

# Calotropis Gigantea-Enhanced Povidone Bandage: A Synergistic Approach For Wound Healing

B. D. TIWARI<sup>1</sup>, Mr. Madanwale N.J<sup>2</sup>, FAHEEM S.S<sup>3</sup>, SANDEEP S.P<sup>4</sup>

<sup>1</sup>Principal

<sup>2</sup>Assistant Professor

<sup>1, 2, 3, 4</sup> Amepurva Fourm's Nirant Institute of Pharmacy, Solapur, Maharashtra, India.

**Abstract-** Wound Healing Is A Complex Biological Process Involving Inflammation, Cellular Proliferation, And Tissue Remodeling. Conventional Synthetic Wound Care Products Often Show Limited Effectiveness And May Cause Adverse Reactions. This Study Aimed To Develop And Evaluate Herbal-Based Adhesive Bandages Incorporating Calotropis Gigantea Extract And Povidone Iodine As Natural Alternatives For Wound Management. Phytochemical Screening Revealed The Presence Of Bioactive Compounds Such As Alkaloids, Flavonoids, Tannins, Saponins, Terpenoids, And Cardiac Glycosides—Compounds Known For Their Antimicrobial And Healing Properties. Five Formulations (B1–B5) Were Assessed For Dermatological Safety, Organoleptic Characteristics, And Antimicrobial Activity Against Escherichia Coli, Staphylococcus Aureus, And Candida Species. All Formulations Were Found To Be Non-Irritant And Non-Allergenic. Organoleptic Evaluation Confirmed Acceptable Physical Properties, Including Uniform Spreadability And Characteristic Odour. Among The Samples, B3 Exhibited The Most Potent Antimicrobial Activity Across All Tested Organisms, Indicating Its Potential For Enhanced Wound Infection Control. These Findings Suggest That Herbal-Based Bandages Are Safe And Effective, Offering A Promising Natural Alternative For Improved Wound Care. Further In Vivo Studies Are Recommended To Validate These Results.

## I. INTRODUCTION

Wound healing is a dynamic and multistage biological process involving inflammation, cellular proliferation, and tissue remodeling [8,9]. The duration of healing varies depending on the nature of the wound—whether acute or chronic. Traditional wound care often relies on synthetic bandages infused with preservatives and analgesic compounds; however, their efficacy in accelerating healing and preventing infections is inconsistent [10]. Consequently, there is a growing interest in harnessing plant-derived bioactive compounds for enhanced wound management.

Historically, plants have been utilized as primary therapeutic agents for inflammation and wound healing. Numerous plant species possess antimicrobial, anti-inflammatory, antioxidant, analgesic, and regenerative properties that can facilitate tissue repair. According to the World Health Organization (WHO), approximately 80% of the global population depends on herbal medicine for healthcare, with nearly 21,000 plant species identified for medicinal use [3].

This study explores the development of herbal-based adhesive bandages, offering a natural alternative to synthetic options. The formulation integrates bioactive plant compounds, including those from *Calotropis gigantea*—a medicinal species known for its wound-healing potential [7]—and povidone iodine, an established antimicrobial agent [4]. By combining these elements, the proposed herbal bandages aim to enhance healing efficiency, modulate bacterial count, support collagen deposition, and improve fibroblast proliferation [11]. Through this research, we highlight the potential of plant-based wound care solutions and present a novel approach to optimizing wound treatment.

## II. MATERIALS AND METHODS

### MATERIAL

About 2 Kg Of Leaves Of Calotropis Gigantea Were Collected From Local Area Of Boramani And Were Positively Identified With The Authentic Sources. [5]

### CHEMICAL:

SR NO.	CHEMICAL NAME
1	Ethanol
2	Picric Acid
3	Glacial Acetic Acid
4	Ferric Chloride Sol
5	Sodium Hydroxide
6	Lead Acetate Solution

7	Acetic Acid
8	Ammonia Solution
9	H <sub>2</sub> SO <sub>4</sub>
10	Chloroform
11	Acetic Anhydride

**APPARATUS:**

SR NO.	APPARATUS NAME	INSTRUMENTS
1	Stirrer	Magnetic stirrer
2	Flask	Weighing Machine
3	Beker	Desiccator
4	Iodin Flask	Calculator
5	Falcon Tube	Hot Air Oven
6	Measuring Cylinder	
7	Petri Dish	

**EXTRACTION PROCESS:**

500gm Of Leaves, Roots, Root Bark And Fruits Were Taken And Dried Under Shade For 15days.

The Dried Plant Material Was Crushed Into Fine Powder By Help Of Grinder And Stored For Required Purpose.

5gm Of The Plant Parts Powder Was Dissolved In 45ml Of Solvent (Ethanol) To Prepare 10% Extract In 200 ml Flask.

The Flask Was Covered With The Aluminium Foil And Kept On Rotating Shaker (120 Rpm) For 2 Days.

The Solution Was Filtered Twice, Firstly With Cheese Cloth (Four Fold) And Then With Whatman's Filters Paper.

The Filtrates Were Collected In Falcon Tubes And Were Concentrated Upto Dryness By Keeping It In Incubator At 35°C.[2]

**PROCEDURE FOR PREPARING BANDAGE:****Loading The Extract On Non-Woven Fabric Material:**

The Concentrated Extract Was Soaked Onto The Non-Woven Fabric Material Under Sterile Condition, Using Syringes. The Extract Loaded Non-Woven Fabric Materials Were Then Allowed To Dry For 2 Hour. The Prepared Pads Were Then Stored Under Optimal Condition To Prevent It From Getting Contaminated.

**Medicated Pad Preparation.:**

Concentrated Extract	Dimension Of Fabric Material	Equipment Used
0.5ml+0.5ml Of Povidone&Extract (B1)	1.4cmx3cm	Sterile Syringe Of 5ml
0.5ml+1ml Of Povidone&Extract (B2)	1.4cmx3cm	
1ml+0.5ml Of Povidone&Extract (B3)	1.4cmx3cm	
1ml Of Extract (B4)	1.4cmx3cm	
1ml Of Povidone(B5)	1.4cmx3cm	

**Development Of Bio-Band-Aids:**

The Bio- Band-Aids Were Prepared By Making Use Of Sterile Adhesive Bandages (Woven Fabric + Adhesive) (5) For Holding The Medicated Non-Woven Fabric Material. The Elastic Adhesive Bandages Consist Of The Adhesive To Stick And Hold The Position And The Non-Woven Fabric To Cover The Wounds.

A. The Woven Fabric Was Cut In Suitable Dimensions Of 1.4cmx3cm, For Each Extract.

B. The Extract Loaded Pads Which Was Prepared, And Then Were Placed On The Central Position Of The Pad.

C. Finally, In Order To Protect The Pads From Getting Contaminated Releasable Labels (Butter Paper) Was Pasted On To The Fabric Materials. As It Will Not Only Protect The Pad But Butter Paper Are Easily Releasable And Do Not Cause Any Harm To The Content.

**III. RESULTS****[A] Phytochemical Screen:**

The phytochemical screening of the sample revealed the presence of alkaloids, cardiac glycosides, saponins, flavonoids, tannins, and terpenoids, while anthraquinones were absent. This suggests that the sample contains various bioactive compounds that may contribute to its medicinal potential.

Name Of Test	Alkaloids	Cardiac Glycosides	Anthraquinones	Saponins	Flavonoids	Tannins	Terpenoids
Observation	Present	Present	-	Present	Present	Present	Present

**[B] Skin Irritation/ Allergy Test:**

The evaluation of the formulated fabrics B1 to B5 showed no signs of skin irritation or allergic reactions in any of the samples. This indicates that all tested fabric formulations are dermatologically safe and non-allergenic under the conditions of the study.

Formulated Fabric	Skin Irritation Reaction	Allergic Reaction
B1	No Irritation Reaction	No Allergic Reaction
B2	No Irritation Reaction	No Allergic Reaction
B3	No Irritation Reaction	No Allergic Reaction
B4	No Irritation Reaction	No Allergic Reaction
B5	No Irritation Reaction	No Allergic Reaction

**[C] Physical Properties Of Non-Woven Fabric Material Loaded With Extract:**

Color: The Color Of Extract Loaded Non-Woven Fabric Material Was Observed.

Odour: The Odour Was Characterized Based On Its Smell Property.

Spreadability: The TheSpreadability Was Observed Based On Uniformly Spread Liquid Extract.

**Physical Test Of Extract Loaded Non-Woven Fabric Material**

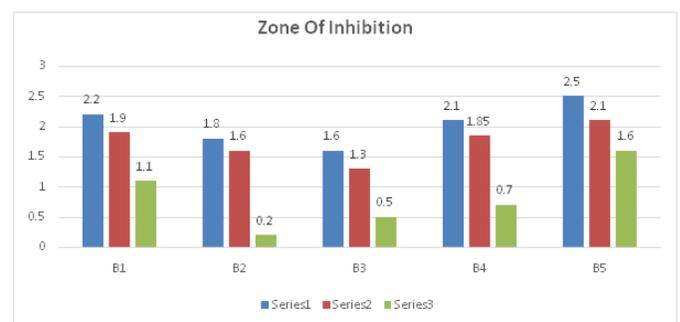
The organoleptic evaluation of formulations B1 to B5 revealed variation in color, with B1 and B3 appearing brown, B2 dark green, B4 green, and B5 orange. All samples exhibited a characteristic odour and showed uniformly spreadable consistency, indicating acceptable physical properties for topical application.

Test	B1	B2	B3	B4	B5
Color	Brown	Dark Green	Brown	Green	Orange
Odour	Characteristic	Characteristic	Characteristic	Characteristic	Characteristic
Spreadability	Uniformly Spread				

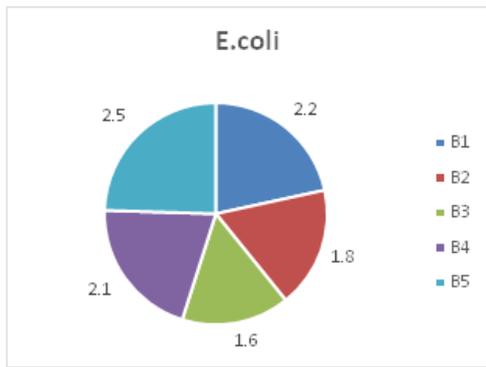
**[D] Zone Of Inhibition:**

The antimicrobial assessment of samples B1 to B5 against *E. coli*, *Staphylococcus aureus*, and *Candida* at 200 µl showed varying levels of activity. Sample B3 demonstrated the lowest microbial counts across all three organisms, indicating the highest antimicrobial effectiveness. In contrast, B5 showed the highest microbial presence, suggesting lower antimicrobial activity. Overall, the results suggest that B3 may possess stronger antimicrobial properties compared to the other formulations.

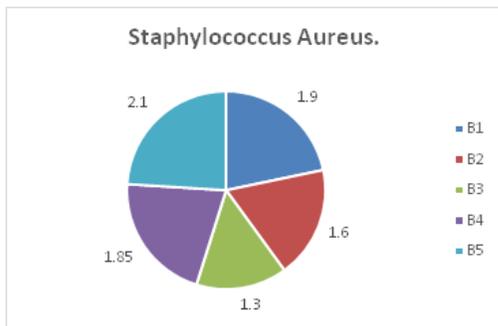
Sample	Volume	E.Coli 200 MI	Staphylococcus Aureus. 200 MI	Candida. 200 MI
B1	200ml	2.2	1.9	1.1
B2	200ml	1.8	1.6	0.2
B3	200ml	1.6	1.3	0.5
B4	200ml	2.1	1.85	0.7
B5	200ml	2.5	2.1	1.6



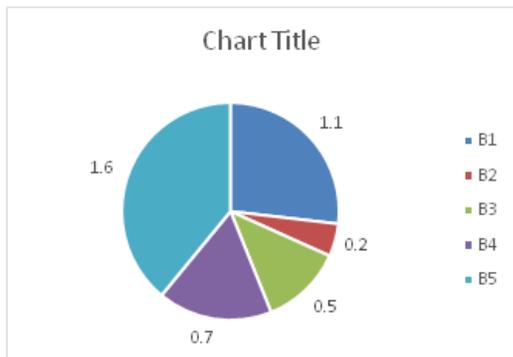
The Antimicrobial Activity Of Samples B1 To B5 Was Evaluated Based On The Zone Of Inhibition At A Volume Of 200 µl. The Results Showed That All Samples Exhibited Inhibitory Effects, With B5 Showing The Largest Zone Of Inhibition (2.5 Cm), Indicating The Highest Antimicrobial Efficacy. This Was Followed By B1 (2.2 Cm), B4 (2.1 Cm), B2 (1.8 Cm), And B3 (1.6 Cm), Suggesting Varying Degrees Of Effectiveness Among The Formulations.



The Antibacterial Activity Of Samples B1 To B5 Against *Staphylococcus Aureus* At A Volume Of 200 Ml Was Assessed By Measuring The Zone Of Inhibition. Sample B5 Showed The Highest Inhibitory Effect With A Zone Of 2.1 Cm, Followed By B1 (1.9 Cm), B4 (1.85 Cm), B2 (1.6 Cm), And B3 (1.3 Cm). These Results Indicate That B5 Exhibited The Strongest Antibacterial Activity Among The Tested Formulations.



The Antifungal Activity Of Samples B1 To B5 Against *Candida* At A Volume Of 200 Ml Was Evaluated Through The Zone Of Inhibition. Among The Formulations, B5 Showed The Highest Antifungal Activity With A Zone Of 1.6 Cm, Followed By B1 (1.1 Cm), B4 (0.7 Cm), B3 (0.5 Cm), And B2 (0.2 Cm). These Findings Indicate That B5 Was The Most Effective Against *Candida* Among The Tested Samples.



Given Five Sample B1, B2, B3, B4 And B5 Were Tested For Antimicrobial Activity Using *E. Coli*, *S. Aureus* And *Candida* Among Five Sample B1 , B4 , B5 Shown Highest Zone Of Inhibition

#### IV. DISCUSSION

The Findings Of This Study Support The Potential Of Herbal-Based Adhesive Bandages As Effective Alternatives To Synthetic Wound Care Products. The Presence Of Key Phytochemicals—Such As Alkaloids, Flavonoids, Tannins, And Terpenoids—Confirms The Inclusion Of Bioactive Compounds Known For Their Antimicrobial And Wound-Healing Properties. All Formulations Were Dermatologically Safe, Showing No Signs Of Irritation Or Allergic Reaction, Which Is Critical For Clinical Application. Organoleptic Evaluations Indicated Acceptable Physical Characteristics, Enhancing User Compliance. Among The Tested Samples, B3 Demonstrated The Strongest Antimicrobial Activity Against *E. Coli*, *Staphylococcus Aureus*, And *Candida*, Highlighting Its Promise For Infection Control In Wound Environments. These Results Suggest That Plant-Based Formulations, Particularly Those Incorporating *Calotropis Gigantea*, Can Offer A Safe, Natural, And Effective Approach To Wound Healing.

#### V. CONCLUSION

This Study Demonstrates The Potential Of Herbal-Based Adhesive Bandages Formulated With Bioactive Compounds From *Calotropis Gigantea* And Povidone Iodine For Effective Wound Care. Phytochemical Analysis Confirmed The Presence Of Key Secondary Metabolites Known For Their Therapeutic Benefits, While Organoleptic Evaluations Showed That The Formulations Were Physically Acceptable For Topical Use. All Samples Were Dermatologically Safe, Causing No Skin Irritation Or Allergic Reactions. Among The Formulations, Sample B3 Exhibited The Highest Antimicrobial Activity Against *E. Coli*, *Staphylococcus Aureus*, And *Candida*, Suggesting Its Superior Potential In Preventing Wound Infections. These Findings Support The Use Of Plant-Based Materials In The Development Of Natural, Safe, And Effective Wound-Healing Products. Further In Vivo Studies Are Recommended To Evaluate Long-Term Efficacy And Healing Outcomes.

**PHOTOGRAPHS:**

91(5): 614–620. <https://doi.org/10.1590/Abd1806-4841.20164741>.

[10] M, S., & R, A. (2017). Functional Modification On Adhesive Bandage Using Natural Herbs. *Journal Of Textile Science & Engineering*, 06(06). <https://doi.org/10.4172/2165-8064.1000281>.

[11] Singh, D. S., Ms ShitalTorkadi, Dr SmitaTakarkhede, Priti Singh, ShrushtiShirke, Samarth. (2022). A REVIEW ON USE OF HERBAL PLANT SOURCES IN ADHESIVE BANDAGES FOR WOUND HEALING PROCESS. <https://doi.org/10.5281/ZENODO.6120224>.

**REFERENCES**

- [1] ANTIBACTERIAL ACTIVITY OF AQUEOUS EXTRACT OF *Calotropis Gigantea* LEAVES – AN IN VITRO STUDY
- [2] Antibacterial Efficacy And Phytochemical Analysis Of Organic Solvent Extracts Of *Calotropis Gigantea*
- [3] DEVELOPMENT OF HERBAL BANDAIDS FOR HUMAN
- [4] Fibers, Surgical Dressings, And Bandages Of Natural Origin
- [5] Anti-Inflammatory Activity Of *Calotropis Gigantea* Linn.
- [6] Povidone Iodine In Wound Healing: A Review Of Current Concepts And Practices (<https://www.sciencedirect.com/science/article/pii/S1743919117305368>)
- [7] Sankara Rao, K., Arun Singh R., Deepak Kumar, Raja K Swamy And Navendu Page (2016). *Digital Flora Of Eastern Ghats*. (<https://indiaflora-ces.iisc.ac.in/easternghats/herbsheet.php?id=443&cat=4>)
- [8] Shedoeva, A., Leavesley, D., Upton, Z., & Fan, C. (2019). Wound Healing And The Use Of Medicinal Plants. *Evidence-Based Complementary And Alternative Medicine*, 2019; 1–30. <https://doi.org/10.1155/2019/2684108>.
- [9] Gonzalez, A. C. De O., Costa, T. F., Andrade, Z. De A., & Medrado, A. R. A. P. (2016). Wound Healing - A Literature Review. *Anais Brasileiros De Dermatologia*,