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FUNCTIONALIZATION OF THE SELECTED REGENERATED CELLULOSIC FABRICS WITH HERBAL OIL AND EVALUATE THE FUNCTIONAL PROPERTIES

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ABSTRACT: In this study, an attempt has been made to approach of developing antibacterial finish using aromatic herbal oils. The five different herbal oils like Palmarosa, Petitgrain, Tea tree, Thyme, Lavender oil were screened with disc diffusion method against bacteria that normally exist like *Staphylococcus aureus*, *Escherichia coli*. The result showed good efficiency in Thyme oil when compared to other oils. Bamboo and Tencel fabrics are treated with thyme oil. The thyme oil finished fabric was assessed with anti- bacterial test (AATCC 147), anti-odor test (Organoleptic test) .The results indicates thyme oil treated fabric showed excellent antibacterial activity in both Bamboo and Tencel fabric compared to untreated sample. For anti-odor test Bamboo fabric shows good result.

INTRODUCTION: Textile materials are good carriers of various types of microorganisms and can cause health related problems to the wearer [1].

Microbes are the tiniest creature not seen by naked eyes. Bacteria are unicellular organism which grows rapidly under ideal condition like moisture and warmth. Subdivision of the bacteria finally includes two classes' gram positive and gram negative of which *staphylococcus aures* and *klebsiella pneumonial* respectively are the typical examples [2]. Microbial infestations possess danger to both living and non-living matters. Obnoxious smell from the inner garment (such as socks), spread of diseases, staining and degradation of textiles are some of the detrimental effects of bad microbes.

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The consumers are now increasingly aware of the hygienic life style and there is a necessity and expectation of a wide range of textile products finished with antimicrobial properties, many commercial products are currently available in market with a range of antimicrobial properties under different trade names for textile industry. Majority of such products are synthetic based and may not be environment friendly.

Their compliance to the regulations imposed by international bodies, such as EPU is essential. There are many natural /herbal products which show antimicrobial properties [3]. The uses of natural products such as chitosan and natural dyes for antimicrobial finishing of textiles materials have been widely reported. Other natural herbal products, such as *Alo vera*, tea tree oil, Eucalyptus oil and Tulsi leaf (*Ocimum basilicum*) extracts can also be used for this purpose [4].

The screening of plant extracts and plant products for antimicrobial activity has shown that plants represent a potential source of new anti-infective agent [5]. Essential oil extracted from several types

of plants either by steam distillation or volatile organic solvent, has been used as flavoring for years. Antimicrobial activity of plant extracts is frequently due to essential oil fraction or to sulfur-containing compounds in the aqueous phase. More than 1,340 plants are known to be potential sources of antimicrobial compounds but that few have been studies scientifically [6].

On the basis of the way by which antibacterial agent works, they are classified as bacteriostats (inhibits bacterial growth) and bacteriocides (kills bacteria). The antibacterial agents can further be classified by the way of functioning of these agents as the leaching method or the non-leaching method. The leaching types of antimicrobials work by leaching or moving from the surface or in the surrounding environment. Leaching type of antibacterial agents possesses poor durability and cause skin disorders. The non-leaching type-control only those microbes that are present on the fibre surface and can potentially be abraded away from the fibre surface or may become deactivated. Depending upon the durability, antimicrobial finishes applied to textiles [7].

The purpose of this study is to examine the antibacterial activity of Bamboo & Tencel fabric treated with herbal oil. Some selective herbal oils were identified and screened for their antibacterial activities. The fabric is subjected to anti odor test.

MATRERIALS AND METHODS:

Material: The Bamboo 100 % and Tencel 100% with the following specification of yarn and fabric. Yarn count: 40s. Fabric type: single jersey fabric. It was scoured, bleached and dyed to attain basic preparatory process.

Antibacterial herbal oil: Herbal oils like palmarosa oil, petitgrain oil, tea tree oil, thyme oil, lavender oil were purchased in Swastik Eucalyptus oil Company, Ooty.

Methods:

Screening of the Herbal oil for Antimicrobial activity by Disc Diffusion Method: The antibacterial activity of herbal oils was studied by disc diffusion method (modified Kirby Bauer method).

Sterile bacteriostasis agar was dispensed in sterile petri dishes. Broth cultures (24 hours) of test organisms *Staphylococcus aures and Escherichia coli* were used as inoculums. Using sterile cotton swab, test organisms were swabbed over the surface of the agar plate. 6 mm diameter discs were made from Whatmann no. 1 filter paper. The sterile disc impregnated with various oils was placed over the post swabbed agar surface by using sterile forceps. After placing the samples, all the plates were incubated at 37ºC for 18 to 24 hours. The size of the clear zone was used to evaluate the inhibitory effect of the herbal oils.

Finish application: The fabric was immersed in the oil for 15 min. The fabric was taken out of bath and squeezed. The fabric was finally dried in ambient air. The efficiency of finished fabric was tested by AATCC- 147.

Measurement and analysis: The standard test methods for the fabrics include the antibacterial screening, testing (disc diffusion method, AATCC 147), Organoleptic and objective evaluation tests.

Antibacterial activity by AATCC 147: The AATCC plates were prepared by pouring 15ml of AATCC media into sterile Petri plates. The plates were allowed to solidify for 5min and the bacterial culture was inoculated as single line followed by the four lines without refilling the inoculation loop. The fabric was cut into 5 cm X 2.5 cm (l*b) size and immersed in treatment bath containing oil with the M: L of 1:20 ratio for 15 minutes and air dried in at room temperature. The finished fabric was placed on over the inoculated bacterial species. And the plates were kept for incubation at 37ºC for 24 hours. At the end of incubation, zone of incubation formed around the fabric was measured in millimeter and recorded.

Organoleptic evaluation of odor control - after 48 hrs (in house method): The male panelists were each given a treated fabric daily during the test period. Each sample was to be kept under socks on a specific foot. At the end of a workday, panelists reported to the lab to remove the samples, seal them in plastic bags, and incubated till next day. Four odor judges made odor evaluations 14 hour after removal of the sample on each test day. The judges used individual scoring sheets and new sheets were used every day of the evaluation.

The odor grading scale was 0 to 10 ("no odor" to "very intense and disagreeable odor"

RESULT AND DISCUSSION:

TABLE 1: ASSESSMENT OF ANTIBACTERIAL ACTIVITY BY DISC DIFFUSION METHOD

Herbal Oil	Zone of Bacteriostasis (mm)	
	Staphylococcus aureus	*Escherichia Coli*
Palmarosa oil	14	09
Petigrain oil	0	0*
Tea tree oil	09	11
Thyme oil	25	40
Lavender oil	0	0

(*No growth beneath the fabric)

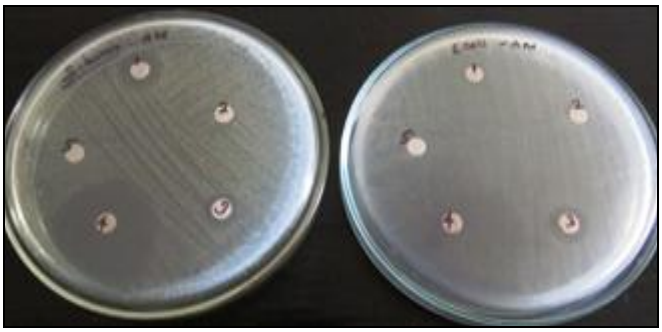
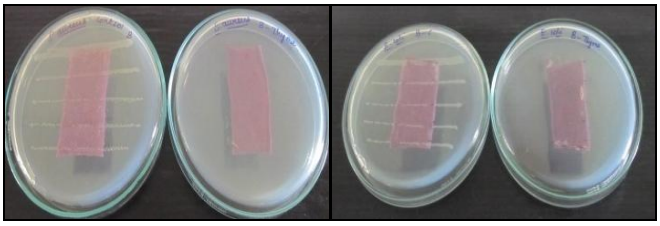


FIG. 1: PHOTOGRAPH VIEW OF (a) *ESCHERICHIA COLI* AND (b) *STAPHYLOCOCCUS AUREUS* BY DISC DIFFUSION METHOD

The data pertaining to antibacterial potential of the herbal oils are presented in **(Table 1 and fig 1)**. Thyme oil which is very effective against both the groups of bacteria Staphylococcus *aures and Escherichia coli*, it produced the widest zone of inhibition shown in **Figure 1**.

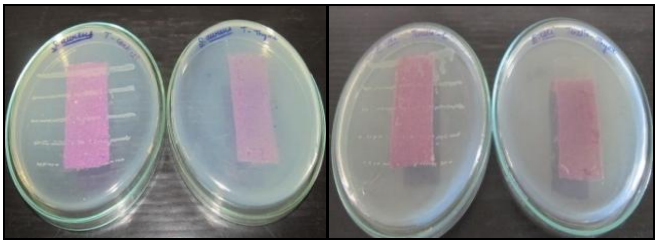
TABLE 2: ANTIBACTERIAL ACTIVITY OF FABRIC – AATCC 147

Fabric Sample		Zone of Bacteriostasis (mm)	
		Staphylococcus aureus	*Escherichia Coli*
Bamboo	Untreated	0	0
	Oil Treated	60	60
Tencel	Untreated	0	0
	Oil Treated	60	60



(a) (b)

FIG. 2: PHOTOGRAPH VIEW (a) *ESCHERICHIA COLI* AND (b) *STAPHYLOCOCCUS AUREUS* OF THE OIL TREATED TENCEL FABRIC



(a) (b)

FIG. 3 PHOTOGRAPH VIEW (a) *ESCHERICHIA COLI* AND (b) *STAPHYLOCOCCUS AUREUS* OF THE OIL TREATED BAMBOO FABRIC

From the above **(Table 2 and Fig. 2 & 3)** shows that antibacterial activity of Bamboo and Tencel fabric treated with thyme oil exhibit excellent zone of inhibition compared with untreated fabric. This oil has higher rate of protection against the human pathogens.

TABLE 3: ORGANOLEPTIC TEST EVALUATION OF ODOR CONTROL-AFTER 48 HRS (in house test method)

Fabric samples	Judges Average	
	Untreated	Treated
Bamboo fabric	3.75	7.5
Tencel fabric	2.75	7.0

Interpretation:

0. Repulsive
1. Very Poor
2. Poor
3. Poorly Fair
4. Fair
5. Acceptable
6. Fairly Good
7. Good
8. Very Good
9. Excellent
10. Ideal

From the above (**Table 3)** and in the interpretation it clearly indicates the value of treated and untreated fabric samples. This shows oil treated Bamboo fabric has higher value than Tencel fabric.

CONCLUSION: This paper investigates the antimicrobial efficacy of thyme oil was studied. Further the treated Bamboo and Tencel fabrics performance was evaluated using AATCC 147 test method. The results showed that oil finished fabric showed maximum antibacterial activity against *Escherichia coli and staphylococcus aureus* in both Bamboo and Tencel fabrics. The anti-odor property is more in Bamboo100% fabric compare to Tencel 100 % fabric.

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