and odour[15].

2. pH Determination:-

The pH of all formulated herbal gels was measured by using digital pH meter[16].

3. Spreadability of Gel Formulations:-

The spreadability of the formulated gels were assessed using the glass slide technique, a widely adopted method for evaluating topical preparations. In this procedures, approximately 0.5 g of gel was carefully placed between two clean glass slides. A weight of 125 g was applied for five minutes to allow the gel to spread evenly, forming a uniform thin film. Following this, any excess gel was removed and a smaller weight of 20 g was attached to upper slide. The time required for the two slides to separate under this load was recorded as an indicator of spreadability. The spreadability value was then calculated using the standard equation providing a quantitative measure of the ease with which the gel can be applied over a surface.

$$S = M / T$$

Where,

S= Spreadability (g/s)

M= Applied weight (g)

T = Time taken for slide separation (s)[17].

4. Viscosity:-

Gels viscosity was studied using Brookfield Viscometer[18].

5. Homogeneity:-

The homogeneity of the gel formulations was examined visually after the gel set in their containers. The evaluation focused on their overall appearance of any visible aggregates with a smooth and uniform textures indicating good homogeneity[19].

6. Washability:-

The formulations were applied on the skin and then ease and extent of washing with water were determined manually[1].

7. Skin Irritancy Test:-

The formulation was applied to a marked area on the dorsal surface of the skin and observed for erythema, oedema or irritation over 2 hours[20].

8. Antimicrobial Study:-

a. Isolation of Bacterial Strains

Pseudomonas aeruginosa and *Escherichia coli* strains were produced from the microbiology laboratory and cultured on nutrient agar medium (Merck Millipore). Then nutrient agar medium (Merck Millipore). The plates were incubated under anaerobic conditions for 48 hours to promote bacterial growth. For the human swab sample, a volunteer clinically diagnosed with acne vulgaris was selected. The volunteer's face was



rinsed with distilled water and dried using a sterile cotton wipe. A visible comedone was carefully punctured with a sterile acne needle, A visible acne needle, and the exudate was collected using a sterile cotton swab. This swab was then immersed in 5 ml of distilled water for five minutes, After which the suspension was evenly spread onto freshly prepared agar plates. The plates were incubated at 37°C for 48 hours, allowing distinct bacterial colonies to develop.

b. Evaluation of Antibacterial Activity

The antibacterial efficacy of the gel formulation was tested using the disc diffusion method against the two bacterial stains. Bacterial stain cultures were standardized in Brain Heart Infusion broth to achieve a density of approximately 10^8 cells /ml. From this suspension , 10 ml was uniformly spread onto agar plates. Sterile filter paper discs (1 cm diameter) were soaked for five minutes in either the prepared polyherbal gel or a Standard Clindamycin gel. The treated discs were then placed at the centre of the inoculated plates and incubated for 72 hours. After incubation the zones of inhibition were measured in millimeters, starting from the edge of the disc to the boundary where bacterial growth was halted[21].

9. Thin Layer Chromatography (TLC):-

1. TLC of Garlic Extract:-

The polar mobile phase was formulated using equal volumes of glacial acetic acid, propanol, water and ethanol (20:20:20:20, v/v/v/v). For the non-polar mobile phase, a mixture of hexane and acetone in the ratio of 70:30 was prepared and adjusted to a final volume of 100 ml. Silica gel60 Tlc plates served as the stationary phase. After development, the plates were examined under UV light at 254 nm, and Rf values were determined. To visualize amino acid derivatives, ninhydrin and

anisaldehyde were applied as spraying reagents[22].

2. TLC of Turmeric Extract and Neem Extract:-

A standard solution was prepared by dissolving 10 mg of the reference compounds in 10 ml of methanol. The mixture was filtered to eliminate any insoluble particles and the clear filtrate was subsequently used for spotting onto silica gel plates. The test solution was prepared by dissolving 0.5 g of the extract in 100 ml of methanol. The mixture was then filtered to remove any insoluble material and the resulting filtrate was applied for spotting onto silica gel plates After development, the plates were examined under UV light at 256 nm, and Rf values were determined.[23].

3. TLC of Aloe vera Extract:-

TLC plates were prepared using silica gel as absorbent. To make the coating slurry 15 g of silica gel-G was blended with 30 ml of distilled water and promptly spread onto the plates. These were left to air-dry for 1 hour followed by heat treatment at 100°C for 90 minutes to fix the layer. Using a micropipette approximately 10 microliters of extract were carefully applied to the plates and allowed to dry. Development was carried out with two solvent systems: system 1 composed of chloroform and methanol (12:2) while system 2 consisted of ethyl acetate, toluene and formic acid in the ratio of 2:2:1:1:1:1 After development, the plates were examined under UV light at 254 nm, and Rf values were determined.[24].

RESULT AND DISCUSSION:-

Evaluation Test for Extract

1. Determination of Phytochemical screening for extract:-



Table No.6:- Phytochemical screening for extracts

Sr. No.	Tests	Reagents	Observation	Result
1.	Alkaloids	Hagner's Reagent	Gives Yellow Precipitate	+
		Mayer's Reagent	Gives White Precipitate	+
2.	Ferric Chloride Test	Ferric Chloride	Gives Brownish Blue Colour	-
3.	Glycosides (Borntrager Test)	Ferric Chloride, Benzene, Ammonia	Gives Pink Precipitate	++
4.	Flavonoids	Magnesium, Hydrochloric acid	Pink to Blue Colour	++
5.	Tannins	1% Ferric Chloride	Gives Black Precipitate	++
6.	Biuret Test	Copper sulphate, Potassium Hydroxide	Gives Purple/ White Precipitate	+++

Note: (+++) Highly present, (++) Moderately present, (+) Weakly Present, (-) Absent.

2. Determination of TLC of Extracts:-

Table No.7:- Rf value of Extracts

Drugs	Allium sativum		Curcuma longa		Azadirachta indica		Aloe barbadensis	
Standards	Alliin		Curcumin		Azadirachtin		Aloin	
Mobile phase	Glacial acetic acid: Propanol:Water:Ethanol (20:20:20:20)		Chloroform:methanol (9.5 : 5)		Diehyl ether : ether (8.1 : 1.9)		Chloroform:methnol (12 : 2)	
Rf value	Standard	Sample	Standard	Sample	Standard	Sample	Standard	Sample
	0.33	0.32	0.7	0.71	0.74	0.78	0.68	0.66



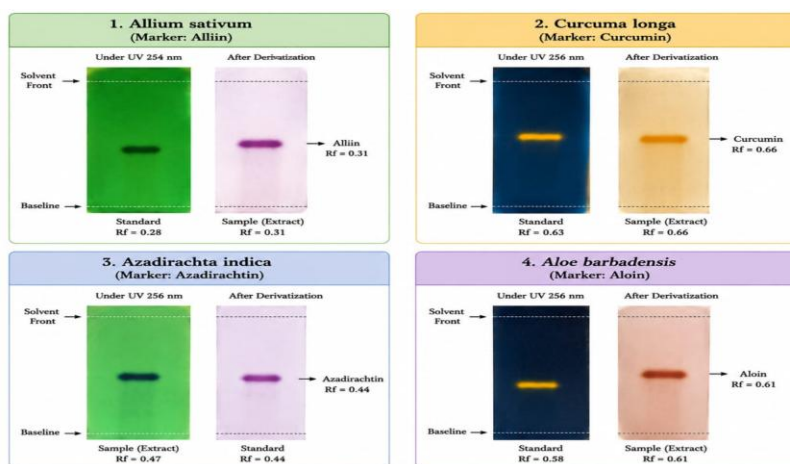


Fig.No.6:- Rf Value of Extracts

Evaluation Test for Polyherbal Gel

1. Determination of Physiochemical Properties:-

Table No.8:- Physiochemical Properties of Polyherbal Gel

Sr. No.	Physical Parameters	Standard Values	Observations		
			Gel 1	Gel 2	Gel 3
1.	Colour	Pale Yellow to Yellow	Pale Yellow	Light Yellow	Light Yellow
2.	Odour	Characteristics	Rose like	Rose like	Rose like
3.	pH	5.0-7.0	5.81	6.08	5.95
4.	Washability	Easily Washable	Easily Washable	Easily Washable	Easily Washable
5.	Texture	Smooth	Smooth	Smooth	Smooth
6.	Homogeneity	Uniform	Uniform	Uniform	Uniform
7.	Skin Irritancy Test	No Irritation	No	No	No

2. Determination of Spreadability:-

Table No.9:- Spreadability of Polyherbal Gel

Formulation	Mass (gm)	Length (cm)	Time (sec)	Spreadability (gm cm/sec)
Gel 1	20 gm	8.5	10.33	16.45
Gel 2	20 gm	6.5	9.00	14.44
Gel 3	20 gm	4.5	7.38	12.19



3. Determination of Viscosity:-

Table No.10:- Viscosity of Polyherbal Gel

Formulation	Viscosity (cP)
Gel 1	9093.33
Gel 2	8720
Gel 3	7770

4. Determination of Antimicrobial Activity

Table No.11:- Antimicrobial Activity of Polyherbal gel

Plant Extract, Trials and Standards (Clindamycin gel)	Microbial Zone of Inhibition	
	Escherichia coli	Pseudomonas aeruginosa
Aloevera	10 mm	10 mm
Neem	15 mm	13 mm
Turmeric	10 mm	10 mm
Garlic	13 mm	07 mm
Gel 1	10 mm	09 mm
Gel 2	13 mm	10 mm
Gel 3	11 mm	09 mm
Clindamycin gel	17 mm	15 mm

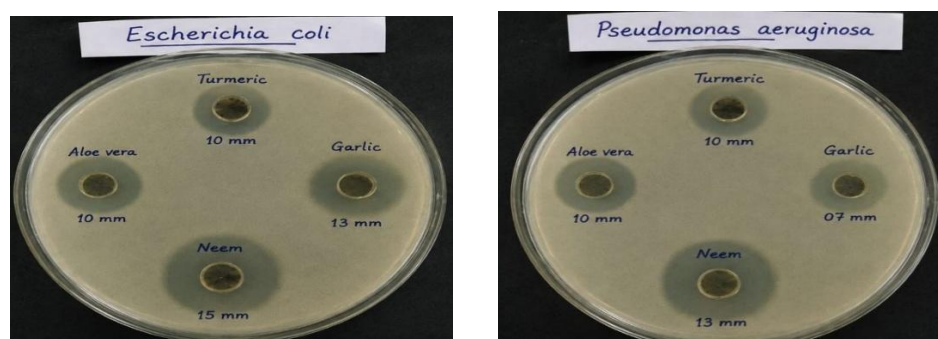


Fig.No.07:- Zone of Inhibition of Extracts

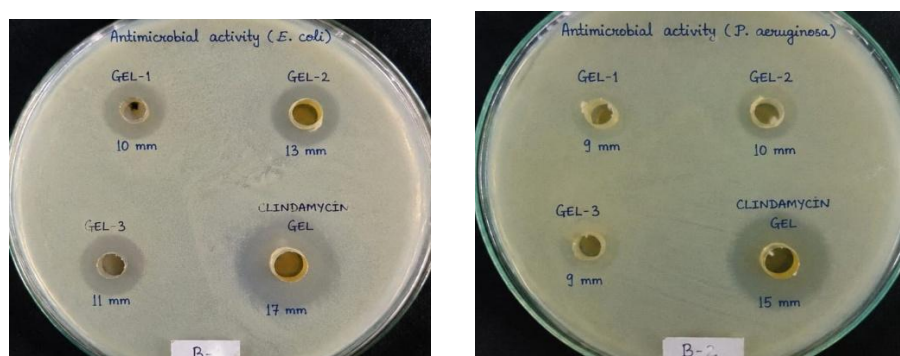


Fig.No.08:- Antimicrobial Activity of Polyherbal gel

DISCUSSION

The polyherbal gel turned out to be both stable and effective. Its pH (5.8–6.0) matched skin compatibility, meaning it's gentle and unlikely to cause irritation. The gel had a smooth texture, spread easily, washed off without difficulty, and showed good consistency making it practical for everyday use. In antibacterial testing, the gel inhibited *E. coli* and *P. aeruginosa* with zones of 9–13 mm. While this was slightly less than the standard clindamycin gel, it still showed strong antimicrobial potential. Among the individual extracts, neem was the most powerful, followed by garlic, turmeric, and aloe vera. When combined, the extracts worked together to provide balanced, broad-spectrum activity. Overall, the study confirms that this polyherbal gel is a safe, natural, and cost-effective alternative to synthetic topical agents. It highlights how traditional medicinal plants can be successfully integrated into modern formulations to manage skin infections and improve therapeutic outcomes.

CONCLUSION

From the present work it is concluded that formulated gel has positive antimicrobial effect when applied topically. It contains natural ingredients and is safer with no side effects. The potential antimicrobial activity observed for the formulation may be due to the presence of active constituents such as allicin, azadirachtin, aloin and curcumin. The widespread acceptance of natural remedies due to the belief that they are safer and have less side effects makes herbal extracts very feasible. In this study, antimicrobial property of each herbal extract was verified.

The pH, Spreadability, Viscosity, Homogeneity and overall appearance of the prepared gel were evaluated and the formulation showed desirable characteristics. It also exhibited a strong antimicrobial activity indicating its potential as a

therapeutic product. Further in vivo testing and clinical evaluation will be critical for translating the formulation into a commercially viable product to take this work forward. The observed antibacterial effects are probably due to active phytoconstituents present in the ethanolic extracts of *Aloe barbadensis* leaves, *Azadirachta indica* leaves, *Allium sativum* buds and *Curcuma longa* rhizomes. Importantly, these bioactivities were retained when incorporated into the gel base, which is a promising indication for future development. Based on these findings, the polyherbal gel could serve as an effective topical treatment for skin infections including *acne vulgaris*, once its safety and efficacy are confirmed through clinical and toxicological studies.

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