

A Study on Herbal Finish for Wound Healing on Adhesive Bandage

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Abstract

Textile industry is one of the largest contributing sectors of India. It is the second largest employer after agriculture, provided direct employment to over 45 million people. Medical textiles are a category of textiles specifically designed for medical purposes, including first aid, clinical, surgical, and hygienic uses. They are engineered to provide various benefits such as biocompatibility, flexibility, strength, and sterility, anti-allergic, anti-bacterial, environmentally friendly, and cost-effective properties. In that an adhesive bandage is also known as sticking plaster, medical plaster, or simply plaster in British English, is a small medical dressing used for injuries not for serious injuries to require a full-size bandage. Finishes play a major role in the field of medical textiles, in that herbal finishes are one such category. *Tridax* is a genus of plants in the family *Asteraceae*. The most well-known species in this genus is *Tridax procumbens*, commonly known as coat buttons or *tridax* daisy. It is a perennial herb that is native to tropical and subtropical regions, and it is widely distributed in countries such as India, Nigeria, Brazil, and the United States. *Tridax procumbens* has been used in various folk medicinal practices. Parts of the plant, such as the leaves and roots, have been used to treat conditions like skin infections, respiratory issues, digestive problems, and even snakebites in some cultures. This paper deals with the research on *tridax* finish applied on a bandage to analyse the wound healing property.

Keywords: Medical Textiles; *Tridax*; Wound Healing Bandages.

1. Introduction

Textiles play an integral role in the life of humans right from cradle to grave. They are used not only to cover the body but also from protecting from dust, wind, sunlight and other foreign matter present in the atmosphere. Similarly, Textiles for apparels retained a vital place in human life describes.[1] one of the most promising sectors of the textile industry in the past few decades is the Technical textile sector reveals [2]. Nonwoven materials have been engineered to imbue products with unique characteristics. Nonwoven textiles are vital components within the medical field, encompassing an extensive range of items, from surgical gowns, masks, and other wearable products, to surgical drapes, pads, dressings, filtration materials, and even implantable textiles like tissue scaffolds utilized in the reconstruction of internal organs, alongside

various other offerings. [3]. A bandage serves the purpose of either supporting a medical device like a dressing or splint, or independently providing support to the body[4]. A wound refers to an injury that results in either an internal or external breach in body tissue, or it can be a form of injury where the skin is torn, cut, or punctured, leading to damage of the dermis layer. The primary consequences associated with wounds include the risk of infection, alterations in the appearance of the skin, and the presence of a blood odor[5]. An adhesive bandage, commonly referred to as a sticking plaster, is a type of wound care dressing utilized for small injuries. These bandages are typically applied to patients who have sustained minor abrasions (scratches) or cuts on their body, generally not requiring treatment for serious accidents.[6] Since ancient times, nature has

been a rich reservoir of medicinal agents. The significance of herbs in treating human ailments cannot be overstated. It's evident that the plant kingdom offers an endless reserve of active ingredients crucial in managing numerous challenging diseases. Ayurveda, an ancient healthcare system widely practiced in India, Sri Lanka, and various other countries, exemplifies this reliance on natural remedies [7]. *Tridax procumbens*, commonly referred to as coat buttons or tridax daisy, is a flowering plant species renowned for its medicinal properties. This species is particularly noteworthy for producing secondary metabolites that have been reported to possess a diverse range of medical benefits. Traditionally recognized for its antiviral and antioxidant effects, as well as its wound healing activity, *Tridax procumbens* shows promising potential in the realm of natural medicine. The extract from *Tridax procumbens* leaves demonstrates its capacity to accelerate blood clotting and promote homeostasis. *Tridax procumbens* is characterized as a semi-prostrate annual or short-lived perennial herb [8]. Cotton fibers are well-suited for manufacturing textiles used in sports, non-implantable medical products, and healthcare/hygienic items. However, their high moisture absorption capacity renders them susceptible to microbial attacks under specific conditions of humidity and temperature. Cotton can serve as a nutrient, providing an ideal medium for bacterial and fungal growth. Consequently, various chemical treatments are applied to cotton fibers to enhance their antimicrobial properties. Among these treatments, silver nanoparticles (AgNPs) have demonstrated potent inhibitory and antibacterial effects [9]. Hence, an attempt of antimicrobial finished adhesive bandage has been made to wound healing by using eco-friendly herbs.

2. Methodology

2.1. Selection of Fiber

The selected fiber is cotton (Figure 1). The fabric is made of natural fibers, which have a cellulosic. Considering the suitability of cotton for the application of medical textile, high moisture regains and it is bio degradability cotton fiber has been chosen.

2.2. Selection of Fabric Formation

Non-woven fabric, also known as nonwoven cotton fabric, is a type of material made from cotton fibres that are bonded together mechanically, thermally, or chemically without being woven into a traditional fabric structure. Non-woven fabrics are commonly produced by entangling fibres to form a web or mat, which is then bonded together using various methods.

2.3. Selection of Herb

The medicinal herb *tridax procumbens* was selected for this study. The herbal of *tridax procumbens* leaves were collected from the rural areas. It has been used for wound healing, hypotensive action, antifungal, insect repellent. The particulars of the medicinal herbs and natural materials used for the development of health care product are furnished in Table 1 & Figure 1.

Table 1 Herb Particulars

S. No	Common Name for the medicinal herbs used	Botanical name for the medicinal herb used	Parts used
1	Coat buttons or Tridax	Tridax procumbens	Leaves



Figure 1 Tridax Procumbens

2.4. Extraction of Herb

The fresh leaves of *Tridax procumbens* were collected in and around Coimbatore region. The fresh leaves of *Tridax procumbens* were washed under running water. The washed leaves were dried in shade for 10 days and then grind into powder. Then the grinded powder is stored in a clean container. Dried Leaves and Powders are shown in Figures 2 & 3.



Figure 2 Dried Leaves



Figure 3 Powder

2.5. Solvent extraction

The solvent extraction was carried out by dissolving 6 grams of powder in acetone solvent and centrifuged at 5000 RPM for 15 minutes in a conical flask at a ratio of 1:5 ml. It was then placed in a shaker for 48 hours. After 48 hours, the solution was filtered using ordinary filter paper and Whatman No. 1 filter paper. The extract was then stored in Eppendorf tubes for further procedures.

2.6. Application of Finish

The application of Tridax procumbens Finish was carried out by applying the chemicals directly on the bandage cloth by pad-dry-cure method. 50 gpl of Tridax procumbens solvent is mixed with 1lt of water then the bandage cloth was immersed into it at room temperature. The pH maintained was 5-5.5. Samples are shown in Figures 4 & 5.



Figure 4 Untreated Sample



Figure 5 Treated Sample

3. Evaluation

3.1. Antimicrobial Activity Assessment Using Agar Diffusion Method (AATCC 147)

Treated and untreated (control) samples were placed in intimate contact with AATCC bacteriostasis agar, which has been previously inoculated with an innoculum of test organisms. After incubation, a clear area of uninterrupted growth underneath and along the side of the test material indicates antimicrobial effectiveness of the bandage cloth. The area of inhibition zone is a measure of antimicrobial effectiveness. It is used to determine the qualitative bacterial zone of inhibition. Three types of bacteria and one type of fungi is used for tests are *Escherichia coli*, *P. aeruginosa*, *Klebsiella* sp., and *Candida* sp

respectively. A solution of nutrient powder was prepared and autoclaved. Petri plate should also be sterilized. The nutrient plates were prepared by pouring the sterilized solution into Petri plate. The solution becomes solid. The broth was spread on AATCC agar plates. Then the samples were placed on plate and kept in incubator for about 24 hrs. The zonal inhibition of 0.4mm was seen by the next day.

3.2. Staining Test

The treated and untreated samples were tested visually for any stains of blood after its use under first wash. Previous day the samples are sprayed with blood and washed by next day. It was noted how fast the blood stains are releasing. Time was also noted for each sample and it was compared with each other.

3.3. Deodorizing Activity Test

Evaluation of odour control was tested in house method. The bandage cloth was given to the patients who had wounds. The cloth was bandaged and was removed by next day. Score sheets were prepared and given to the patients to report the deodorizing activity, allergies and comfortableness during the wear. The evaluation was made consolidating the score sheets.

3.4. pH Test

pH testing is a fundamental chemical analysis used to measure the acidity or alkalinity of a solution. It provides valuable information about the chemical properties of substances and is widely employed across various industries, including food and beverages, pharmaceuticals, agriculture, environmental monitoring, and water treatment. Three samples were tested for pH values.

3.5. Wound Healing Test

Inhibition of protein denaturation was evaluated by the method of Mizushima and Kobayashi 1968 and Sakat *et al.* 2010 with slight modification. 500 μ L of 1% bovine serum albumin was added to 10, 20, 30, 40 and 50 μ L of plant extract. This mixture was kept at room temperature for 10 minutes, followed by heating at 51°C for 20 minutes. The resulting solution was cooled down to room temperature and absorbance was recorded at 660 nm. Aspirin using as a standard.

4. Development of sample

The sample is developed to reduce the bacterial

infection. Bandages are used for the health care in medical textiles to prevent the bacterial infection. Adhesive bandage has the properties of antimicrobial, antifungal and wound healing properties. Adhesive Bandage is shown in Figure 6.



Figure 6 Adhesive Bandage

5. Results and Discussion

5.1. Antimicrobial Activity Assessment Using Agar Diffusion Method (AATCC 147)

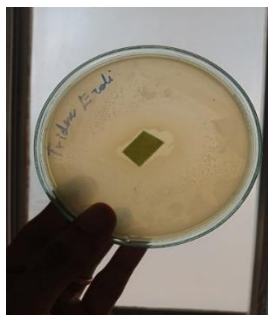


Figure 7
Escherichia Coli



Figure 8
P. Aeruginosa

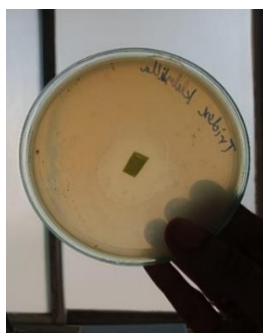


Figure 9
Klebsiella Sp.

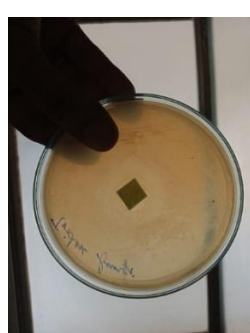


Figure 10
Candida Sp.

Figure 7, 8, 9 & 10 shows the antimicrobial effectiveness of Tridax procumbens against the *P. aeruginosa*, standard test cultures such as *Escherichia coli*, *Klebsiella sp.*, and *Candida sp* respectively. A clear zone of inhibition is visible on treated bandage cloth for all the test cultures. In Figure 7, there is no inhibited zone around the untreated bandage cloth and is completely surrounded by the colonies of

bacteria. The study confirms the antimicrobial nature of Tridax procumbens finished bandage cloth, as the microbes initially laid over the plate has been killed and could not proliferate to produce a lawn in its surrounding.

5.2. Staining Test

The untreated and treated samples were physically tested for the stains of blood under normal condition. From Table 2, it is seen that cotton performs faster on stain release.

Table 2 Staining Test on Untreated and Treated Samples

Sample	Time Taken for Releasing stain	
	<i>Before Finish</i>	<i>After Finish</i>
Cotton	2.0	1.5

5.3. Deodorizing Activity Test

The score sheets reported that the treated bandages have good performance towards odor massing property and they were comfortable to wear. It also says that there were no allergies or itching to the wearers while wearing the treated bandages.

5.4. pH test

The pH value (Table 3) was checked for finding the bandages have any irritation to the skin. pH was measured by using pH detector. 6 to 8.5 pH value shows good bandage.

Table 3 pH Value

Sample	pH
Cotton	7.3

5.5. Wound Healing Test

5.5.1. Inhibition of Protein Denaturation

Inhibition of protein denaturation was evaluated by the method of Mizushima and Kobayashi 1968 and Sakat *et al.* 2010 with slight modification. 500 μ L of 1% bovine serum albumin was added to 10, 20, 30, 40 and 50 μ L of plant extract. This mixture was kept at room temperature for 10 minutes, followed by heating at 51°C for 20 minutes. The resulting solution was cooled down to room temperature and absorbance was recorded at 660 nm. Aspirin using as a standard. The result is shown in Table 4 & Figure 11. The experiment was carried out in triplicates and

percent inhibition for protein denaturation was calculated using:

$$\% \text{ Inhibition} = 100 - (O.D. \text{ of test} - O.D. \text{ of product control}) \times 100$$

Table 4 Wound Healing Test Result

CONCENTRATION	% INHIBITION OF SAMPLE
10 µl	08.09 %
20 µl	40.60 %
30 µl	48.90 %
40 µl	57.20 %
50 µl	70.82 %

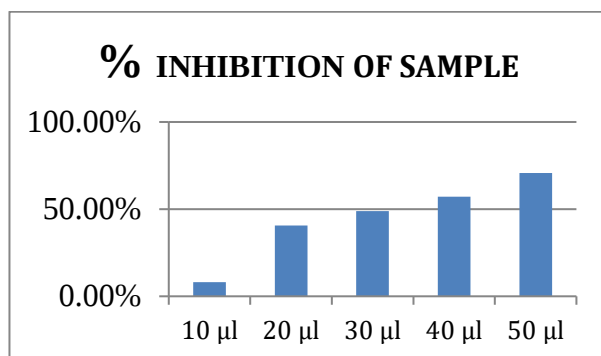


Figure 11 % Inhibition of Sample

Conclusion

Medical Textiles plays an important role in the field of medicine by bringing many new kinds of antimicrobial finishes with the help of natural extract. Similarly antimicrobial finishes are being an elixir for the medicine filed by providing support for faster healing of wounds. In connection with that the adhesive bandages play a significant role which is intimate to the patient skin and also act as a barrier against microorganism and odor of blood. The finish applied on the bandage gave good result by showing higher resistivity towards bacteria and fungi. The comfort property seems to be better and the wound healing property shows a faster result. The Tridax procumbens treated adhesive bandages can be used for accidental wounds. Thus the bandage can be used in patients for better wound healing property.

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