EFFECT OF ECO-FRIENDLY ANTIMICROBIAL FINISH ON AESTHETIC PROPERTIES OF SILK FABRIC

S. Sadaf, M. Saeed*, T. Hussain**and S. Kalsoom

Govt.College of Home Ecoomics,Gulberg, Lahore.
*Institute of Education and Research (IER), University of the Punjab , Lahore.
**National University Faisalabad
Corresponding author email: sadaf.shama@gmail.com

ABSTRACT: The study was conducted to explore eco-friendly antimicrobial finish extracted from *Azadirachata indica* (A. Juss), *Butea monosperma* (Lam.) and *Litchi chinensis* (Gaetin) trees and to determine its effect on aesthetic properties of 100% silk fabric. In aesthetic properties stiffness and smoothness appearance were checked. These properties were checked bypre and post test application of antimicrobial finish by using ASTEM E2149 Shake Flask method. The AATCC standard testing methods were used for checking aesthetic properties of fabric. It was observed that the antimicrobial finish increased the aesthetic properties of 100% silk fabric and it made 89 % reduction in microbial growth up to 25 washes. The antimicrobial finish showed good result on silk fabric.

Key words: Antimicrobial finish, *Azadirachata indica, Butea monosperma, Litchi chinensis* and Aesthetic properties.

(Received 31-03-2016 Accepted 13-10-2016)

INTRODUCTION

With the arrival of innovative technologies, customers are demanding textiles in relations to health, hygiene and cleanliness. The market for antibacterial fabrics has revealed double digit progression in the last few years. The role of textiles to limit microbial proliferation by appliance of antimicrobial action is important (Wasif and Laga, 2009). All over the world customers are demanding functional textiles as wrinkle, fade, water and microbial resistant. Amongst these, expansion of antimicrobial fabric finish is highly crucial and applicable. (Sathianarayanan *et. al;* 2010).Due to an important aspect of life and environmental factors, it becomes the major concern of the fabric processor to give importance to quality and ecosystem. So there is need for variations and revolutions in the procedures. As a consequence, there is need of highly focused research in the fabric business to support sustainability and eco-friendliness (Niinimäki and Hassi, 2011).

There has been quick development in practical fabrics for application of new finishes on fabrics. Advanced finishes on apparel fabrics are significantly prised by more challenging customer market for health and cleanliness. Fabrics such as silk and wool are protein in nature. Cotton, flax, jute and other fibres are cellulosic base. When on contact of natural fabrics come in contact with human body, environment become suitable for growth harmful microorganisms which cause skin infections, bad smell, allergies, product decomposition and other related diseases(Khan *et. al;* 2011) .

Microbes present on fabric are responsible for damaging colour, development of bad odor and destruction of fabric. Antimicrobial can be applied on sports clothing, towels, undergarments, medical clothing, shoes and upholstery etc(Varesano*et.al;* 2011).Silk is the most luxury fiber used in fabric industry and due to its biocompatibility in biomedical and biotechnological procedures as well(Leal-Egaña and Scheibel, 2010).

Microorganisms cause damage to human beings by spreading contaminations and sicknesses (Sathianarayanan *et. al;* 2010). Therefore, it is very essential to finish all apparels by antimicrobial action to check the bacterial development on fabrics without abolishing desirable features of fabrics. These antimicrobial treated fabrics are routinely used in medicinal garments, carpets, napkins, sanitary, socks and disposable wipers (Joshi *et. al;* 2009).Present research was aimed to investigate the effect of antimicrobial finish *Azadirachata indica, Butea monosperma* and *Litchi chinensis* on aesthetic properties (stiffness, smoothness appearance) of 100% Silk fabric.

MATERIALS AND METHODS

The silk fabric consisted of 90/90 warp/weft yarns. The fabric was washed in 2g/Lanti cleansing agent for 1 hour at 90°C temperature then bleached in wetting agent 2g/L $H_2O_2$and 1g/L Na_2CO_3 for one hour at 70° C. The plant leaves of Azadirachata indica, Butea monosperma, Litchi chinensis *A. indica, B. monosperma* and *L. chinensis* were collected in March 2014 from botanical garden of Government College University, Lahore. The leaves were washed then shadow dried. By using stain less steel grinder leaves were grinded into very fine powder. The powder was soaked in distilled water at ratio of 100g leaves and 250 mL water. It was soaked for seven days, then filtered by using Whatman filter paper (0.44 µ) and evaporated by using rotary film evaporator.

The solution of finish was prepared by using ratio of 200 mL leaves extract of *A. indica* (Neem), 50 mL poly urethane binder and 150 mL distilled water. Same ratio was used for *B.monosperma* and *L. chinensis*. Three meter length and one foot width silk sample was taken. The samples were labelledas untreated (un), *A. indica* (A), *B. monosperma* (B) and *L. chinensis* (C). So there were four samples from silk fabric. No finish was applied on untreated silk sample. The antimicrobial finish was applied by using the pad dry cure machine in National Textile University Faisalabad. On pad dry cure machine drying was done at 120°C temperature for two minutes and curing was done 150°C temperatures for three minutes. After applying antimicrobial finish, presence of microorganism was checked in Centre of Excellence in Molecular Biology (CEMB). The Poly urethane binder was used to improve the durability of finish and it was taken from CHT. The ASTEM E2149 Shake Flask Method (quantitative screening test) was used for testing presence of microorganism on silk fabric pre and post applies of antimicrobial finish. Before and after applying the antimicrobial finish aesthetic (stiffness, surface appearance) properties were studied. For stiffness, Shirley Stiffness tester was used. The surface appearance as an aesthetic property was checked by using AATCC Technical Manual /2004 TM 124-2001 203 test method. Fourier Transform Infrared Spectroscopy (FTIR) test was performed to confirm presence of finish on fabric.

RESULTS AND DISCUSSION

The statistical analysis of application of plant leaves extract on silk fabric and antimicrobial finish were studied in comparison with control group (untreated fabric) and result regarding fabric stiffness and smoothness appearance rating were recorded (Table 1).

Table 1. Effect of Antimicrobial Finish on Stiffness and Smoothness appearance of Silk Fabric.

	Plants		
	F-value	**P-value**	**η^2**
Multivariate	37.77	.000	.990
Univariate			
Stiffness Wrap (cm)	49.24	.000	.95
Stiffness weft (cm)	4.97	.031	.65
Stiffness warp+ weft (cm)	32.89	.000	.86
Smoothness Appearance (SA Replica)	5.50	.024	.67

MANOVA was conducted to find out the significance difference of control group in comparison of A. *indica, B. monosperma and L. Chinensis* of all plants extract on stiffness and smoothness appearance of silk fabric. The results of pillai's (0.000) indicate that there is significant difference of antimicrobial finish on stiffness warp, weft and smoothness appearance of silk fabric and its effect size is large (η^2=.990).

ANOVA was conducted to find the significant difference of *A. indica, B. monosperma, L. chinensis* and control group plants extract on stiffness warp, weft and smoothness appearance of silk fabric. The result of F test indicated that there was significance difference of Antimicrobial finish on stiffness warp (.000) of silk fabric and the effect size is large (η^2=.95) and the result of F test of stiffness weft (.031) and effect size was large (.65). The result of F test indicates that smoothness appearance (.024) and its effect size was large (.67). In case of stiffness (warp + weft) F test indicated that there was significance difference of Antimicrobial finish on stiffness (warp + weft) on silk fabric and the effect size was large(η^2=.86).

The stiffness and smoothness appearance of 100% silk fabric was increased.The reason was that antimicrobial finish made a coating on treated fabric which increased its stiffness. Previous researches on antimicrobial nature of these plants were studied with reference to mechanical property (tensile strength) of fabrics, whereas little work was conducted on "appearance" characteristics of fabrics.

The readings of antimicrobial finish were taken after 22 hours as mentioned in ASTM 2149 Shake Flask Method and after six days to check the effectiveness of antimicrobial finish. On untreated (control group) fabric microorganisms presence was shown while on treated fabrics, on 100% silk fabric after six days interval two microorganisms colony was shown while all other antimicrobial treated fabrics shown 100% reduction against microorganisms.

The application of *A. indica* was reported on textiles, but on the other hand less research work was reported in reference to the application of *B. monosperma* and *L. chinens is* on textile materials. *A. Indica* were applied on cotton fabrics which exhibited good efficiency against microbes through ENISO 20645(Qualitative) and AATCC 100-2004 (Quantitative) analysis the results exhibited good efficiency against microbes (Sumathi *et. al*; 2015).

The Fourier Transform Infrared Spectroscopy FTIR spectrum cleared that the absorption band at ≈ 3275 cm-1assigned to N-H stretching of the serine amino acid in silk samples, and the band at ≈ 2920 cm-1assigned to C-H stretching. The signal at ν = 1443 cm-1 assigned to C-C stretching in ring of tyrosine and the band ≈ 1231 cm-1 assigned to C-N stretching in only found in silk samples spectrum. This study was supported by another study in which *A. indica* was a good alternative to work as synthetic antimicrobial agent for Lyocell yarn. This study was supported with the application of FTIR in this regard. The effect of *A. Indica* was studied on woven and non-woven fabrics and good efficacy was observed against microbes(Patel and Desai, 2014).

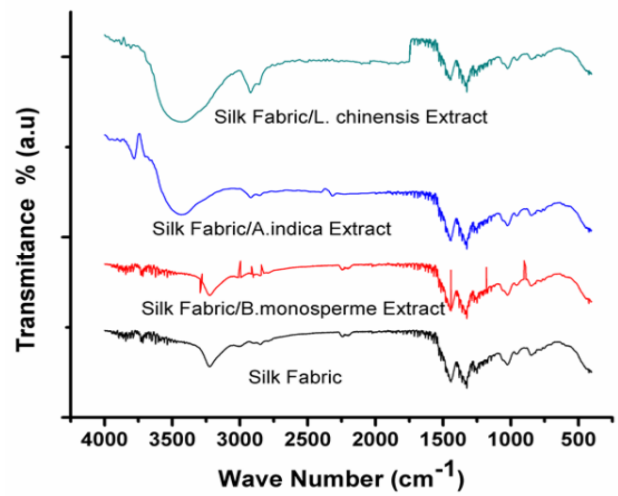

Figure 1. FTIR spectra of untreated Vs treated Silk Fabrics

Green tea (Camellia sinensis), Neem leaf (*A. indica*) and Aero root (Marantaarundinacea) have been selected as an antimicrobial finish against for organic cotton by using exhaust method. The finished fabrics have been tested for its antibacterial activity using standard test method ENISO 20645(Qualitative) & AATCC 100-2004 (Quantitative). It showed good efficacy against microorganisms which can be used for apparel (Sumathi *et. al*; 2015).

Sericin was applied as antimicrobial finish on cotton fabric by pad dry cure method. It persisted for 20-40 home washes (Doakhana*et.al;* 2013). The antimicrobial finish in this study lasted up to 25 washes and microorganisms' presence was checked after every five washes interval. The treated fabrics with *A. indica, B. monosperme and L. chinensis* revealed 100% reduction against microbes as compare to untreated fabric.

Conclusion: The antimicrobial finish extracted from *A. indica*, *B. monosperma* and *L. chinensis* trees leaves increased the aesthetic properties of 100% silk fabric and it made 89 % reduction in microbial growth up to 25 washes.

Acknowledgments: The researcher would also like to express her special gratitude and thanks to Mr Ali for their support and cooperation in checking fabrics properties in lab of National Textile University Faisalabad and Dr. Muhammad Abaid Ullah and Mr. Abdul Qayyum from IER, University of the Punjab for providing assistance in data analysis.

REFERENCES

Doakhan, S., M, Montazer, A, Rashidi, R, Moniri and M, Moghadam. (2013). Influence of sericin /TiO 2 nanocomposite on cotton fabric: Part 1. Enhanced antibacterial effect. Carbohydr. Polym.94(2), 737-748.

Joshi, M., A.S. Wazed, R, Purwar, and S, Rajendran (2009). Ecofriendly antimicrobial finishing of textiles using bioactive agents based on natural products. *Indian j. fibre text. res*, *34*(3), 295-304.

Niinimäki, K., and L, Hassi. (2011). Emerging design strategies in sustainable production and consumption of textiles and clothing. J Clean Prod, 19(16), 1876-1883.

Khan, M. I., A.K. Ahmad., A, Shafat., M, Yusuf., M, Shahid., N, Manzoor., and F, Mohammad. (2011). Assessment of antimicrobial activity of Catechu and its dyed substrate. J Clean Prod19(12), 1385-1394.

Leal-Egaña, A. and T, Scheibel. (2010). Silk-based materials for biomedical applications. Biotechnol. Appl. Biochem. 55(3), 155-167.

Patel, M.and P, Desai. (2014). Grafting of Medical Textile using Neem Leaf Extract or Production of Antimicrobial Textile Research. Res J Recent Sci. 3, 24-29.

Sathiyanarayanan, M. P., N.V. Bhat., S. S. Kokate and V. E. Walnuj. (2010). Antibacterial finish for cotton fabric from herbal products. *Indian J. Fibre Text. Res*, *35*, 50-58.

Sumathi, S., A, Thomas and E. Wesely. (2015). Study on Antimicrobial Activity of Organic Cotton Fabric Treated with Microencapsulated Herbal Extract. IJBPR. 6(4), 259-263.

Wasif, A., and S, Laga. (2009).Use of nano silver as an antimicrobial agent for cotton. AUTEX Res J, 9(1): 5-13.

Varesano, A., C, Vineis and A, Aluigi. (2011). Science against microbial pathogens: communicating current research and technological advances. In *Antimicrobial polymers for textile products.* (pp. 99-110). Italy: Giuseppe Pella.