International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 3 May-June 2025, pp: 2011-2015 www.ijprajournal.com ISSN: 2456-4494

# Formulation Development and Evaluation of Flexi Bandage of Lavender oil and Tea tree oil

Hrishikesh Patil[1], Aniruddha Pathak [2], Pratham Panjwani[3], Akshata More[4], Abha Doshi [5]

[1,2,3,4]*B.Pharm. Students of Mumbai Educational Trust Institute of Pharmacy, Mumbai, Maharashtra*
[5]*Principal of Mumbai Educational Trust Institute of Pharmacy, Mumbai, Maharashtra*
*Corresponding Author: Abha Doshi*

Date of Submission: 20-06-2025 Date of Acceptance: 30-06-2025

**ABSTRACT:**A new Flexi bandage product has been formulated from natural sources, including Tea tree oil and Lavender oil. These natural sources provide an alternative approach for synthetic bandages. These important oils have healing, anti-inflammatory and antibacterial characteristics which assist with minor cuts and wounds,Tea tree oil eliminates infections and promotes healing and Lavender oil eases pain and swelling. The new bandage prepared using essential oils with the polymer is a safe and sustainable alternative to wound care.

**KEYWORDS:** Bandage, Tea tree oil, Lavender oil, Wounds, Herbal, Healing.

## I. INTRODUCTION:

The skin is the largest organ of the human body, serving as a protective barrier against environmental aggressors, pathogens, and physical damage. It plays a crucial role in thermoregulation, sensation, and immune response. The skin is composed of three primary layers: [1]

**Epidermis** – The outermost layer, primarily made up of keratinocytes, which provide structural integrity. It also contains melanocytes responsible for skin pigmentation and Langerhans cells involved in immune defence. The stratum corneum, the outermost part of the epidermis, consists of dead skin cells that act as a protective shield.

**Dermis** – The middle layer, rich in collagen, elastin fibres and connective tissues, providing skin strength, elasticity, and hydration. It contains blood vessels, sebaceous glands, sweat glands, and hair follicles that contribute to skin health.

**Hypodermis** (**SubcutaneousTissue**) – The innermost layer composed mainly of fat cells (**adiposetissue**) that serve as insulation and cushioning for the body.

An open wound involves an external or internal break in your body tissue, typically involving the skin. Falls, accidents with a sharp object, and car accidents are the most common causes of open wounds. In the case of a severe wound, you should seek immediate medical care, especially if there is a lot of bleeding or if you cannot stop minor bleeding within 20 minutes.

There are basically four types of open wounds as follows:[2]

a) Abrasion occurs when your skin scrapes against a rough or hard surface.
b) A laceration is a deep cut or tearing of your skin by items such as knives, tools, or machinery. If deep, bleeding can be rapid and heavy.
c) A puncture is a small hole caused by a pointy object like a nail, needle, or bullet (bullet puncture). When deep, punctures can damage internal organs.
d) Avulsion occurs when there is a partial or complete tearing away of the skin and the tissue beneath. Avulsions typically occur during violent accidents.

**Conventional Bandage**

A bandage is a medical device used to cover, protect and support wounds or injuries. It can also be employed to apply pressure to control bleeding and reduce swelling.

Bandages play a crucial role in the healing process by keeping wounds clean, preventing infection and promoting recovery. You may have used a simple crepe or wound bandage before but even apart from these, there are many different types of bandages.

They are made from various materials like cotton, gauze, elastic or adhesive strips and their selection depends on the type and severity of the injury. [3]

International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 3 May-June 2025, pp: 2011-2015 www.ijprajournal.com ISSN: 2456-4494

**Types of Bandages:**

- Roller bandage
- Crepe bandages
- Snake bite bandage
- Triangular bandages
- Wound care bandages.

What are the Side Effects of Conventional Bandages?

Bandages are generally safe for use but there can be potential side effects or complications, especially if they aren't applied or removed properly. Some possible side effects or risks associated with bandages include:[4]

- Skin Irritation
- Infection
- Moisture Trapping
- Delayed Healing
- Adhesive Residue
- Allergic Reaction
- Skin Maceration
- Inability to visualize wounds
- Dressing may adhere to the wound bed.

Flexi-Bandage or Spray bandage is an easy-to-use spray designed to protect cuts, wounds, and bruises from infection. It forms a protective layer over the affected area, acting like a liquid bandage. The spray is convenient and quick to apply, making it perfect for on-the-go use.

Why Herbal Flexi Bandages Are a Better Alternative to Conventional Bandages?

- Natural Healing Properties[5]
- Antibacterial and Antiseptic Benefits
- Fewer Chemicals and Additives
- Soothing and Comforting
- Sustainability and Eco-Friendliness[6]
- Non-Toxic and Safe for Sensitive Skin
- Pain Relief[7]
- Convenience and Ease of Use

The objective of the present research work was to formulate the flexi bandage using the herbal essential oils. The Flexi bandage formulation can offer multiple benefits for wound healing and treating minor injuries.

## II. MATERIALS USED:

### 1. Lavender Oil[8]

Biological Source: Distilling the flower of the plant Lavandula angustifolia.
Scientific name: Lavandula angustifolia
Synonym: Lavanda, Lavandae
Family: Lamiaceae
Chemical Constituents: Linalool, linalyl acetate, camphor, and terpinen-4-ol
Uses: Calming, soothing, and healing properties
Lavender oil was procured from JB Ayur Pharmacare India, Mumbai, Maharashtra.

Figure 1 Lavender

### 2. Tea Tree oil[9]

Biological Source: Distilling the flower of the plant Melaleuca alternifolia.
Scientific name: Melaleuca alternifolia.
Synonym: Paperbark, Honeymyrtles.
Family: Myrtaceae.
Chemical Constituents: α-Terpineol, 1,8-Cineole (Eucalyptol), γ-TerpineneLinalool, Terpinolene, Terpinen-4-ol.
Uses: Antioxidant and Supports tissue regeneration.
Tea Tree oil was procured from JB Ayur Pharmacare India, Mumbai, Maharashtra.

Figure 2 Tea Tree

### 3. Ethyl Cellulose [10]

Synonym:Aquacoat, Cellulose ethyl ether, Ethocel

Uses: Polymer.
Ethyl cellulose was procured from S.D. Fine Chemicals, Mumbai, Maharashtra.

International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 3 May-June 2025, pp: 2011-2015 www.ijprajournal.com ISSN: 2456-4494

Figure 3 Ethyl Cellulose

## III. METHOD OF PREPARATION:

Dissolve Polymer in small quantity of Ethanol and then mix drug and boric acid. Then make up the volume with Ethanol.

Formulation Table:

| Ingredients | Qty. Given | | | | Uses |
|---|---|---|---|---|---|
| | F1 | F2 | F3 | F4 | |
| Ethyl Cellulose | 1.25 %w/v | 2.5 %w/v | 5.0 %w/v | 7.5 %w/v | Polymer |
| Essential Oils | 2.5 %v/v | 2.5 %v/v | 2.5 %v/v | 2.5 %v/v | Drug |
| Boric Acid | 0.1% w/v | 0.1% w/v | 0.1% w/v | 0.1% w/v | Plasticizer |
| Ethanol | q.s. 100ml | q.s. 100ml | q.s. 100ml | q.s. 100ml | Solvent |

## IV. EVALUATION TEST: [11]

### 1. Drying time:

The formulation was sprayed 2 times on a tile to check for calculation of time taken for the formulation to dry. Result: 220sec

### 2. Spray volume:

1 spray contains 0.120ml.

### 3. Spray pattern:

Measure the distance from the nozzle to where the spray pattern begins to disperse on each side. The spray angle can be determined by measuring the distance from the center of the nozzle to the edges of the spray and calculating the angle using their mean radius and further calculating the $\tan^{-1}$. Start the spray and observe the spray pattern on the collection surface. Nozzles produce a cone-shaped spray, with the angle varying from 30 to 170 degrees depending on the nozzle design.

### 4. Stickinesstest:

The formulation was sprayed on a tile and then a cotton pluck was dabbed onto the sprayed formulation. Measure of cotton fibres stuck to the sprayed area was classified as rarely, moderately and Highly.Result: Rarely sticky

### 5. pH:

The formulation was tested with a pH paper and reading was matched with the pH meter scale.
Results: pH was found to be 6

### 6. Viscosity:

1. Level the instrument and turn it on.
2. Select and attach the appropriate spindle.
3. Adjust sample temperature if required.
4. Pour the sample into a container.
5. Immerse the spindle to the proper depth.
6. Set the speed (RPM) on the viscometer.
7. Run the test and wait for a stable reading.
8. Record the viscosity value (in cP or mPa·s).
9. Clean the spindle and container after use.

Viscosity = Dial reading × Factor
Result: Average Viscosity was found to be 123centipoise.

### 7. Stability testing:

The product was kept for 1 month
**Accelerated studies**:
Temperature: Store samples at **40°C ± 2°C**,
Relative Humidity: **75% RH ± 5%**.

| 4 Week Stability Studies | | |
|---|---|---|
| Test | Room Temperature | Humidity chamber (40°C and 75%RH) |
| Quantity | 25ml | 25ml |
| pH | 6 | 6 |
| Viscosity | 100-123cps | 100-123cps |
| Drying Time | 220 sec | 230 Sec |
| Leakage | 0% | 0% |
| Volume per spray | 0.120ml | 0.120ml |

International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 3 May-June 2025, pp: 2011-2015 www.ijprajournal.com ISSN: 2456-4494

**8. CAM Assay (Irritancy test):**

1. Select Eggs: Use clean, fertile White Leghorn eggs (≤7 days old, 50–60 g). Discard defective ones. Avoid shaking or damaging eggs.
2. Incubation: Still-air incubator: $38.3 \pm 0.2°C$, $58 \pm 2\%$ RH Forced-air incubator: $37.8 \pm 0.3°C$, $58 \pm 2\%$ RH Rotate eggs 5 times/day until day 8.
3. Day 8: Candle and discard nonviable eggs. Return viable ones upright (large end up) without rotating.
4. Day 9: Mark air cell and cut the egg shell with needle and forceps avoid damaging membrane, gently peel membrane with forceps.
5. Observe the reactions on the CAM over a period of 300 seconds. The time for the appearance of each of the noted endpoints should be monitored and recorded, in seconds. Endpoints that should be observed are:

1. Haemorrhage time (H) = observed start (in seconds) of haemorrhage reactions on CAM
2. Lysis time (L) = observed start (in seconds) of vessel lysis on CAM
3. Coagulation time (C) = observed start (in seconds) of coagulation formation on CAM.

**Formula for Irritancy Score**:

$$IS = \left(\frac{301 - Ht}{300}\right)5 + \left(\frac{301 - Lt}{300}\right)7 + \left(\frac{301 - Ct}{300}\right)9$$

Result: The formulation showed no Irritancy as the score is 0.07 for both the formulations.

Figure 4 CAM Assay for Formulation 4

## V. RESULTS

**Evaluation Test**

| Sr. No. | Tests | Result |
|---|---|---|
| 1. | Drying Time | 220 sec |
| 2. | Spray pattern | Cone Shaped |
| 3. | Stickiness Test | Rarely Sticky |
| 4. | pH | 5-6 |
| 5. | Viscosity | 123 cps |
| 6. | CAM Assay | No Irritancy (0.07) |
| 7. | Stability Testing | Stable for 4 weeks |

**Chemical Test**

| Sr. no. | Phytochemical Compound | Test | Result |
|---|---|---|---|
| 1. | Linalool | $KmNO_4$ | Reddish Brown |
| 2. | Sesquiterpenes | Salkowoski | Reddish pink |
| 3. | Terpienol | Silver Nitrate | Colourless to Turbid |
| 4. | α-Terpineol | $KmNO_4$ | Purple colour turns light purple |

## VI. CONCLUSION:

The combination of lavender oil and tea tree oil in a spray bandage offers a potent, natural solution for treating minor wounds. Together, they provide antibacterial, anti-inflammatory and soothing properties that promote faster healing, prevent infection, and keep the skin hydrated—making them an effective and holistic approach to wound care. The combination of lavenderoil and green tea tree oil in a spray bandage formulation can offer multiple benefits for wound healing and treating minor injuries. Here's a summary of their individual contributions and synergistic effects.

Synergistic Effect:

The combination of these oils creates a powerful natural antiseptic spray that can treat woundseffectively while promoting healing, reducing inflammation and preventing infection. The oilswork together to moisturize the skin, keeping the wound area hydrated, which is critical for optimalhealing. The antibacterial, anti-inflammatoryand wound-healing properties of the

oils provide acomprehensive approach to healing minor injuries such as cuts, scrapes.

## REFERENCES

[1]. Tortora, Gerard J., and Bryan H. Derrickson. Principles of Anatomy and Physiology. John Wiley & Sons, 2018.
[2]. "Open Wound: Types, Treatments, and Complications." Accessed June 24, 2025. https://www.healthline.com/health/open-wound#types.
[3]. Healthcare, Aero. "Different Types of Bandages and Their Uses." Aero Healthcare (blog), August 26, 2022. https://aerohealthcare.com/news/articles/different-types-of-bandages-and-their-uses/.
[4]. Britto, Errol J., Trevor A. Nezwek, Patrycja Popowicz, and Marc Robins. "Wound Dressings." In StatPearls. Treasure Island (FL): StatPearls Publishing, 2025. http://www.ncbi.nlm.nih.gov/books/NBK470199/.
[5]. Pathak, Deepika, and AvijitMazumder. "A Critical Overview of Challenging Roles of Medicinal Plants in Improvement of Wound Healing Technology." DARU Journal of Pharmaceutical Sciences 32, no. 1 (January 15, 2024): 379–419. https://doi.org/10.1007/s40199-023-00502-x.
[6]. "Biodegradable Bandages: A Sustainable Solution For Wound Care | Gents Fashion Co," February 11, 2025. https://gentsfashion.co/biodegradable-bandages-a-sustainable-solution-for-wound-care/.
[7]. "Learn About Benefits of Ayurvedic & Herbal Pain Relief Patches." Accessed June 25, 2025. https://www.hansaplastindia.com/articles/relief-and-care/why-you-should-choose-natural-and-herbal-pain-relief-patches.
[8]. PubChem. "Lavender Oil." Accessed June 25, 2025. https://pubchem.ncbi.nlm.nih.gov/compound/Lavender-Oil.
[9]. Carson, C. F., K. A. Hammer, and T. V. Riley. "Melaleuca Alternifolia (Tea Tree) Oil: A Review of Antimicrobial and Other Medicinal Properties." Clinical Microbiology Reviews 19, no. 1 (January 2006): 50–62. https://doi.org/10.1128/CMR.19.1.50-62.2006.
[10]. National Center for Biotechnology Information (2025). PubChem Compound Summary for CID 24832091, Ethylcellulose. Retrieved June 24, 2025 from https://pubchem.ncbi.nlm.nih.gov/compound/Ethylcellulose.
[11]. "Vol. 9 No. 1 (2023): January | International Journal of Research in Medical and Basic Sciences (IJRMBS)." Accessed June 25, 2025. https://mbsresearch.com/index.php/IJRMBS/issue/view/70.
[12]. Ilkogretim Online - Elementary Education Online, 2021; Vol 20 (Issue 1): pp. 5476-5487 http://ilkogretim-online.org doi: 10.17051/ilkonline.2021.01.581
[13]. Pünnel, Larissa Carine, and Dominique Jasmin Lunter. "Film-Forming Systems for Dermal Drug Delivery." Pharmaceutics 13, no. 7 (June 23, 2021): 932.
[14]. https://doi.org/10.3390/pharmaceutics13070932.
[15]. Kathe, Kashmira, and Harsha Kathpalia. "Film Forming Systems for Topical and Transdermal Drug Delivery." Asian Journal of Pharmaceutical Sciences 12, no. 6 (November 2017): 487–97. https://doi.org/10.1016/j.ajps.2017.07.004.
[16]. Luongo, M., J.J. Sciarra, and C.O. Ward. "In Vivo Method for Determining Effectiveness of Spray-on Bandages Containing Anti-Infectives." Journal of Pharmaceutical Sciences 63, no. 9 (September 1974): 1376–79. https://doi.org/10.1002/jps.2600630908.63, no. 9 (September 1974): 1376–79. https://doi.org/10.1002/jps.2600630908.
[17]. Mohite, Priyanka, Harshil Patel, Mansi Patel, Chainesh Shah, and Umesh Upadhyay. "Film Forming Spray: A Comprehensive Review" 7, no. 12 (2022).
[18]. Radhakrishnan, Arun, GowthamarajanKuppusamy, and Veera Venkata Satyanarayana Reddy Karri. "Spray Bandage Strategy in Topical Drug Delivery." Journal of Drug Delivery Science and Technology 43 (February 2018): 113–21. https://doi.org/10.1016/j.jddst.2017.09.018