

Development and Application of Non-Woven Cotton Wound Dressing using *Justicia Tranquebariensis* Extraction

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ABSTRACT

Wound dressing is crucial for preventing infections and minimising patient suffering. This study aimed to evaluate the antibacterial properties of *Justicia tranquebariensis* in wound healing. *Justicia tranquebariensis*, also known as water willow or water jasmine, has been used for its medicinal properties, including wound healing, anti-inflammatory effects, and antioxidants. Incised wounds, which can be classified as stab wounds or cut wounds, are caused by sharp-force trauma. The antibacterial activity of *Justicia tranquebariensis* encourages further research on its wound-healing properties. Cotton fabric is typically used for cleaning and dressing wounds for faster healing. Non-woven cotton wound dressings are also used in wound care due to their softness, absorbency, hypoallergenicity, conformability, biodegradability, and ease of application and removal. Cotton fibre and non-woven cotton fabric are utilized for wound dressing. For the dressing, *Justicia tranquebariensis* leaf extract is applied to cotton fibre, covered with non-woven cotton, and secured with adhesive tape. The extract was tested using the standard disc diffusion method against microbial species commonly found at wound sites, including *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*. An anti-inflammatory test was also performed, which confirmed that the herb has anti-inflammatory properties.

Key Words: Wound dressing, *Justicia tranquebariensis*, non-woven cotton, anti-inflammatory, wound healing

1. Introduction

Wounds can be caused by a variety of factors such as accidents, medical treatments, chronic illnesses, and more^[1-3]. Incised wounds are caused by sharp force trauma and can be classified as either stab or cut wounds. Stab wounds are longer than they are deep, while cut wounds are shorter than they are deep^[7,8]. Wounds caused by heavy blades like axes and machetes can include both lacerations and incised wounds^[8].

Traditional medicines like herbs, used as a paste, are thus employed for wound healing^[22]. *Justicia tranquebariensis*, also known as water willow or water jasmine, has been used in certain parts of the world for its possible medical benefits such as wound healing, anti-inflammatory effects^[9,19], antimicrobial properties^[9,19], antioxidants^[9,19], and more. Traditional wound management often involves the topical application of extracts from the leaves of *Justicia tranquebariensis*^[17,18]. These extracts are believed to possess qualities that accelerate wound healing and reduce the risk of infection^[9].

Wound dressing is a crucial aspect of wound care and is a key intervention in treating injuries and medical conditions^[20,23]. The basic goals of wound

dressing are to protect the wound from external contaminants, promote an ideal healing environment, and reduce the risk of complications like infection, scarring, and extended recovery^[6]. Proper wound dressing is vital in promoting healing, preventing infection, and minimizing patient discomfort^[21]. Wound healing takes time and may cause infection or allergies in some individuals due to the chemicals in some medicines^[1].

Non-woven cotton wound dressings are commonly used in wound treatment due to their excellent properties that enhance the healing process^[23,24]. These bandages are made from cotton strands that are chemically or mechanically attached without weaving. They offer benefits such as softness, comfort, absorbency, hypoallergenic properties, conformability, biodegradability, versatility, and ease of application and removal^[26]. The extract of *Justicia tranquebariensis* leaves is applied to non-woven cotton fabric and used as a wound dressing due to its wound-healing properties. The extract is subjected to anti-inflammatory and antimicrobial tests.

2. Materials and Methods

2.1. Selection of Herb

Justicia Tranquebariensis is a herb which has wound-healing properties^[9-13]. Leaf juices were used as a cooling agent^[17,18], aperient, and for treating smallpox in children^[15]. Crushed leaves were applied to contusions, and a paste made from *Justicia tranquebariensis* was applied externally to reduce pain^[13,15]. The juice of leaves taken orally and leaf paste applied topically on the site of a snake bite act as an antidote for Cobra bite^[16].



Figure 1. *Justicia Tranquebariensis*

2.2. Collection and Extraction of Leaf

Justicia Tranquebariensis leaf was collected from the local area of Coimbatore. The selected leaves were extracted using ethanol as the solvent^[13]. First, the leaves were water-washed thoroughly to remove the dirt^[14]. The leaves were kept for shadow dry for 2 days. The dried leaves were then chopped up into smaller pieces^[17]. The leaves were grained to a nearly powder-like consistency^[13]. A fine strainer was used to remove large particles. In a conical flask with a thousand-millilitre capacity, 50 grams of powder were dissolved in half a liter of ethanol (1:10)^[25] after being weighed. The process was done at 60°C in the shaker method for 24 hours. To stop the ethanol from evaporating, a rubber cork was used to snugly shut the flask's open end. The extracted liquor was filtered off by using filter paper^[18]. Filtering was used to get rid of the tiny particles that were scattered in the solution.



Figure 2. Before 2 days of drying the leaf



Figure 3. After 2 days of drying the leaf



Figure 4. Fine powder of *Justicia Tranquebariensis* leaf



Figure 5. Ethanol extraction

2.3. Selection of Wound Dressing

2.3.1. Fiber

Cotton is a popular medical fibre due to its moisture control, insulation, comfort, and hypoallergenic properties. It is adaptable to steam, ethylene oxide, and gamma radiation sterilization methods. Cotton bandages, available in various varieties, have shown promising results in patient health management and maintenance^[26].

2.3.2. Cotton non-woven spunlace

Cotton Spunlace is a spunlace nonwoven fabric made by securely entangling cotton fibres with

water jets (water jet interlaced nonwoven fabric). This fabric is comprised of 100% cotton and was created by gluing fibres into a sheet using just hydraulic power and no binder, making it suitable for use in skin-care products.

The cotton fibre was kept in between the 2 layers of cotton nonwoven spunlace fabric and stitched together.



Figure 6. Cotton fibre



Figure 7. Cotton non-woven spunlace

2.4. Finishing: Extract Application

The non-woven cotton wound dressing was soaked in ethanol extract for 5 mins. Then the wound dressing was left to dry at room temperature for 1 day. After drying the wound dressing is sealed with adhesive tape and a butter sheet.



Figure 8. Non-woven cotton wound dressing drying



Figure 9. Non-woven cotton wound dressing with herbal extraction

2.5. Antimicrobial activity by agar diffusion method

Stock cultures were maintained at 4°C on nutrient agar and potato dextrose agar. In experiments, active cultures were prepared and incubated at 37°C for 24 hours. The Well Diffusion method was used to determine the antibacterial and antifungal activities of crude extract extracts. MHA plates were prepared and bacterial inoculums were swabbed uniformly. The agar diffusion method was used to measure the antibacterial activity against tested microorganisms.

2.6. Anti-Inflammatory Study of plant extract

The study evaluated protein denaturation inhibition using Mizushima and Kobayashi's 1968 method and Sakat et al.'s 2010 modified method. The experiment involved adding bovine serum albumin to the sample, heating at 51°C, and recording the absorbance at 660 nm.

$$\text{Percentage inhibition} = \frac{100 - (O.D. \text{ of test} - O.D. \text{ of product control})}{O.D. \text{ of Control}} \times 100$$

3. Result and Discussion

3.1. Antimicrobial activity of plant extract

The result finds extract having antimicrobial activity against the E.coli, S.aureus and Candida albicans. The result shows the given Herbal extract heaving Anti-microbial activity which is shown in Table 1.

3.2. Anti-Inflammatory Activity of plant extract

The given extract shows an Anti-inflammatory activity. The higher concentration of 50 ml of the shows 76% and standard Aspirin drug shows 88 % which is shown in Table 2.

Table 1: Results of Antimicrobial activity of plant extract of *J. tranquebariensis* leaves by agar diffusion method

| S.No | Organisms | <i>E.Coli</i> | <i>S.aureus</i> | <i>Candida albicans</i> |
|------|---|---------------|-----------------|-------------------------|
| 1. | Plant extract | 1.2 cm | 1.4 cm | 1.6 cm |
| 2. | Standard (Bacteria-Chloramphenicol) Fugues- Fluconazole | 1.5 cm | 1.5 cm | 1.5 cm |



Plate.1. Candida albicans



Plate.2. S.aureus



Plate.3. E.coli

Table 2: Results of Anti-inflammatory activity of plant extract of *J. tranquebariensis* leaves

| S.No | Concentration | % Inhibition of Standard (Aspirin) | % Inhibition Sample |
|------|---------------|------------------------------------|---------------------|
| 1. | 10 ml | 33% | 24 % |
| 2. | 20 ml | 43% | 38% |
| 3. | 30 ml | 58% | 49% |
| 4. | 40 ml | 79% | 60% |
| 5. | 50 ml | 88% | 76% |

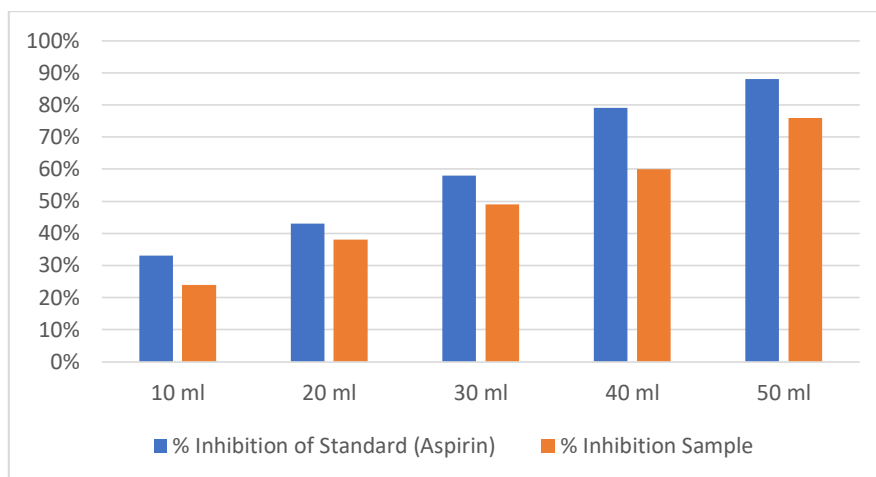


Figure 12: Graphical representation of anti-inflammatory activity of plant extract of *J. tranquebariensis* leaves

4. Conclusion

The development of non-woven cotton wound dressings with herbal extraction applications is a promising innovation in wound care. These dressings, made from natural fibres like cotton, offer several benefits, including antimicrobial, anti-inflammatory, and tissue-regenerating properties, accelerated wound healing, and reduced infection risk. They are gentle on the skin, minimizing allergic reactions or irritation. The use of natural fibres like cotton is eco-friendly and biodegradable, making them a sustainable option compared to synthetic materials. The wide range of herbal extracts available allows for customization based on specific wound types and patient needs. Non-woven cotton provides a soft, breathable dressing that enhances patient comfort during the healing process. However, rigorous testing and validation are needed to ensure safety, efficacy, and consistency in wound management. Collaboration between medical professionals, researchers, and manufacturers is crucial for refining and advancing this technology. Future research and clinical studies are needed to establish the efficacy of these

dressings. This innovative approach could become an integral part of modern healthcare, offering patients a natural, effective, and sustainable solution for wound treatment.

5. Reference

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