Research Paper

Volume : 2 | Issue : 4 | Apr 2013 • ISSN No 2277 - 8179

An Eco-Friendly Antimicrobial Finish Using Datura Innoxia and Leucas Aspera on Cotton Fabric

Home Science

KEYWORDS : Anti Microbial finish, Natural Herbs, Antimicrobial Property, ecofriendly textiles

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ABSTRACT

Antimicrobial finish on fabrics can minimize the transfer of microorganisms onto the wearer by creating a physical barrier. It prevents the skin diseases caused by the microorganisms. The various medicinal plants found in nature exhibit excellent anti-microbial properties. Cotton fabrics were selected for giving the antimicrobial finish. It is found that that the selected herbal plants of Datura innoxia and Leucas aspera finish samples showed good result. Antibacterial activity of cotton fabric is good with reference to staphylococcus aureus and streptococcus organisms when compared with untreated sample. Antimicrobial finish is an eco-friendly finish and it is applicable for patients who are affected from skin diseases100% Datura innoxia and Leucas aspera leaves treated samples was found to be the best of all exhibiting a good finish and antimicrobial activity.

INTRODUCTION

Healthcare is a serious business which is not only influenced by practicing medical professionals. Good hygiene is an aid to health, comfort and social interactions. It directly aids in disease prevention or disease isolation.

With the increasing threat from new strains of bacteria and viruses growing problems textiles being vulnerable to microorganisms attack would cause many cross infections and allergic reactions.

Datura innoxia belongs to the family "Solanaceae". "Thorn apple and Toloache" in English; "Dhatura" in Hindi and "Dhatur" in Sanskrit. It is an annual shrubby plant that typically reaches a height of 0.6 to 1.5 meters. Its stems and leaves are covered with short and soft grayish hairs, giving the whole plant a grayish appearance. It has elliptic entire-edged leaves with pinnate venation. All parts of the plant emit a foul odor similar to rancid peanut butter when crushed or bruised, although most people find the fragrance of the flowers to be quite pleasant when they bloom at night.

'Thumbai' (Tamil) is distributed throughout India from the Himalayas down to Ceylon. "Leucas aspera" is the botanical name of thumbai. It belongs to the family "Labiatae". The plant is used traditionally as an antipyretic and insecticide. Flowers are valued as stimulant, expectorant, aperient, diaphoretic, insecticide and emmenagogue. Leaves are considered useful in chronic rheumatism, psoriasis and other chronic skin eruptions. Bruised leaves are applied locally in snake bites.

Antimicrobial finish causes a fabric to inhibit the growth of microbes. The humid and warm environment found in textile fibers encourages the growth of the development of odor where the fabric is worn next to skin. In addition, stains and made the skin of the wearer and the textile substrate itself, an antimicrobial finish is applied to textile materials.

OBJECTIVES

The objectives of the study are,

- To select the cotton fabric with 40's count.
- To collect the herbs and shadow dried to make the herbal powder.
- To apply the antimicrobial finish using citric acid in pad-dry-cure method.
- To find the antimicrobial activity by AATCC-147 test.

EXPERIMENTAL PROCEDURE

SELECTION OF FABRIC

Cotton fabrics are generally recognized as being long-wearing, due to good abrasion resistance. Comfort can be that either of coolness or warmth. Cotton is more outstanding for coolness than for warmth. Cotton of 40's count was selected for the study.

SELECTION OF ANTIMICROBIAL FINISH

Antimicrobial finishes are designed to inhibit the growth or kill micro-organisms, but storage of textile materials under conditions that deprive the micro-organism of one of the factors that promote microbial survival or growth can also promote an antimicrobial effect. Micro-organisms on textiles can lead to obnoxious smells, generate stains and fiber degradation, as well as spread infections.

Antimicrobial finishes are thus used for hygiene finishes. Antimicrobial agents operate via different mechanisms of antimicrobial activity and their durability. These antimicrobial agents may be classed according to whether they are biocides or biostats, or leaching or bound antimicrobial agents.

SELECTION OF HERBAL PLANTS

DATURA INNOXIA Datura innoxia shows the property of quite toxic and its high range in its odour and good application with fabrics. This herbal plant also has effective antimicrobial property.

It dissolves well in water and it does not require any other solvents. The plant was collected from interior places and it was allowed to shadow dried for few days and hours. The herb was powdered with the help of dried leaves. Leaf alone taken for the study

LEUCAS ASPERA

This was one of the traditional plants and has wide range of properties and this leucas aspera also has good antimicrobial activity which was seen in its flower. So, the above mentioned herbs were collected dried well and the plant were manually crushed and transferred to make powder.

EXTRACTION PROCESS

The collected leaves of datura innoxia and leucas aspera were shadow dried within a temperature range of 38-400C. The moisture content of the leaves collected was reduced to less than 14% with proper drying since most of the herbs have 60-80% of moisture content and cannot be stored without drying. After drying, grinding was done to break down the leaves of the plant into very small units ranging from larger course fragments to fine powder. Extraction refers to separating the desired material by physical or chemical means with the aid of a solvent. Active substances were extracted from the powder by liquid extraction method.The powdered plant material was extracted with water by adding 20g of herbal powder in 100ml of water for 24 hours to separate the alkaloids. In between the solution was put under the sonicater equipment for 90 minutes to aid the extraction of active materials from the herbal extract.

APPLICATION OF HERBAL EXTRACT USING CITRIC ACID AS CROSS LINKING AGENT

PROCESS OPTIMIZATION

The two herbal powder samples Datura Innoxia and Leucas aspera were taken 50g each and dissolved along with citric acid 0.5 g/l in water. The cotton samples were dipped in that solu-

tion for 30 minutes, padded, dried. Fabric samples were padded with different concentration of plant extract, dried at the temperature of 1000C for 5 minutes and curedat1500C for 3 minutes. The independent variables were concentration of the plant extract, treatment temperature and concentration of citric acid. The dependent variables were bacterial reduction % by Challenge test(AATCC 100), Zone of inhibition in both agar diffusion test and in parallel streak method (AATCC 147).

OPTIMIZED PARAMETER S

S. NO	PARAMETERS	PARTICULARS
1	Datura innoxia	50 gms
2	Leucas aspera	50 gm
3	Material liquor ratio	1:20
4	Citric acid	0.5 g/l
5	Padding Temperature	1000C (5 min)
6	Curing temperature	1500C (3 min)

ANTIMICROBIAL TEST

Antimicrobial activities of the treated fabrics were evaluated by both qualitative (AATCC-147) methods. Parallel streak method was done to know the development of growth. After incubation, the plates were observed for bacterial growth. Then the numbers of colonies were counted for each plate. This showed that 100% treated samples has got less number of colonies when compared to other samples. Samples treated with 75% concentration also got less number of colonies when compared to untreated sample.

The result indicate that 100% treated sample do not support the bacterial growth to larger extent, whereas 50% and 75% treated sample to a smaller extent when compared to untreated sample.

ANTIBIOTIC SENSTIVITY TEST

An inoculating loop or needle is touched to four or five isolated colonies of the pathogen growing on agar and then used to inoculate a tube of culture broth. The culture are staphylococcus aureus and streptococcus. The culture is incubated for a few hours at 350 C until it becomes slightly turbid and is diluted to match a turbidity standard. A sterile cotton swab is dipped into the standardized bacterial test suspension and used to evenly inoculate the entire surface has dried for about 5 minutes, the appropriate antibiotic test disks are placed on it, either with sterilized forceps or with a multiple application device. The plate is immediately placed in a 350 C incubator.

After 16 to 18 hours of incubation, the diameters of the zones of inhibition are measured to the nearest mm.

PARALLEL STREAK METHOD

This method helps to know the growth of the organisms and the presence of the antibacterial activity. By this method, the finished samples had the growth of the organisms in the specimen. So there is a presence of antibacterial activity.

SHAKE FLASK METHOD

In the short, the number of living micro organism were counted after stirring the micro organism suspension in an Erlenmeyer Flask (1x105 cells / ml of organism). The test solution was then shaken for 1 hour with 320 rpm speed at 250 C after the addition of 1 gm textile sample. The decrease in the number of living micro organism present in the medium containing sample is been noted and reduction (%) is been calculated using following equation.

Reduction (%) =[(A-B) / A] x100

Where,

A = the number of living micro organism before shaking.

B = the number of living micro organism after shaking.

RESULT AND DISCUSSION

ANTIBIOTIC SENSITIVITY TEST

The antibiotic sentivity test-qualitative study results are given in Table-1 and figure-1

Table -1

ANTIBIOTIC SENSITIVITY TEST-

Qualitative study

FABRIC	GROWTH UNDER FABRIC	CONCENTRATION	QUALITATIVE STUDY			
			ZONE OF INHIBITION MM			
			DTIN		LEAS	
			Sa	St	Sa	St
Untreated	Present	-	Nil	nil	nil	nil
Crosslinked	Absent	0.1	4	7	1	2
		0.5	6	15	3	3
		1.0	8	20	5	4

The above table reveals that DTIN and LEAS extracts had the growth of 4, 6 and 8 mm in Staphylococcus and 7, 15 and 20 mm in strephtococcus and 1mm, 3mm and 5mm in staphylococcus and 2mm, 3mm and 4mm in streptococcus, when compared with UNTD, the growth is present.

On finishing, sample DTIN is increased in zone development when compared to LEAS sample

Figure-1

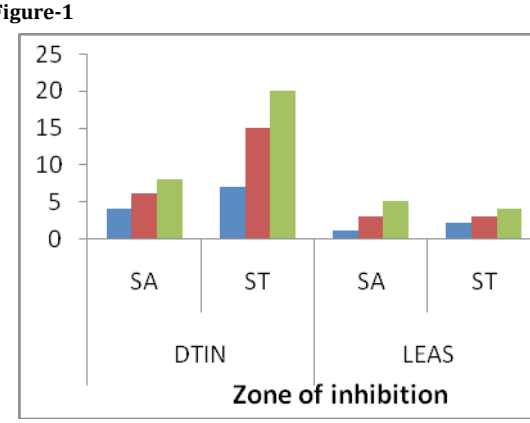


Table -2

FABRIC	GROWTH UNDER FABRIC	CONCENTRATION	QUANTITATIVE STUDY			
			ZONE OF INHIBITION MM			
			DTIN		LEAS	
			SA	ST	SA	ST
Untreated	Present	-	0	0	0	0
Cross linked	Absent	0.1	94.2	90.8	80.1	92.1
		0.5	89.2	99.9	89.9	88.9
		1.0	87.1	104.2	94.5	94.2

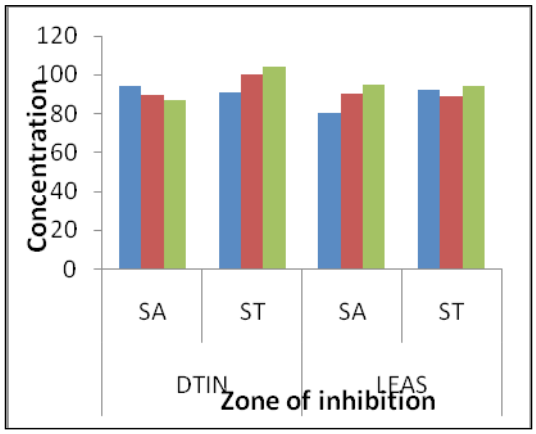
ANTIBIOTIC SENSITIVITY TEST-

Quantitative study

The above table 2 and figure -2 reveals that DTIN and LEAS extracts had the growth of 94.2mm, 89.2mm and 87.1mm in Staphylococcus and 90.8mm, 99.9mm and 104.2mm in strephtococcus and in LEAS, 80.1mm, 89.9mm and 94.5mm in staphylococcus and 92.1mm, 88.9mm and 94.2mm in streptococcus, when compared with UNTD, the growth is present. On finishing, sample DTIN is increased in zone development when compared to LEAS sample.

Volume : 2 | Issue : 4 | Apr 2013 • ISSN No 2277 - 8179

Figure -2



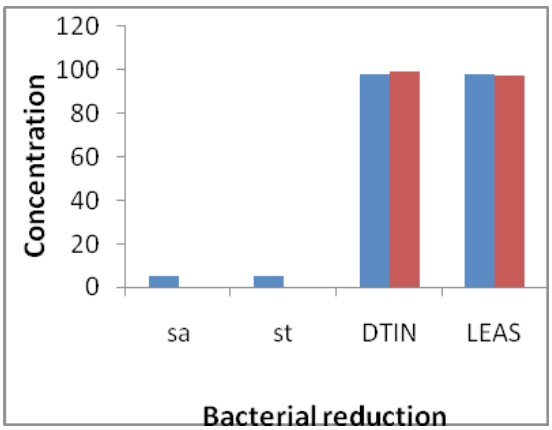
SHAKE FLASK METHOD

The shake flask method results are given in Table-3 and figure-3. The above table reveals that DTIN and LEAS extracts had the bacteria reduction of 98.1% and 97.9% in staphylococcus and the same time, 99.1% and 97.1% in Streptococcus. On finishing, sample DTIN is increased in zone development when compared to LEAS sample.

Table -2
SHAKE FLASK METHOD

S. NO	BACTERIA	FINISHING AGENT CONCENTRATION IN MM	% OF BACTERIA REDUCTION AFTER TREATMENT
1.	Staphylococcus aurues- DTIN	5	98.1%
	LEAS	5	97.9%
2.	Streptococcus- DTIN	5	99.1%
	LEAS	5	97.1%

Figure -3
SHAKE FLASK METHOD



FINDINGS OF THE STUDY

The findings of the study are summarized and given below.

In antibiotic sensitivity test, the sample DTIN had better zone development in qualitative and quantitative study, when compared to LEAS sample.

In shake flask method, the sample DTIN gives good bacterial reduction when compared to LEAS sample.

SUMMARY AND CONCLUSION

Antimicrobial finish as is the first in the protection of the textile user against pathogenic or odour causing micro organisms .The second aspect is the protection of the textile itself from damage caused by mould, mildew, rot producing micro organisms. Protection of textiles from damage caused by insect.

It may be concluded that the selected herbal plants of Datura innoxia and Leucas aspera finish samples showed good result. Antibacterial activity of cotton fabric is good with reference to staphylococcus aureus and streptococcus organisms when compared with untreated sample.

Antimicrobial finish is an eco-friendly finish and it is applicable for patients who are affected from skin diseases.

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