International Journal of Biomedical Research

ISSN: 0976-9633 (Online)
Journal DOI:10.7439/ijbr
CODEN:IJBRFA

Research Article

Effect of functional finish on bandages for hospital application

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Abstract

Overcoming the literatures about bandages which come under the division of healthcare and hygiene this research work was concentrated on medical bandages. 100% cotton, 100 % bamboo and 50:50 bamboo/cotton were chosen for the construction of bandages and it was given for a vital finish which includes antimicrobial using triclosan (an antimicrobial agent), vitamin E and aloevera to improve the functional property. The woven bandages are tested for antimicrobial activity (AATCC 147), comfort and aesthetic property. It is clearly proved that the bandages finished with triclosan, an antimicrobial agent gives better efficiency about 0.4 mm of zonal inhibition and also gives better resistance against microbes. The aloevera and vitamin E finish produces fragrance, cooling effect and also prevents the skin from getting scars.

Keywords: Absorbency, Antimicrobial, Biodegradable**,** Deodorizing activity, Staining

1. Introduction

A bandage is a piece of material used either to support a medical device such as a dressing or splint, or on its own to provide support to the body[1]. A wound is an injury that causes either an internal or external break in body tissue or it is a type of injury in which skin is torn, cut or punctured which damages the dermis of the skin. The main effects that comes along with wound are infection, change in appearance of skin and odor of blood bled.[2]

To overcome the above mentioned effects, an antimicrobial finish to improve antibacterial activity, vitamin-E finish which helps in reducing scars, stretch marks and introduce fragrance to mass the odor was given to the bandage cloth which is of cotton and bamboo. Aloevera finish is been given to make the patient feel cool and the gel plays significant role in wound healing.

In the current study, fibers used are cotton and bamboo. Cotton, as a natural cellulosic fibre, has a lot of characteristics, such as Comfortable Soft hand, Good absorbency, Colour retention, Good strength, Drapes well, Easy to handle. The major advantage for choosing cotton is that it is cheaper one. But it does not possess any special function on its own nature.[3] Whereas Bamboo fiber has particular and natural functions of anti-bacteria, bacteriostasis and deodorization. Bamboo fiber is biodegradable textile material and so it can be biodegraded in soil by microorganism and sunshine. The decomposition process doesn't cause any pollution to environment.[3,4]

Use of bandage cloth is disposable way of dressing. Several researchers have used antimicrobial finishes to provide bandage cloth fabrics with barriers against micro organisms. The present study aims at developing bandage clothes having antimicrobial nature by imparting antimicrobial finish to it.

2. Materials and Methods

Bamboo and Cotton of 30's count yarn was sourced and woven into loosely woven fabric in S.S bit looms, Pallipalayam, Erode. Here Cotton with warp and weft yarn of 30 s count and bamboo with warp and weft yarn of 30 s count and bamboo and cotton blend where warp yarn of 30 s count and weft yarn of 30 s count respectively was produced from bit loom.

2.1 Processing

The loosely woven bandage cloth was scoured using soap water. The material was dipped in soap water for 30 min, then it was washed twice and dried. Then the bandage cloth was bleached with hydrogen peroxide. Then the Bleached fabric was taken to the process of finishing.

2.2 Finishing

- Antimicrobial finish
- Vitamin E finish
- Aloevera finish

Finishing was carried out by applying the chemicals directly on the bandage cloth by pad-dry-cure method. 20 gpl of triclosan, 15 gpl of vitamin E and Aloe vera of 15 gpl was mixed with 1lt of water then the bandage cloth was immersed into it at room temperature. The pH maintained was 5-5.5.

2.3 Fabric Testing

Mechanical tests were carried out using standard testing methods for the treated and untreated bandage cloth. The mechanical tests of the woven bandage cloth is given in table 1.

Table 1 Mechanical testing of bandage fabric

Parameters	100% Bamboo		100% Cotton		50 :50 Bamboo - Cotton	
	Before finish	After finish	Before finish	After finish	Before finish	After finish
Warp Tensile strength (in kg)	1.2	1.1	1.4	1.2	1.9	1.6
Weft Tensile strength (in kg)	1.4	1.2	1.9	1.7	2.4	2.1
Warp Stiffness (cm)	1.4	1.1	1.7	1.5	1.8	1.6
Weft Stiffness (cm)	1.1	0.8	1.5	1.3	1.3	1.2
Cloth weight (gms)	1.41	1.565	1.14	1.195	0.515	0.77
Warp Tearing strength	902.4	758.4	1286	931.2	1104	912
Weft Tearing strength	662.4	643.2	787.2	700.8	672	662.4

2.4 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. Two bacterial organisms used for tests are Staphylococcus aureus (gram positive) and Escherichia coli (gram negative). 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.

2.5 Absorbency Test (AATCC/ASTM TEST METHOD TS-018)

Samples were placed over the top of a beaker so that the center is unsupported. A measured drop of water is placed on the fabric 1 cm from the surface. Time is recorded until the water drop absorbs completely.

2.6 Wicking Test

A well absorbent fabric behaves like a wick and water rises to it against gravity. If the water was tinted with the

dye, the height of the water level wicked through the fabric strip can be noted. Wicking height is higher for a good absorbent fabric.

2.7 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.

2.8 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. Results And Discussion

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

Fig 1 and 2 shows the antimicrobial effectiveness of triclosan against the standard test cultures such as S.aures and E.coli organism respectively. A clear zone of inhibition is visible on treated bandage cloth for both the test cultures. In fig 3, there is no inhibited zone around the untreated bandage cloth and is completely surrounded by the colonies of bacteria. Bamboo has got antimicrobial nature by its own but the antimicrobial activity of bamboo can be seen when it is in contact with skin. The study confirms the antimicrobial nature of triclosan 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.

Fig 1 Antimicrobial activity against *E.Coli* (treated)

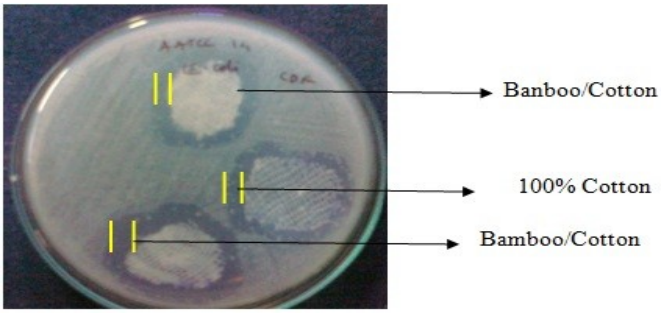


Fig 2 Antimicrobial activity Against S.aureus (treated)

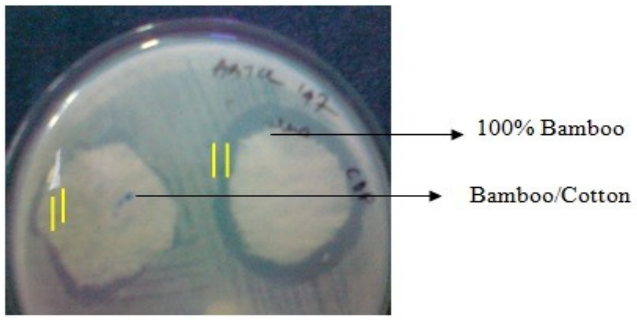
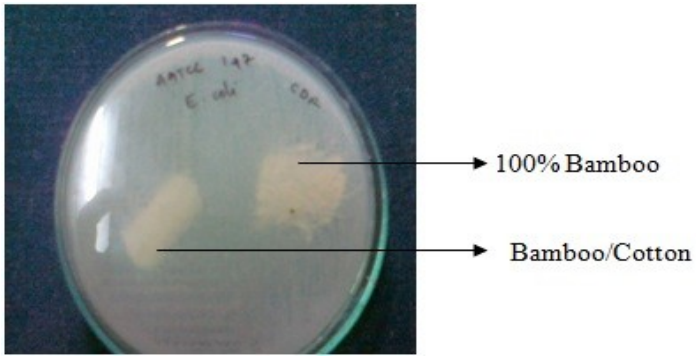


Fig 3 Antimicrobial activity (Untreated bandage cloth)



Here the broad spectrum of antimicrobial activity is good in treated bandage cloth of 100 % bamboo, 100% cotton and bamboo – cotton.

3.2 Effect Of Absorbency on Treated and Untreated Fabrics

Table 2 shows that the time taken to absorb blood and water molecules by treated vital finish samples is comparatively less with respect to the untreated samples. The Aloevera finish makes the cloth softer and thus the absorbency is higher than untreated cloth.

Table 2 Absorbency test on Treated and Untreated samples

Samples	Time Taken (s) For water molecules		Time Taken (s) For blood molecules	
	Before finish	After finish	Before finish	After finish
100% bamboo	<2sec	<1sec	<3sec	<2sec
100% cotton	<4sec	<3sec	<6sec	<4sec
Bamboo-Cotton	<3sec	<2sec	<4sec	<3sec

Among the three untreated samples (100% bamboo, 100% cotton and bamboo- Cotton) bamboo behaves higher in absorbency. Since bamboo is the softer and hollow in nature and hence enhances higher absorbency. Whereas the absorbency of bamboo – Cotton is higher than that of 100 % Cotton.

Among the three treated samples (100% bamboo, 100% cotton and bamboo- Cotton) bamboo behaves higher in absorbency. Whereas the absorbency of cotton is higher than that of bamboo – Cotton.

3.3 Wicking

The fig 4 & 5 shows that the wicking property of the treated samples is effective when compared to the untreated samples. The reason behind this is the samples are treated with vitamin Eand triclosan which provide wickability for the better transport. Treatment of fabric with Aloevera will also improve the absorbency and wickability.

Among the three untreated samples (100% bamboo, 100% cotton and bamboo- Cotton) bamboo have higher wickability. Since bamboo becomes softer and more absorbent it enhances higher wickability. Whereas the wickability of bamboo – Cotton is higher than that of Cotton.

Among the three treated samples (100% bamboo, 100% cotton and bamboo- Cotton) bamboo have higher wickability. Whereas the wickability of bamboo – Cotton is higher than that of Cotton.

Fig 4 Wickability Vs Untreated fabrics

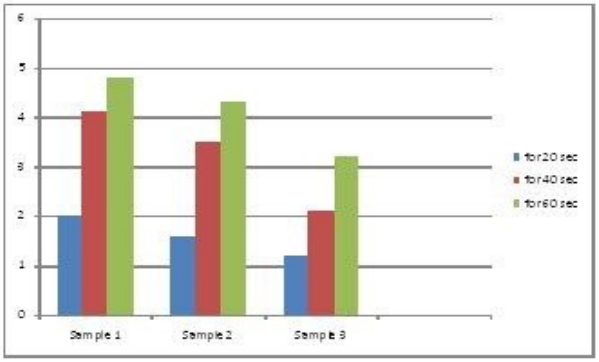
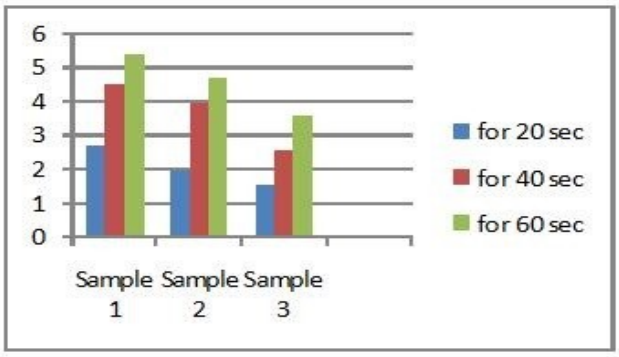


Fig 5 Wickability Vs treated fabrics



3.4 Staining

The treated and untreated samples were tested physically for the stains of blood under normal condition. From table 3 it is seen that bamboo performs faster on stain release.

Table 3 Staining test on Treated and Untreated samples

Samples	Time Taken for Releasing Stain (Human blood)	
	Before finish (min. sec)	After finish (min. sec)
100% bamboo	1.2	1.0
100% cotton	2.0	1.5
Bamboo - cotton	1.5	1.2

3.5 Deodorizing Activity of Finished and Unfinished Bandage Cloth

The score sheets reported that the finished bandage cloths have good performance towards odour massing property and they were comfortable to wearer. Also the report encloses that there were no allergies or itching to the patients while wearing the finished bandage cloth.

4. Conclusion

In current scenario, medical textiles plays vital role in hospital applications. Bandages are found to be intimate with the patients and so it is important to provide bandage cloth with barrier against micro organisms and odor of blood.

The functional finishes imparted shows antimicrobial activity and it is assessed using agar diffusion method. The result shows higher resistivity about 0.4 mm of zonal inhibition against E.Coli and S.aureas.

The comfort property and physical property seems to be good in bamboo bandages. Moreover it has got antimicrobial nature by its own but the antimicrobial activity of bamboo can be seen when it is in contact with skin. Therefore it can be concluded that bamboo bandages can be used for accidental wounds. Whereas treated bamboo-cotton equally proved to have better properties can be used for patients at trauma conditions.100% cotton can be treated with triclosan and used for patients to avoid infections from microbes.

The finishes such as Aloevera and vitamin E resulted in excellent fragrance and improvement in skin tone after the use of bandage cloth.

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