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IMPACT OF ANTI-MICROBIAL FINISH ON NATURAL DYED BHARAT MERINO, SANDYNO AND COIMBATORE KURUMBA WOOL AND WOOL BLEND MATERIALS

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ABSTRACT

The micro-organisms deposit themselves and multiply on our bodies and on textile materials in contact with our skin. Various types of bacteria, fungi and viruses are present in the environment of our every day life. Under suitable conditions, the multiplication of micro-organisms in textiles can create staining, discolouration, degradation of the fibres, materials and the generation of foul odours. Hence, this article relates to study the effect of Anti-microbial functional finish when applied to selected wool and wool blend materials to achieve specific properties and purpose.

1 INTRODUCTION

Functional finishes are mainly applied or performed on textiles to improve the properties of fabric. Basic finishing processes encompasses three groups namely mechanical processes, heat setting and chemical processes based on the requirements of finishes. Textile finishes generally fall into one of two general categories according to purpose or end result. These categories are standard, wet or chemical finishes and decorative or mechanical finishes. Persons concerned with end products usually categorise finishes as aesthetic finishes and functional finishes. The former modifies the appearance and handle (feel) of fabrics, while the latter improves the performance of a fabric under specific end use conditions. Finishing includes value addition processes of mechanical or chemical nature, which may be temporary or permanent effect. A temporary finish lasts until the fabric is washed or dry-cleaned. A durable finish lasts longer than temporary but it may become unsatisfactory with the passage of time. A permanent finish lasts until the garment is in

service. Another classification of finishes is based on whether it is a general or special finish. The general finishes include those, which affect the texture and appearance of cloth. Functional finishes or special purpose finishes are applied to textile to enhance its performance in a specific area, although these finishes do not alter the appearance of textiles. Functional finish requirements can be met by using modern finishing methods, which is a combination of chemical finishing and mechanical finishing. Among which new innovative functional finishes play an important role now-a-days and in which this article projects on.

Textiles have to be functional, easy care, attractive and practical. These requirements can be met by using (some special finishing) functional finishes which will impart some innovative properties to the material. Functional finishes help to overcome certain inherent drawback of natural fibres. Functional finishes must last as long as the life of the textile material with its periodical washings and dry cleaning methods. The finish must be compatible to human as well as for ecology. These requirements have ultimately induced into developing various functional finishes depending upon their end use applications.

Textiles made from natural fibres are generally more susceptible to bio-deterioration in comparison to the synthetic man made fibres. Products such as starch, protein derivatives, fats and oils used in the finishing of textiles can also promote microbial growth. Micro-organisms may attack the entire substrate, such as the textile fibres or they may attack only one component of the substrate, such as elasticizes contained therein or grow on dirt that has accumulated on the surface of a product. However, microbial activity can be minimized by keeping susceptible materials dry as surface growth will occur when the moisture is high.

The structure of the substrates and chemical processes also induce the growth of microbes which cause cross infection by pathogens and development of odour 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 aver Shanmugasundaram (2007) and Sarkar et al (2002). Garvey (2008), Shukla and Sundar (2008) express that wool has rather poor resistance to mildew and bacteria that grow when moist wool is stored over an extended period. Ramachandran et al (2004) view that textile finishing involves treating a textile material in such a way that the product has the desired aesthetic and functional properties required for its intended use and therefore has greater market value.

2 METHODOLOGY

2.1 SELECTION OF WOOL FIBRES

Indian breeds of sheep produce wools of coarse and medium quality. The Central Sheeep and Wool Research Institute (CSWRI), Mannavanur, Kodaikanal and Sheep Breeding Research Station, Sandynallah, Ooty has developed several new geno types of sheep for production of relatively finer wool by selective inter breeding of Indian sheeps – such as "Bharat Merino Sheep" from CSWRI and "Sandyno Sheep" from Sandynallah, a cross breed of Russian Merino of the hilly district of Ooty. There are also numerous roughly classified Indian breeds, were the Kurumba of Coimbatore region called after the community that reared it and in Coimbatore and adjacent districts "Curumbaadu" is a local sheep with thick coarse wool. Hence, three wool fibres which were available locally namely Bharat Merino (BM), Sandyno (S) and Coimbatore Kurumba (K) wool fibres were selected for the study.

2.2 PROCESSING OF WOOL FIBRES

2.2.1 SCOURING OF WOOL FIBRES

The selected three Bharat Merino (BM), Sandyno (S) and Coimbatore Kurumba (K) wool fibres were scoured using non-ionic detergent.

2.2.2 SPINNING

Scoured Bharat Merino, Sandyno and Coimbatore Kurumba wool fibres were opened thoroughly, cleaned from extraneous matter and blended. Wool fibre was spun through short staple system popularly known as cotton spinning system Three 100% BM, !00%S and 100%K pure wool yarns were spun for the study. Similarly, BM, S and K wool fibres were blended with selected proportions with cotton (C) and Coimbatore Kurumba (K) wool fibres to develop six blended wool yarns namely 50:50 BM (Bharat Merino : Cotton), 60:40 (Bharat Merino : Cotton), 50:27:23 BM:K:C (Bharat Merino : Coimbatore Kurumba : Cotton), 50:50 S (Sandyno : Cotton), 60:40 S(Sandyno: Cotton), 50:27:23 S:K:C (Sandyno : Coimbatore Kurumba : Cotton) were spun. So. totally nine yarns were spun and undertaken for the study.

2.3 SELECTION OF NATURAL DYES, MORDANT, MORDANTING TECHNIQUE, BIO FIXING AGENTS AND ITS PER CEN TAGE

The spun wool yarn namely 100% BM, 50:50 BM, 60:40 BM, BM:K:C, 100% S, 50:50 S, 60:40 S, S:K:C and 100% K yarns were subjected to selected natural dyes such as annatto, eclipta and manjistha of 4%, 4% and 6% respectively. Karuvelam Bark and Neem Bark was selected as bio mordants with one per cent and Karonda leaf as bio fixing agent with 0.05 per

cent. Mordanting Technique used for natural dyeing was pre, simultaneous, post and pad mordanting techniques respectively to dye wool yarns.

2.4 SELECTION OF FABRICATION

Each of the selected wool yarn namely 100% BM, 50:50 BM, 60:40 BM, BM: K: C, 100% S, 50:50 S, 60:40 S, S:K:C and 100% K yarns were woven in handloom using plain weave. The handloom fabrics consisted of the respective wool yarns both in warp and weft directions.

2.5 VALUE ADDITION FUNCTIONAL FINISHES

Value addition functional finishes are performance textiles that provide additional function such as resistance or protection from a specified element including fabrics that resist wrinkles, soil or odour and/or protect from an environmental condition. Different types of fibres have different susceptibilities to biological attack. Textile materials are treated with anti-microbial finishing agents to protect the wearers or users of the textile product for aesthetic, hygienic or medical purpose against bacteria, dermatophytic fungi, yeasts, viruses and other deleterious micro-organisms.

2.5.1 SELECTION OF FUNCTIONAL FINISH

Anti-microbial finish was selected for the study. Microbes are the tiniest creatures not seen by the naked eye. They include a variety of micro-organisms like bacteria, fungi, algas and viruses. The sources of microbes are air, soil and skin. They are divided into Gram positive (*Staphylococcus aureus*), Gram negative (*E-coli*), spore bearing or non-spore bearing type. They stain the fabric and deteriorate the performance properties of the fabrics as expressed by Gopalakrishnan (2006), Babu (2003), Murphy (2000), Saraf et al (2005) and Choudhury (2008). The function of anti microbial finish given to textile materials control, destroy or suppress the growth of micro organisms, reduce odour from perspiration and stain state Teli and Prabhu (2006). Hence, antimicrobial finished fabrics have gained significant importance in the recent years express Rekha and Poornima (2005).

2.6 APPLICATION OF ANTI-MICROBIAL FINISH

The anti microbial finish was imparted to all the nine handloom plain weave woven fabrics namely 100% BM, 50:50 BM, 60:40 BM, BM:K:C, 100% S, 50:50 S, 60:40 S, S:K:C and 100% K following the recipe and procedure as given below.

Five Kgs of wool fabrics were soaked in 60 litres of water along with 50 ml of wetting agent and the machine was rotated for 20 minutes. pH was maintained between 5.0 to 5.5 by addition of 50 ml of acetic acid. Then 150 ml of anti microbial finish chemical ultra fresh NMV_2 was added to the above mixture and the machine was rotated for 40 minutes. After the desired time, the water was drained. The wool fabric was tumble dried at 60°C to arrest shrinkage and cured at 170°C.

2.7 AGAR DIFFUSION TEST

Agar diffusion method is used to assess the anti-microbial activity. This test was conducted on handloom fabrics as the material consisted of wool yarns both in warp and weft directions. All the nine handloom dyed control samples (Hd) and the treated samples which were subjected to anti microbial finish after treating them with bio enzyme wash and insect repellent finish (Hm) were taken for the test. This test was mainly conducted to find out the anti microbial effect which was given on the insect repellent treated material because there was no literature study pertaining to the effect on wool fabrics treated with anti microbial finish after insect repellent finish. This assessment of anti-bacterial activity was carried out following AATCC test method 147 (Qualitative Method). The materials required are AATCC bacteriostasis agar medium and sterile cotton swabs. The test strains used were *Staphylococcus aureus* (representative of gram +ve bacteria) AATCC 6538 of inoculum size 2.4×10^9 cfu/ml. and *Escherichia coli*, (representative of Gram –ve bacteria) AATCC 11229 of inoculum size 2.7×10^9 cfu/ml.

For the agar diffusion test method (halo) or zone of inhibition methods, sterile AATCC bacteriostasis agar medium was dispensed into the sterile petridishes which was kept over night. By using sterile cotton swab, the test organisms were inoculated over the surface of the agar plate. The test specimens H1d (control) and H1m (treated) were taken separately and gently pressed in the center of the mat culture of bacteria in petri dishes separately. The plates were incubated at 37°C for 18 to 24 hours. After 24 hours of incubation, the zone of inhibition was measured for anti bacterial activity. If the antimicrobial additive has been effective, a clear zone of no growth (the zone of inhibition) is seen around the sample or no growth is seen above or

below the sample. The zone of inhibition can be measured and this gives a qualitative impression of how effective the additive is against different micro-organisms. This gives a clear indication that the samples exhibited good antimicrobial activity. The anti bacterial activity was tested for all the nine handloom control and treated wool materials. The photos of pure wool samples of 100% BM, 100% S and 100% K subjected to agar diffusion test are shown in Plate 1, 2. The control samples of 100% BM, 100% S and 100% K subjected to *Escherichia coli* are shown in Plate 1a, b and c and their treated samples are shown in Plate 1d, e and f. The control samples of 100% BM, 100% S and 100% K subjected to *Staphylococcus aureus* are shown in Plate 2a, b and c and their treated samples are shown in Plate 2d, e and f.

3 RESULTS AND DISCUSSION

3.1 RESULT OF AGAR DIFFUSION METHOD

The results of anti microbial finish shows zone of inhibition indicating the prevention of micro-organism growth. From the result, it is observed that anti-microbial activity is excellent in the dyed control sample. When the anti bacterial activity was compared with both *Staphylococcus aureus* and *Escherichia coli,* it was observed that the activity against *Staphylococcus aureus* was found to be more efficient than against *Escherichia coli* confirming that the anti-microbial agent is having a broad spectrum activity against both gram positive and gram negative bacteria. The observation noted is also substantiated by the study of Patel and Tandel (2005) that all natural extracts impart excellent anti microbial finish. The results of anti microbial finish are presented in Figure 1.

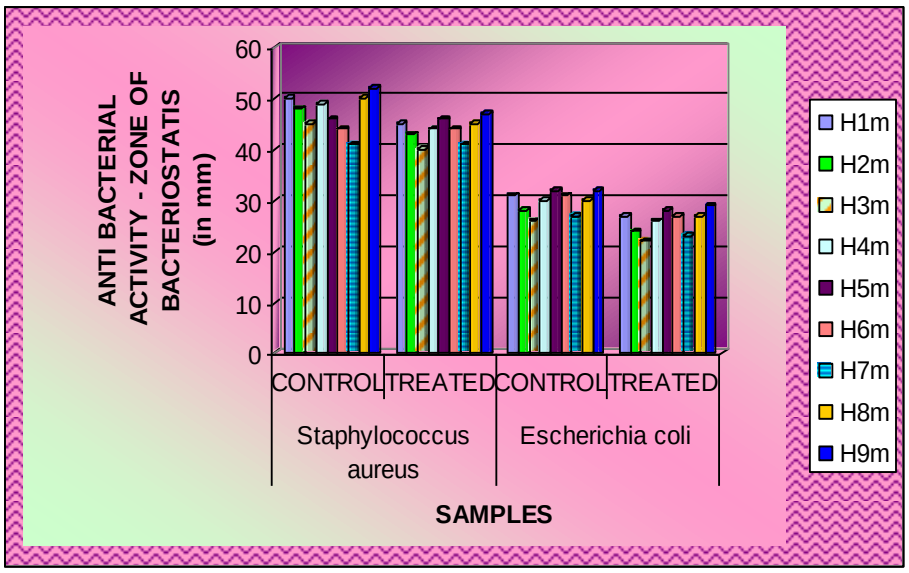

Fig. 1: Anti Microbial Activity.

4 CONCLUSION

The use of Anti-microbial functional finish for textile wool fabrics is likely to increase particularly in technical textile sector. The greater incidence and awareness of allergy related complaints have stimulated interest not only in textile materials but also in household textiles and furnishings, which minimize exposure to possible aggravating agents such as dust, mites, water and oil etc. This has stimulated for an all round protection of textile materials against microbiological infestation and its effects. Therefore, anti-microbial finish will fruitfully act as a functional protection for wool and wool blend materials which can be used in conditions where they remain wet or dry for long periods of time.

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