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STM JOURNALS

Research & Reviews: A Journal of Toxicology
ISSN: 2231-3834 (online), ISSN: 2349-1264 (print)
Volume 4, Issue 2
www.stmjournals.com

Development of Cotton and Cotton Gauze Fabric Coated with *Swietenia microphylla* Bark as a Wound Contact Layer

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Abstract

The present work discusses the development of cotton and cotton gauze-based bandage using mahogany. The biological properties of mahogany bark extract have been identified. The 25% concentration of mahogany extract have been treated directly and kept at room temperature for conditioning. Further the antibacterial activity of mahogany-treated samples have been evaluated against wound infecting pathogens (AATCC- 147) Escherichia coli, Bacillus subtilis, Pseudomonas aeruginosa, Klebsiella pneumoniae, Serratia marcescens and Staphylococcus aureus. It was found that mahogany has good antibacterial property against wound infecting pathogens.

Keywords: *Herbs, Mahogany, Pathogens, Wound contact layer*

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INTRODUCTION

The textile materials have applications in various fields. Among all, medicinal textile is a boon to the human healthcare where all the forms of textile material from fibre to technical fabrics used for biomedical applications. The bio-textiles represent the most innovative domain of me dical science and technology where these materials remain in close contact with the biological environment. Bio-receptivity and biocompatibility are the two major requirements at the application level in human being. Antimicrobial finish on textiles has become essential in day to day life to live in fresh and hygienic atmosphere. Clothing and textile materials are not only the carriers of microorganisms such as pathogenic bacteria, bacteria which create odor and mould fungi but also good media for growth of microorganisms [1]. Though many products have come out, still there is very good scope for the textile researchers in this field [2]. Textile materials have found a variety of medical applications which include a vast range of applications. The medical textile has been classified as healthcare and hygiene products, extracorporeal devices, implantable materials and non-implantable materials. Non-implantable materials include wound dressing, bandages, plasters, gauze and wadding [3]. The present work deals with the development of wound contact layer with gauze and wadding finished with mahogany bark extract.

MATERIALS AND METHODS

Selection of Plant Source

Mahogany is a wild tree, available in the natural rainforest. *Swietenia mahogany* belongs to the Meliaceae family. Based on the size of leaf, it was classified as *S. microphylla* and *S. macrophylla*. Its common name is Honduras mahogany / large-leaved mahogany [4]. Table 1 shows the mahogany scientific detail [5] and Figure 1 shows the mahogany tree.

Table 1: *Mahogany Scientific Details.*

Kingdom	**Plantae**
Phylum	Tracheophyta
Class	Magnoliopsida
Order	Sapindales
Family	Meliaceae
Genus	*Swietenia*
Common Name	Mahogany

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Fig. 1: *Mahogany Tree.*

Mahogany is a tall tree that towers above the forest canopy. The leaves which are red or pinkish appear mostly in the month of March. The bark has a sweet odor and small white flowers are produced by the trees [6]. The plant under investigation has many traditional uses. The bark was collected from the Mettupalayam forest area. Studies reveal that mahogany bark has been used as an astringent for wounds and occasionally for tanning because of the rich red colour [7].

Selection of Fabric

The cotton fiber which is known for its absorbent, smooth, comfort and biodegradable property was selected for the study. The wound contact layer was prepared with cotton wadding and sterile cotton gauze purchased from Kovai Medical Center & Hospital, Coimbatore, India.

Preparation of Bark Powder

The barks collected from the mahogany tree were cleaned, shade dried for 30 days and powdered thoroughly.

Preparation of Wound Contact Layer

The non-implantable material—the wound contact layer was prepared by treating the mahogany bark extracts with cotton gauze. The known amount of water (M:L- 1:20) was added with bark powder and kept for an hour to prepare the bark extract.

The filtrate was prepared for 25% bark concentration. The surface of the cotton wadding measuring12"X12" was treated with the mahogany bark extract. The medicated cotton was then allowed for drying at room temperature in a sterile atmosphere. The sterile gauze was then treated with the filtrate over boiling water bath for 1 hour. The treated gauze was then dried in a sterile room at room temperature.

Wound contact layer was prepared by medicated cotton and gauze. The finished cotton was placed in between two layers of gauze. The prepared layers are then cut to the required sizes and used as a wound contact layer. i.e., cotton wadding was cut to 20mm diameter and gauze was cut to 30 mm X 50 mm dimension. The prepared wound contact layer was tested against wound infecting pathogens.

Assessment of Wound Contact Layer

Qualitative determination of the antibacterial activity—Agar diffusion method—AATCC 147(2004).

The wound contact layer cut to the diameter of 2 ± 0.1 cm was taken for the analysis. The samples are evaluated for antibacterial activity by agar diffusion method.

Culture medium

AATCC bacteriostatic agar medium was used as a growth medium for the evaluation of microorganisms.

Procedure

Sterile AATCC bacteriostatic agar was dispensed in sterile petridishes. 24 hours broth cultures of test organisms (*Escherichia coli Bacillus subtilis, Pseudomonas aeruginosa, Klebsiella pneumoniae, Serratia marcescens and Staphylococcus aureus*) were used as inoculums. The test organisms were coated over the surface of the agar plate using sterile cotton swab. The test specimen was gently pressed in the center of the mat culture. The plates were incubated at 37 ^{o}C for 18–24 hours (As per AATCC 147(2004) method).

Evaluation

The incubated plates were examined for the interruption of growth over the inoculums. The size of the clear zone was used to evaluate the inhibitory effect of the test sample.

RESULT AND DISCUSSION

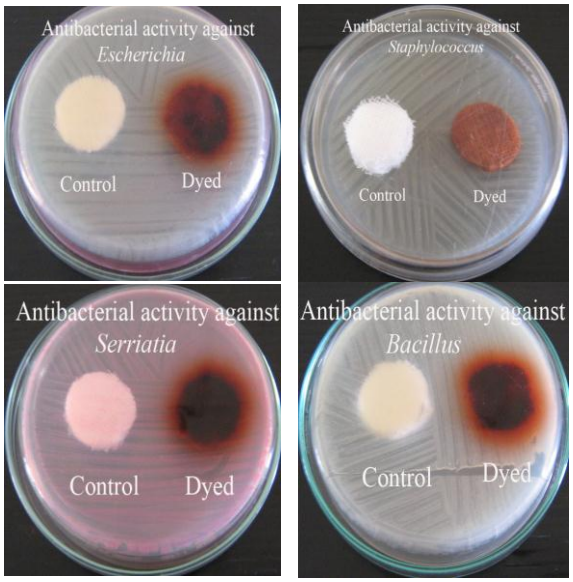
Assessment of Wound Contact Layer Against Wound Infecting Pathogens (AATCC-147)

Table 2 shows the antibacterial effect and the zone of inhibition area (mm) of wound contact layer.

Table 2: *Assessment of Wound Contact Layer against Wound Infecting Pathogens (AATCC-147).*

S. No	Wound causing pathogens	Zone of inhibition (mm)	
		Control product	Wound care product
1	*Escherichia coli*	0	25
2	*Bacillus subtilis*	0	23
3	*Pseudomonas aeruginosa*	0	23
4	*Klebsiella pneumoniae*	0	24
5	*Serratia marcescens*	0	0
6	*Staphylococcus aureus*	0	25

From Table 2, Plate 1 and Figure 2, it is clear that the wound contact layer was tested against wound infecting pathogens by AATCC 147 Agar well-diffusion method. Each test pathogen gave different inhibitory zone. The maximum inhibitory zone of 25 mm was observed against *Escherichia coli* and *Staphylococcus aureus*, whereas in *Bacillus subtilis and Pseudomonas aeruginosa* the inhibition zone was 23 mm. And there was no inhibition to *Serratia marcescens*.



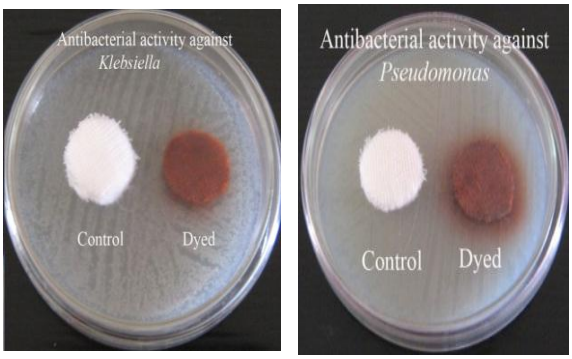


Plate 1: *Shows the inhibitory zone of test organisms against pathogens*

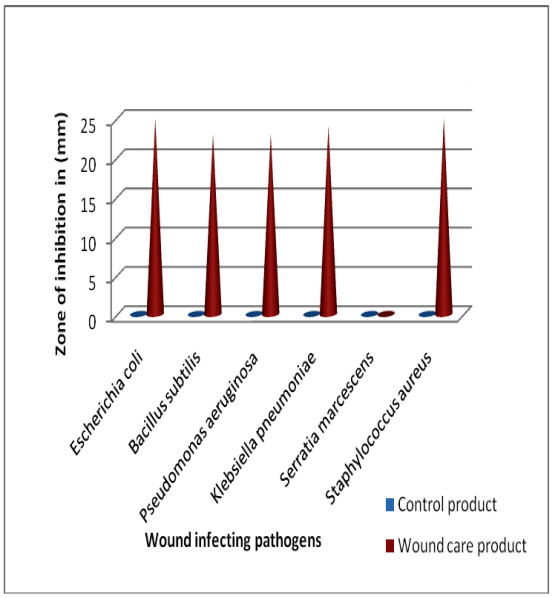


Fig. 2: *Assessment of Wound Contact Layer Against Wound Infecting Pathogens (AATCC-147).*

SUMMARY AND CONCLUSION

Based on the above analysis, it is found that mahogany bark treated cotton wadding and gauze has considerable antibacterial activity against wound infecting pathogens.

This type of treatments increases the awareness about the medicinal herbs and also the effective utilization of the same. Mahogany bark has good medicinal and antibacterial values.

The demands of the medical textile can be shared and satisfied by mahogany-treated textile products. Hence, we conclude that the mahogany bark extract treated samples are quite suitable for surgical bandage and wound healing.

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