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FORMULATION AND EVALUATION OF *Wrightia tinctoria* TOPICAL HERBAL GEL ENRICHED WITH ALOEVERA AND VITAMIN E FOR ANTI BACTERIAL ACTIVITY

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ABSTRACT

The aim of the present study is to formulate and evaluate a topical herbal gel that contains *Wrightia tinctoria* leaf extract. The ethanolic extract of *Wrightia tinctoria* leaf extract was used to create a gel formulation in different concentrations (0.5, 1, 1.5, and 2%). Topical anti-bacterial activity of gel was also assessed. Gel was prepared using Carbopol 934 (0.5% w/v), tinctoria leaf extract, ethanol, vitamin E, aloe vera, propylene glycol , methyl paraben, glycerine, tri-ethanolamine, hydroxy propyl methyl cellulose, rose oil and the necessary amount of distilled water. Wrightia tinctoria extract as the main active ingredient, along with Aloe vera and Vitamin E due to their known antibacterial, anti-inflammatory, soothing, antioxidant, and skin-protective properties. The prepared formulations were assessed for their physical qualities, pH, viscosity, spreadability, extrudability and anti-bacterial activity. The findings suggested that gel compositions were good in terms of appearance and uniformity.

KEYWORDS: Herbal; Topical gel; *Wrightia tinctoria*; Anti-bacterial.

1. INTRODUCTION

Herbs plays an essential role in the maintenance and wellbeing of human beings. Many of them are considered medicinally important. Herbs are plant parts such as leaves, seeds, flowers, roots used for flavouring, food, and

medicine. Herbs and herbal preparations are considered as the backbone of systems of medicine. The WHO recognizes the importance of herbal medicine to the health of many people and has developed guidelines to evaluate herbal medicine using modern control procedures and suitable standards.[1] Topical herbal gels are a semisolid preparation containing herbal extracts for skin application. These have emerged as effective alternatives for skincare, combining the therapeutic benefits of natural ingredients with advanced formulation techniques. It was helpful for treating skin rashes, swelling, and skin cracks. It can equally be important to skin.[2]

Wrightia tinctoria (Pala indigo plant) is a small, deciduous tree with a light grey, scaly smooth bark with white fragrant flowers distributed throughout the world. This plant is reported to have wound healing, anti-ulcer, fungicidal, anti-bacterial, anti-nociceptive and immunomodulatory activity.[3] The leaf contains Flavonoid, Lupeol, α- and β- amyrin, Indigotin, Indirubin, Tryptanthrin, Isatin, Rutin, β- sitosterol, Triacontanol, Myristic acid, Palmitoleic acid, Palmitic acid, Stearic acid, Behenic acid, Arachidic acid.[5] The Aloe vera plant has been known and used for centuries for its health, beauty, medicinal and skin care properties.[4] It is hydrating, rejuvenating, and toning for skin. It moisturizes and softens skin. Known for its cooling and healing properties, it helps soothe burns, rashes, and dry skin.[4] Vitamin E is an important fat-soluble antioxidant and has been in use for more than 50 years in dermatology. Topical vitamin E has emerged as a popular treatment for several skin disorders owing to its antioxidant properties.

Bacterial skin infections are common dermatological disorders caused by pathogenic microorganisms, leading to inflammation, discomfort, and damage to skin tissues. Acute bacterial conditions such as impetigo, folliculitis, furunculosis, and infected wounds are frequently associated with symptoms including redness, swelling, pain, itching, pus formation, and irritation. Hence, the present study was aimed to formulate and evaluate a topical herbal gel containing Wrightia tinctoria extract enriched with Aloe vera and Vitamin E for the management of bacterial skin infections.[6]

2. MATERIALS AND METHODS

2.1 Plant collection and authentication

Fresh leaves of wrightia tinctoria was collected from Thirumittacode, Pattambi, Kerala. Authentication and certified by Sree Neelakanta Govt Sanskrit College, Pattambi, Palakkad, kerala-679306.

Figure 1: Plant collection.

2.2 Drying

The collected fresh leaves of Wrightia tinctoria were washed well using running water and by double distilled water. This helped to remove all impurities present in the collected leaves. They were then dried under shade for a period of

20 days to remove the excess moisture present in them and this process helps to avoid destruction of active compounds. After drying, they were ground completely and stored.[7]

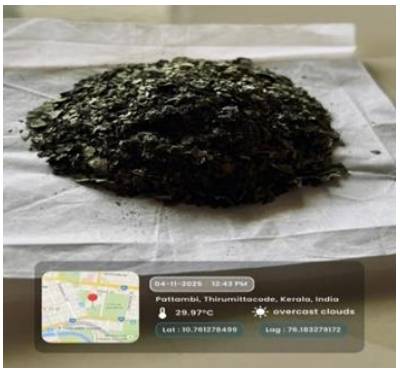


Figure 2: Drying.

2.3 Preparation of plant extract

The Wrightia tinctoria leaf (30g) to be extracted was grinded with mechanical grinder, the powder was kept in small, labelled plastic bags. The extract was prepared by using the Soxhlet extraction at 60-80˚C. The leaves were extracted with ethanol for 72 hours to get crude extract. Then the thimble which is made from the specially made FP is placed inside the extractor and the required solvent in 300 ml is taken in the RBF which is placed in heating Mandle. When the apparatus is turned on, the vapor from the solvent travels through the distillation arm and then through the thimble. The thimble is surrounded by the warm solvent which makes the powder to get dissolved in it. When the solvent is full in that area, then it gets automatically emptied to the RBF placed at the bottom. The cycle is repeated until the solvent becomes colourless. The extracted solvent is taken. It was filtered through Whatman No.1 filter paper and placed in a rotary evaporator or hot air oven. Here the solvent is evaporated, and the dry crude extract is transferred to the vial.[8][9]

Figure 3: Preparation of plant extract.

2.4 phytochemical screening of plant extract

Table 1.

Phytoconstituents	test	Result
Alkaloids	Mayer's test	+ve
	Hager's test	
	Wagner's test	
Flavonoids	Alkaline reagent test	+ve
	Lead acetate test	
carbohydrates	Molisch's test	+ve
saponins	Saponin test	+ve
Phenols and tannins	Phenols and tannins test	+ve
Triterpenoids	Salkowski test	+ve

2.5 Preparation of topical herbal gel[10]

Accurately weighed carbopol 934 was dispersed slowly in 35 ml of distilled water in a 250 ml beaker. Kept the beaker aside to swell the carbopol 934 for 30 min. then stirred well using magnetic stirrer at 1200 rpm for 30 min. Required quantity of methyl paraben was dissolved in 5ml distilled water with aid of heat on water bath. After cooling propylene glycol was added and stirred. Add required quantity of vitamin E, aloe vera and glycerine to the above mixture. Add Varying concentration of W.t leaf extract with constant stirring. Required quantity of HPMC and 1-2 drops of rose oil was added. Triethanolamine was added dropwise to the formulation for the adjustment of skin pH and to get required gel consistency.

Table 2.

Ingredients	F1	F2	F3	F4
leaf extract	0.5g	1g	1.5g	2g
Carbopol 934	0.15g	0.15g	0.15g	0.15g
Vitamin E	5drops	5 drops	5 drops	5 drops
Aloe vera	0.25g	0.25g	0.25g	0.25g
Methyl paraben	0.06g	0.06g	0.06g	0.06g
Propylene glycol	1.5 ml	1.5 ml	1.5 ml	1.5 ml
Glycerine	1 ml	1 ml	1 ml	1 ml
HPMC	0.3g	0.3g	0.3g	0.3g
Triethanolamine	1 drop	1 drop	1 drop	1 drop
Rose oil	q. s	q. s	q. s	q. s
Water	q.s to 30 ml	q.s to 30 ml	q.s to 30 ml	q.s to 30 ml

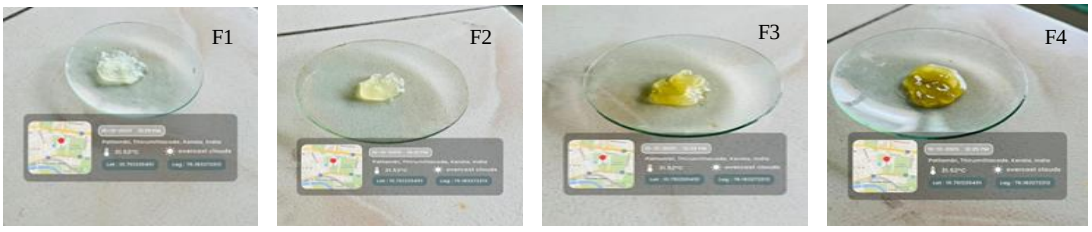


Figure 4: Formulations [F1,F2,F3,F4].

2.6 Evaluation gel formulation parameters

2.6.1 Physical appearance

Visual inspection is done to determine the topical herbal gels physical characteristics, odour, colour, texture.

- Colour: Herbal gel formulation were checked visuality for colour. Applied a small amount of topical herbal gel on to a white surface. Observe the colour of the gel under standard lighting condition.[10]
- Odour: Ensured that gel testing is conducted in a scent-neutral environment. Open the container and bring the gel close to your nose, take a moderate sniff to detect any scent.[10]
- Homogeneity: The gels will be tested for homogeneity by visual inspection based on the appearance and the presence of any aggregates.[11]
- Texture: Take a small amount of gel in your fingers and spread it and check the texture of the gel.
- Consistency: Consistency was evaluated by applying the formulation onto the skin.

2.6.2 pH test

The pH of the different gel formulations was determined using digital pH meter.[14] 1 g of the gel should be dissolved in 100 ml of distilled water and will be stored at 4℃ for about 2 h. The electrode should be dipped in the diluted gel and the readings should be recorded. The measurements will be done in triplicate form and average values are noted.[13]

2.6.3 Viscosity

The viscosity of gels was determined by using a Brookfield viscometer. Gels were filled in a jar and the spindle was lowered taking care that spindle does not touch bottom of the jar. The spindle no.3 was rotated at 6 rpm, and the corresponding dial reading was noted. The measurement of viscosity of each formulation was in triplicate and the average values are presented.[13]

2.6.4 Spreadability

It specifies the extent of the area to which the gel spreads readily on the application to the skin. To assess spreadability, 0.5g herbal gel formulations placing between the two glass slides and keeping a weight of 100 g on the upper slide for a period of 5 minutes The increase in diameter due to gel spreading is noted. The spreadability is calculated using the following formula:-

$$\text{Spreadability (S)} = M \times L/T$$

Were,

M- Weight tied to slide

L - Length of slide

T - Time required to separate slides.[14]

2.6.5 Washability

To test the washability of the gel, apply a small amount of gel on to the rough surface of an old glass slide and let it dry. Once dry, pour water over the gel to see how easily it washes off. The rough surface of the glass slide is used to stimulate the texture of the skin.[14]

2.6.6 Extrudability

The gel formulations were placed into regular capped collapsible aluminium tubes and sealed by crimping the ends. The weights of the tubes are noted. The tubes were then placed between two glass slides, clamped and balanced. A weight of 500g was placed on top of the slides, and the cap was removed. The amount of gel that came out was collected and weighed. The percentage of extruded gels was calculated.[15]

2.6.7 Zone of inhibition

The antibacterial activity of the formulations was evaluated using Disc diffusion method. Mueller-Hinton Agar served as the culture medium for testing against Staphylococcus aureus and Escherichia coli bacterial strains. Bacterial strains were transferred to the agar plates using streak plate method. Total of three discs were prepared on each agar plate. One disc was impregnated with Standard antibacterial substance (Gentamicin). While the remaining two disc were loaded with different concentration of herbal gel formulation. After incubating the plates for 24 hours at 37°C, the antibacterial efficacy of the herbal gel formulation was evaluated by measuring the diameter of the zone of inhibition surrounding each disc containing the formulation. These results were then compared with the inhibition zone produced by a standard reference substance.[15]

3. RESULT AND DISCUSSION

3.1 Physical appearance

Table 3.

Parameters	F1	F2	F3	F4
Colour	Light yellow	Yellowish Brown	Golden- brown	Amber
Odour	Rose oil fragrance	Rose oil fragrance	Rose oil fragrance	Rose oil fragrance
Texture	Visible and smooth	Visible and smooth	Thick and smooth	Thick and smooth
Homogeneity	Homogenous	Homogenous	Homogenous	Homogenous
Consistency	Uniform	Uniform	Uniform	Uniform

3.2. Viscosity

Table 4.

Topical gel	F1	F2	F3	F4
Viscosity (cPs)	2985	3809	4980	6000

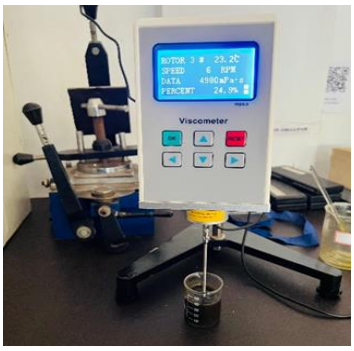


Figure 5: Viscosity of formulations.

3.3 pH

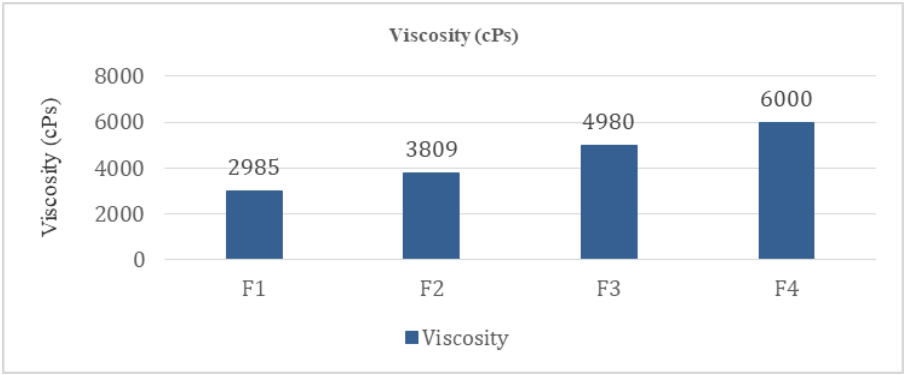


Table 5.

Topical gel	F1	F2	F3	F4
Trail 1	5.93	6.39	6.63	6.74
Trail 2	5.95	6.41	6.63	6.77
Trail 3	5.98	6.43	6.64	6.76
Average	5.95	6.41	6.63	5.75

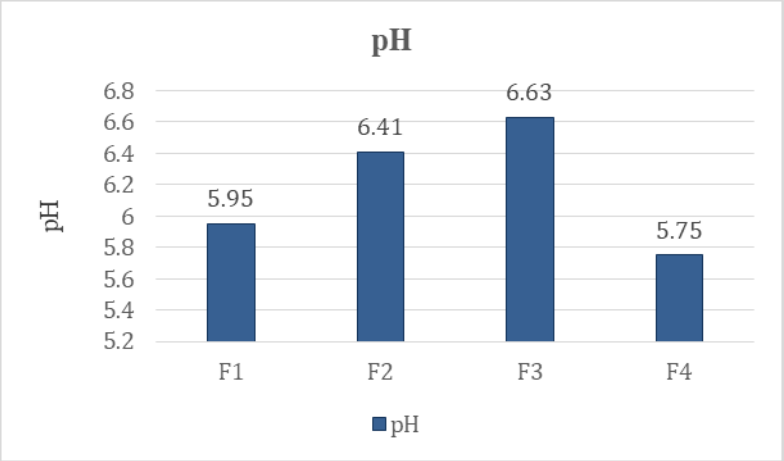
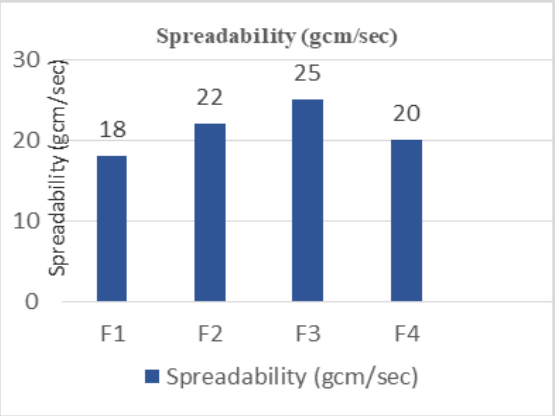


Figure 6: pH.



3.4 Spreadability

Spreadability test was done to ensure the spreadability, the formulated topical herbal gel was found to be easily spreadable.

Table 6.

Topical gel	**F1**	**F2**	**F3**	**F4**
Spreadability (gcm/sec)	18	22	25	20

3.5 Washability

Table 7.

Topical gel	**F1**	**F2**	**F3**	**F4**
Washability	Easily washable	Easily washable	Easily washable	Easily washable

Result of antibacterial activity

Antibacterial study by disc diffusion method

Table 8.

Sl. No.	Sample	Zone of inhibition (mm)	
		Escherichia coli	*Staphylococcus aureus*
1	F1	12	15
2	F2	15	16
3	F3	19	23
4	F4	17	18
5	Standard (Gentamicin)	22	27

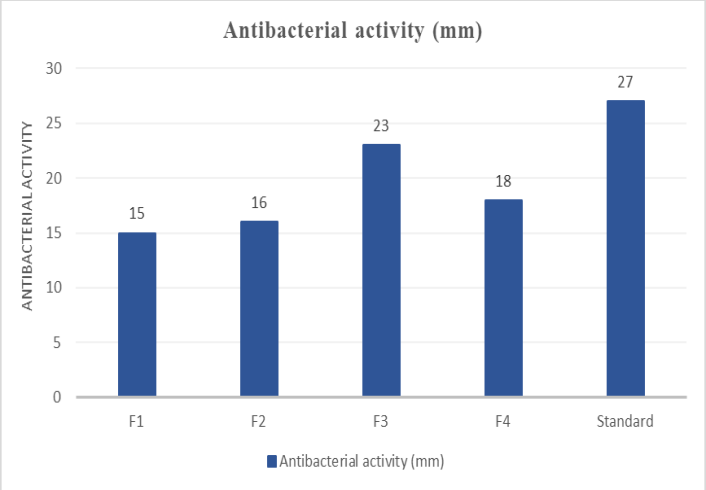
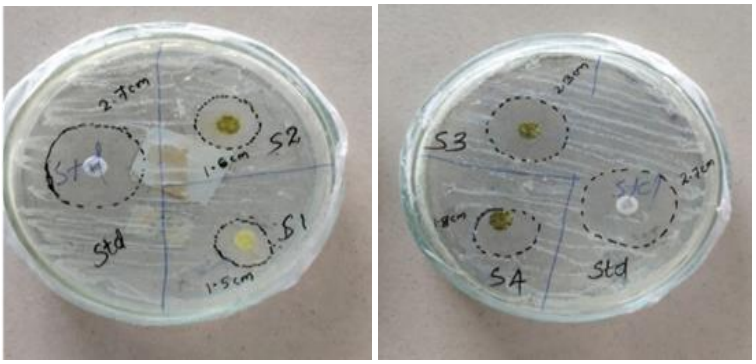


Figure 7: Zone of inhibition of *Escherichia coli.*

Figure 8: Zone of inhibition of *Staphylococcus aureus.*



DISCUSSION

The study formulated and evaluated a Topical herbal gel using Wrightia tinctoria leaf extracts enriched with Aloe vera and vitamin E, assessing its phytochemical composition, physical properties, rheology, and anti-bacterial efficacy.

Phytochemical Analysis

Phytochemical screening confirmed alkaloids, phenols, flavonoids, tannins, and terpenoids and glycosides in Wrightia tinctoria leaf extracts, enhancing the gel's antibacterial properties with Aloe vera and Vitamin E.

Physical and Rheological Properties

The prepared formulations F1, F2, F3 and F4 were observed to have a Light Yellow, Yellowish Brown, Golden- brown, amber colour, all formulations had a pleasant rose oil fragrance, and a smooth, thick texture. The homogeneous nature of the gel ensures uniform distribution of active ingredients.

- Viscosity values ranged from 3809 cPs (F2) to 4980 cPs (F3), indicating good consistency and ease of application.
- pH values were in the range of 5.75-6.63, which is suitable for topical application, ensuring no irritation.
- Spreadability tests confirmed that the gel was easily spreadable, enhancing ease of use.
- Washability was found to be efficient, ensuring easy removal without residue.

Antibacterial Activity

The antibacterial study demonstrated the gel's effectiveness against Staphylococcus aureus and Escherichia coli, two common microorganisms.

The zone of inhibition for Staphylococcus aureus was highest in F3 (23 mm), followed by F1 (15mm), F2 (16 mm), and f4 (18) showing strong antibacterial activity.

The zone of inhibition for Escherichia coli was highest in F3 (19 mm), followed by F1 (12 mm), F2 (15 mm), and F4 (17) confirming antibacterial potential. The antibacterial efficacy was comparable to standard drugs (Gentamicin 27 mm inhibition in S. aureus & 22 mm inhibition in E. coli).

4. SUMMARY AND CONCLUSION

The result of this study confirms that a topical herbal gel formulated with Wrightia tinctoria extract, enriched with Aloe vera and Vitamin E, exhibits potent antibacterial activity, making it an effective alternative to synthetic treatments. The optimized formulation (F3) demonstrated superior physicochemical parameters including excellent spreadability, viscosity, skin compatible pH, enhanced hydration, and stability. The inclusion of Vitamin E and Aloe vera not only boosted the gel's antioxidant profile but also ensured overall efficiency in combating microorganisms while maintaining desirable cosmetic properties.

The study supports the potential use of this multi-ingredient herbal blend in pharmaceutical and cosmetic formulations, promoting safer and more skin care formulations. By merging the anti-bacterial properties of Wrightia tinctoria with the soothing and antioxidant benefits of Aloe vera and Vitamin E, this study presents a holistic approach to modern dermatology. These results validate the transition toward sustainable, plant-based pharmaceuticals. While the current results are highly promising regarding efficacy and physical stability, this study serves as a foundation for future clinical trials to standardize the formulation for large-scale pharmaceutical production and commercial distribution.

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