ANTIBACTERIAL TREATMENT ON COTTON FABRIC FROM NEEM OIL, ALOE VERA &TULSI

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ABSTRACT

Textile materials, in particular the garments are more susceptible to wear and tear. It is important to take into account the impact of stress strain, thermal and mechanical effects on the finished substrates. The following requirements need to be satisfied to obtain maximum benefits out of the finish:

1. Durability to washing, dry-cleaning and hot pressing.

2. Selective activity to undesirable microorganisms.

3. Should not produce harmful effects to the manufacturer, user and the environment.

4. Should comply with the statutory requirements of regulating agencies.

5. Compatibility with the chemical processes.

6. Easy method of application. No deterioration of fabric quality.

7. Resistant to body fluids; and resistant to disinfections/sterilization

Keywords*: *Antibacterial, Aleovera, Cotton, Neem Oil, Tulshi

I INTRODUCTION

Increasing global competition in textiles has created many challenges for textile researchers and industrialists. The rapid growth in technical textiles and their end-uses has generated many opportunities for the application of innovative finishes. Novel finishes of high added value for apparel fabrics are also greatly appreciated by a more discerning and demanding consumer market. Antimicrobial textiles with improved functionality find a variety of applications such as health and hygiene products, specially the garments worn close to the skin and several medical applications, such as infection control and barrier material.[1]

In the last few decades, with the increase in new antimicrobial fibre technologies and the growing awareness about cleaner surroundings and healthy lifestyle, a range of textile products based on synthetic antimicrobial agents such as triclosan, metal and their salts, organometallics, phenols and quaternary ammonium compounds, have been developed and quite a few are also available commercially. Although, the synthetic antimicrobial agents are very effective against a range of microbes and give a durable effect on textiles, they are a cause of concern due to the associated side effects, action on non-target and microorganisms and water pollution. Hence, there is a great demand for antimicrobial textiles based on eco-friendly agents which not only help to reduce effectively the ill effects associated due to microbial growth on textile material but also comply with statutory requirements imposed by regulating agencies.[2]

The use of natural products such as chitosan and natural dyes for antimicrobial finishing of textile materials has been widely reported. Other natural herbal products, such as Aloe Vera, tea tree oil, Eucalyptus oil and tulsi leaf (Ocimumbasilicum) extracts, can also be used for this purpose. There is a vast source of medicinal plants with active antimicrobial ingredients. Although, there are many natural products rich in antimicrobial agents, the study on their use in textiles is very limited and not well documented. The relatively lower incidence of adverse reactions of herbal products as compared to modern synthetic pharmaceuticals, coupled with their reduced cost, can be exploited as an attractive ecofriendly alternative to synthetic antimicrobial agents for textile applications. Recent developments on plant based bioactive agents have opened up new avenues in this area of research. Most of the papers in this area concentrate on the technical details of applying individual natural agents, such as Neem extracts, natural dyes, chitosan, and other herbal products (tulsi, Aloe Vera, tea tree oil, etc.) on textile substrates and their testing. This paper comprehensive critical review on the natural product based antimicrobial finishing agents for application on textiles has been reported. [3]

Chitosan, a natural polysaccharide, is a derivative of chitin, which is commonly found in shells and exoskeletons of some crustacean and is the second most abundant bio-polymer with unique structural and physiological characteristics. They have a unique combination of properties such as biocompatibility, biodegradability and antibacterial activity which makes it an ideal polymer for industrial applications including textiles, agriculture, food science, pharmaceuticals and biomedical. Nan encapsulation is a new technique rapidly emerging and widely used in Pharmaceutical, chemical, cosmetics, food processing and in recent years to textile finishing. A potential application of Nano encapsulation with regards to finishing is the slow controlled release of the active ingredient (antimicrobial agent) to achieve the desired delay until the right stimulus is obtained. Composites are formed by the combination of two or more materials that have quite different properties. These different materials work together to give the unique properties of the composite which is the materials ‘individual properties. Hence, in the present study the cotton fabrics finished with Neem chitosan composite were compared with those fabrics finished with Neem chitosan Nano composites by placing the Neem treated and the chitosan treated fabrics as the basic material of comparison. The antimicrobial activity of the Nano composite finished cotton fabrics were assessed against bacteria that normally

exist in textiles like *E.coli*and*S. aureus*using standard AATCC 100 and147 test methods. This study would bring out the best antimicrobial finish of the above combinations used.

II ANTIMICROBIAL FINISH IN TEXTILES

"The consumers are now increasingly aware of the hygienic life style and there is a necessity and expectation for a wide range of textile products finished with antimicrobial properties, says O L Shanmugasundaram."

The inherent properties of the textile fibers provide room for the growth of microorganisms. Besides, the structure of the substrates and the chemical processes may induce the growth of microbes. Humid and warm environment still aggravate the problem. Infestation by microbes cause cross infection by pathogens and development odor where the fabric is worn next to skin. In addition, the staining and loss of the performance properties of textile substrates are the results of microbial attack. Basically, with a view to protect the wearer and the textile substrate itself antimicrobial finish is applied to textile materials.[4]

III ANTI BACTERIAL FINISHES FOR TEXTILE

Among all the natural antibacterial agents, the plant products comprise the major segment. Healing power of some of the plant materials has been used since ancient times. It is estimated that there are 250,000-500,000 species of plants on Earth. [5]A relatively small percentage (1-10%) of these is used as food by both humans and other animal species. Possibly, even more than this has medicinal properties. Hippocrates reported 300-400 medicinal plants. Plants also have an almost limitless ability to synthesize aromatic substances, most of which are phenols or their oxygen-substituted derivatives Most of them are secondary metabolites, of which at least12,000 have been isolated (less than 10% of the total). In many cases, these substances serve as plant defense mechanisms against predation by microorganisms, insects, and herbivores. Some compounds such asterpenoids give plants their odors; others (quinones and tannins) are responsible for plant pigment. Many compounds are responsible for plant flavor (terpenoid capsaicin from chili peppers). Some of the herbs and spices used by humans in food yield useful medicinal compounds. Useful antibacterial phyto- chemicals can be divided into several categories which are summarized in below[6]

3.1. Necessity Of Antimicrobial Finishes

Antimicrobial treatment for textile materials is necessary to fulfill the following objectives:

1. To avoid cross infection by pathogenic microorganisms.

2. To control the infestation by microbes.

3. To arrest metabolism in microbes in order to reduce the formation odor.

4. To safeguard the textile products from staining, discoloration and quality deterioration

IV NATURAL ANTIMICROBIAL AGENTS FOR TEXTILE:

1) Neem extract
2) Aloevera
3) Sericin
4) Citosin
5) Tea tree
6) Tulsi leave
7) Clove oil

4.1. Neem Extract

Neem (Azadirachtaindica), an evergreen tree of India, belongs to the plant family Meliaceae (mahogany). It has been recognized as one of the most promising sources of compounds with insect control, antibacterial and medicinal properties58.[7] Neemhasbeen used as a traditional medicine against various human ailments from ancient times in India and about 700 herbal preparations based on Neem are found in Ayurveda, Siddha, Unani, Amchi and other local health prescriptions. However, Neem has also received a lot of attention worldwide for its potential use as a herbal pesticide and other healthcare formulations in countries such as China, USA, France, Germany, Italy, etc. The active ingredients of Neem are found in all parts of the tree but in general, seed, bark, leaves and roots are used for extraction purpose. More than 300 different active compounds have been reported from different parts of Neem tree but, the most important limonoids are azadirachtin, salannin and nimbin. The Neemextracts have been widely used in herbal pesticide formulation because of its pest repellent properties has a potential to inhibit growth of bacteria both Gram positive and Gram negative.[8]

4.2. Aloe Vera

Aloe Vera belonging to family Liliaceous is known as 'Lily of the desert'. Aloe Vera has been used as a skin care product for than 2000 years. In modern times, scientific research has shown that the Aloe leaf contains over75 nutrients and 200 active compounds, including20 minerals, 18 amino acids and 12 vitamins. rich constituents give the Aloe Vera gel special properties as a skin care product which has been used in the USA since the 1970s and is found today virtually all cosmetic products. Aloe Vera has been used in traditional medicinal practices of many cultures for a host of curative purpose such as healing of wounds and burns and finds uses for medical and cosmetic purpose as well as for general health AloeVera also possesses antifungal and antibacterial properties, which can be exploited for medical textile applications, such as wound dressing, suture bioactive textiles, etc[9,10]

4.3. Tulsi Leaves

Tulsi (osmium basilicum) belonging to Labiatae family consists of the leaves of osmium basilicum Linn. The main constituents of tulsi are eugenol(70%), methyl eugenol (20%), carvacrol (3%),(70%), methyl eugenol (20%), carvacrol (3%), leaves are used as antibacterial, insecticidal, antiprotozoal, diaphoretic and expectorant and also as

that tulsi leaves having antibacterial activity are observedtulsi leaves were applied on cotton fabric by dipping method. In their preliminary study, although tulsi did not show any activity, it exhibited a bacterial reduction of 73% in challenge test. The bacteria-resist properties of tulsi oil have also been studied by Sarkar The oil was added to the size paste as size preservative for application on cotton yarn in lea form but it did not produce any encouraging results after storage of the sized leaves from the strength retention point of view[11,12]

V ANTIMICROBIAL FINISHING METHODOLOGIES

The antimicrobial agents can be applied to the textile substrates by exhaust, pad-dry-cure, coating, spray and foam techniques. The substances can also be applied by directly adding into the fibre spinning dope. It is claimed that the commercial agents can be applied online during the dyeing and finishing operations. Various methods for improving the durability of the finish include:[13,14]

1) Insolubilisation of the active substances in/on the fibre.
2) Treating the fibre with resin, condensates or cross-linking agents.
3) Micro encapsulation of the antimicrobial agents with the fibre matrix.
4) Coating the fibre surface.
5) Chemical modification of the fibre by covalent bond formation.
6) Use of graft polymers, homo polymers and/or co-polymerization on to the fibre.

VI RESULT& DISCUSSION

Quantitative Bacterial Reduction of cotton fabrics was carried out by serial dilution method in which the percentage in reduction of the test bacteria (*S. aureus*and*E.coli*) was confirmed. The results were calculated and tabulated below in *Table*. Due to the combined activities of the two antimicrobial agents in the form of finishes, the fabric treated with herbal finishes showed an increased bacterial reduction percentage when compared to other antimicrobial agents used in the study. It is evident that the herbal finishes with 10% Neem oil showed 56% reduction against *S. aureus*and. 95% reduction against *E.coli* whereas the fabric finishes with 10% Aloe Vera Gel reduced to 86% of *S.aureus*and, 95% of *E.coli*. This difference can be attributed to the fabric finishing with antibacterial finishing in the former, which paves the way for the better surface properties of the antimicrobial agent resulting in enhanced activity. The 100% Neem oil treated fabrics reduced to 65% and 96% of *S.aureus*and*E.coli*respectively. The antibacterial activities of bulk Azadirachtaindica and Aloe Vera were studied respectively which proves the potent antibacterial property of the Neem oil extract and aloe Vera.[15,16]

VII OBSERVATION TABLE

Samples	E-coli (10^8cfu/ml)	Staphy (10^8cfu/ml)
Untreated	1100	1200
Treated with 5% N.O	200	600
Treated with 10% N.O	150	530
Treated with 15% N.O	100	475
Treated with 5% Aloe Vera	69	320
Treated with 10% Aloe Vera	60	250
Treated with 15% Aloe Vera	52	243
Treated with 5% Tulsi	300	800
Treated with 10% Tulsi	256	734
Treated with 15% Tulsi	195	698
Treated with 100 % Tulsi	154	635
Treated with 7.5%+7.5% N.O + Aloe Vera	80	600
Treated with 7.5% + 7.5% Aloe Vera + Tulsi	75	387
Treated with 5% + 5% +5% N.O + Aloe Vera + Tulsi	78	450

Formula used for CFU calculation:-

CFU $= \frac{No.of colonies}{Amountplated(ml)} \text{ x } dillutionfactor$

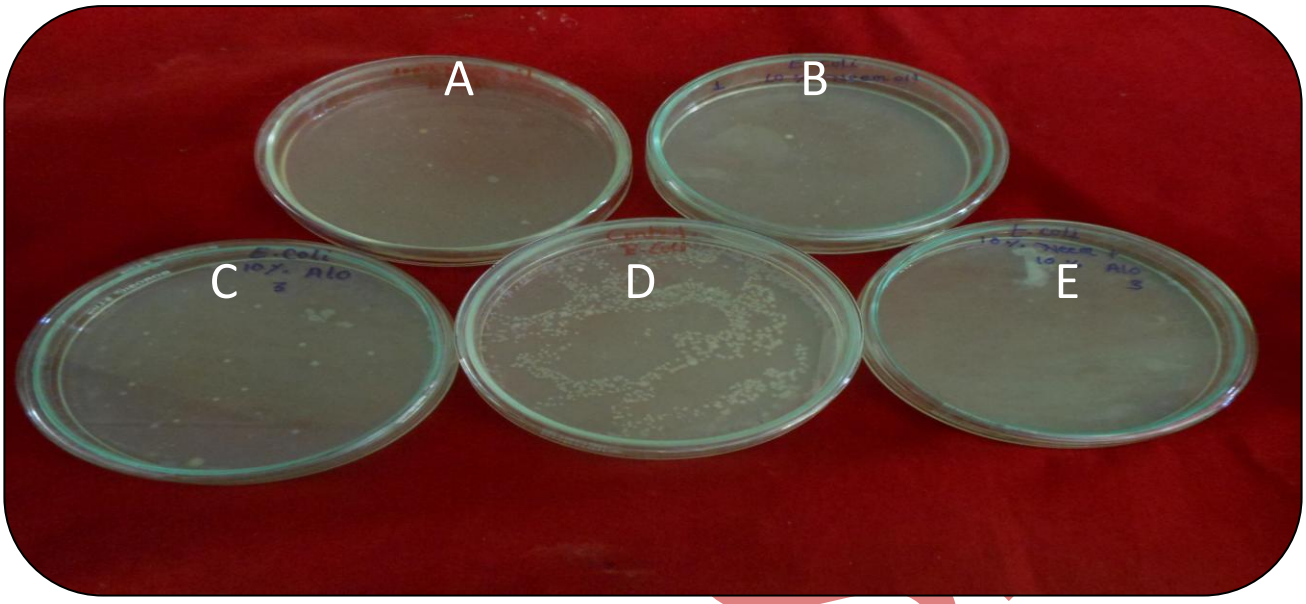
For control Specimen, CFU $= \frac{1100}{1(ml)} \text{x}10^8 = 1100 \text{ x}10^8$**cfu/ml.**

Where, CFU = Colony Forming Unit

VIII AFTER TREATMENT GROWTH OF E-COLI

Here if we compare the growth of e-coli on untreated and treatedsample with different concentration of the Neem oil and the aloe Vera sample is likely to more in the untreated sample and the reduction in bacterial growth on the treated sample.Both are showing excellent result, But we conclude that the growth of E-coli on the sample is treated with the5% neem oil, 10% neem oil, 15% neem oil, 5% aloe vera, 10% aloe vera, 15% aloe vera, 5% tulsi, 10% tulsi, 15% tulsi, 7.5% neem oil + 7.5% aloe vera, 7.5% aloe vera +7.5% tulsi, 5% neem oil + 5% aloe vera + 5% tulsi which directly shown in fig.[17,18]

From the above result we conclude that the antibacterial efficiency is best or greater in the aloe Vera as compared to the Neem oil &tulsi case of E-coli.



A E –COLI, 15%ALOE VERA,

B E-COLI. ,15%NEEM

C E –COLI, 10%ALOE VERA,5%NEEM

D E- COLI, UNTREATED

E E-COLI ,5%ALOE VERA,10%NEEM

IX CONCLUSION

Textiles have always played a central role in the evolution of human culture by being at the forefront of both technological and artistic development. The protective aspects of textile have provided the most textile ground for innovative developments. Hygiene has acquired importance in recent years. Odor has become an important factor. Unpleasant odor can arise from the acquisition of a variety of compounds produced in bodily fluids such as perspiration. "Consumers are looking for solutions to odor and microbial problem and the unique benefits provided by antimicrobial finish".

Microorganism growth is another factor that has resulted in development of antimicrobial finish. Microbial infestation poses danger to both living and non-living matters. Microorganisms cause problems with textile raw materials and processing chemicals, wet processes in the mills, roll or bulk goods in storage, finished goods in storage and transport, and goods as the consumer uses them. Obnoxious smell form the inner garments such as socks, spread of diseases, staining and degradation of textiles are some of the detrimental effects of bad microbes. The consumers are now increasingly aware of the hygienic life style and there is a necessity and expectation for a wide range of textile products finished with antimicrobial properties.

This anti-microbial finishes covers the full range of positive effects that antimicrobials bring to textile industry and provides the types and properties of antimicrobials by using the antibacterial properties of Neemoil, aloe Vera and tulsi.

With advent of new technologies, the growing needs of the consumer in the wake of health and hygiene can be fulfilled without compromising the issues related to safety, human health and environment. The consumers are now increasingly aware of the hygienic life style and there is a necessity and expectation for a wide range of textile products finished with antimicrobial propertie

X REFERENCES

[1] Pamela Paterson .Neem the wonder tree, Its pesticide and medicinal Application, university of Maryland august 2009. pp27

[2] Kristic Jernigan The Disadvantage of Neem Oil Side Effect You May Want to Consider mhtml:file://F:/The Disadvantage of Neem Oil Side Effects You May Want to Consider 11/2/2010

[3] Rajendran R , Synthesis and Characterization of Neem Chitosan Nanocomposites for Development of Antimicrobial Cotton Textiles Journal of Engineered Fibers and Fabrics Volume 7,Issue 1-2012,136-141

[4]Ramachandran,T ,.Rajendrakumar,k.Rajendra ,R. Antimicrobial Textile and Overview,IE (1)journal-TX2004,84,42-47

[5]Kwong,T,.et,al.Durable antibacterial finish on cotton fabric by using chitosan –based polymeric core-shell particles particles.Journal of Applied polymer science.2006.102(2),1787-1793

[6]Thilagavathi,G,.Krishna Bala,S,.Kannian,T,.Microencapsulation for herbal extracts for Microbial resistance in healthcare textiles IJFTR,2007,32;351-354.

[7]lan Holme,Durable freshness through antimicrobial finishes,Text.Mag,2008,30(4),13-16.

[8]Kut, D,.et al . Effects of Environmental Conditions on the Antibacterial Activity of Treated Cotton Knits .AATCC REVIEW.2005,5(3).25-28

[9]Pratruangkrai,P.Technical Textiles seen as way to go. The Nation (Thailand).2006

[10]Purwar,R. Joshi.M. Recent Developments in Antimicrobial Finishing of Textiles-A Review. AATCC REVIEW.2004, 4. (3), 22-26.

[11]Joshi D, Experimental study on antimicrobial activity of cotton fabric treated with aloe gel extract aloe Vera plant for controlling the staphylococcus aureus (bacterium), African Journal of Microbiology Research, 2009, 3:228-232

[12]M ,Joshi ,Ecofriendly antimicrobial finishing of textiles using bioactive agents based on natural products, Indian journal of Fiber &Textile Research Vol 34 ,September 2009 ,pp,295-304

[13]Chinta Medical Textiles-Application of Essential Oil as Antimicrobial Agent on Nonwoven G, J, B, B VOL1 (1) 2012 75-80,

[14]Neem oil –Wikipedia, pp 1-5

[15] AATCC Test Method 147-1993, Antibacterial Activity Assessment of Textile Materials, Parallel streak Method, AATCC technical Manual, 261-262

[16]AATCC Test Method 100-2004, Antibacterial Activity Assessment of Textile Materials Percentage Reduction Method, AATCC technical Manual, 149-150.

[17]Sarkar,R,K, Purushottam De.Chauhan, P,D .Bacteria resist finish on cotton fabric using natural herbal extract, Indian Journal of Fiber of Textile Research,2003,28,322-331

[18] Dr V M PATIL Physical properties of fabrics made from cotton covered filament core yarn produced on air jet and ring spinning system p 51-54