

Antibacterial Finish for Fabric Used In Helmet Interlining

M. Saravanan, L. Sasikala, R. Sukanya Devi

Abstract: Development of bacteria free interlining fabric for helmet interlinings remain mandatory in today's competitive and fast growing technical world since our government is imposing the need of safety through implementation of strict rules that all motor cycle riders wear helmet and it's our duty that we wear a hygienic helmet to protect our health. In this study, presence of bacteria in the used helmet swabs under aerobic bacterial culture method has been analysed and determined that two bacterium namely staphylococcus aureus and klebsiella pneumonia were present in it. As nano silver is widely know for its antibacterial activity, used it in our study for applying antibacterial finish on polyester fabrics through pad dry cure technique. The treated samples (unwashed) show a very good zone of Bacteriostatics against identified bacteria. The washed sample possesses antibacterial activity upto 20 washing cycle, which depicts clearly that the acrylic binder used for finishing retains the antibacterial activity of the agent.

Keywords: Interlining – Motor cycle – Helmet – Bacterial culture – Finish – Washing cycle.

I. INTRODUCTION

A layer of fabric termed as "Interlining" are kept inserted in between forehead bald i.e. hair and lining of the helmets. It is a similar material such as batting of fibres, a thick fibre layer designed in such a way to provide insulation, lofty and bodily equivalent to quilts, also similarity of pillow toppers, and heavy jackets used in winter condition. As per requirements with its concern applications, interlinings can be woven, knitted, or fused fibers (cohesive together). An Artificial / Synthetic fiber that have better insulating qualities were a common choice for these interlinings. On an average, these interlinings are buffy, thick and are really well flexible. Some of the interlinings are made by fuse techniques, while others are sewn together to one or both layers of the textile. Such kind of inner linings in the textile field were used in a number of applications. As consumers never focus in many occasions, interlining serves as an additional insulation layer. Helmets with interlining are usually stronger, because of added layer of fabric. In addition, they drape better, along with keeping the wearer's temperature relatively stable. Interlining enhances a higher level of quality in a helmet, because of the extra manufacturing time involved in it. Interlining is with similar structure as batting, a thick layer fiber is kept intact and is designed to provide insulation, loft, and quilt in body, pillow toppers, and heavy winter jackets¹, 2. Synthetic fibers of excellent insulating qualities are common choices for these interlining. Polyester fabrics

which are used as the interlining fabric in helmets require antibacterial finishing to protect it from the growth of bacteria and so called finish textile production are referred to as, any process performed on any of the textile form such as yarn, or fabric i.e. after spinning, weaving or knitting to enhance its look, or improvised performance, or nurture the "handle" (feel) of the finished textile or clothing. A wide range of finishing technique is employed, such as fulling, that are in use with hand weavers for centuries; others, such as mercerization, are by products of the Industry revolution era.

Different treatments by means of physical and chemical are widely performed to impart the specific/particular properties to the textile fabric materials³. In citation of an example, wear and wash resistant finish for a cotton fabric and peach style of finishing resultant in excellent fabric properties as desired by consumers. Antibacterial finishes on textile materials Textile materials need to have antimicrobial finishes to overcome bacterial infections, control infestation and keep on safeguarding textiles from the deterioration. Keeping-in minds the safety aspects of healthy lifestyle and hygiene^{4, 6} leads to a range of textile products. Two forms namely synthetic antimicrobial agents namely Triclosan, organo-metallics, phenols, quaternary ammonium compounds, metal and their salts, whereas from natural agents such as neem extracts, natural dyes, Chitosan, Tulsa leaf extracts, Aloe Vera extracts, tea tree oil are readily available in the market as antimicrobial agents for natural and synthetic textile materials. These natural available abundant herbs on converting to antibacterial key natural extracts through textile finishing agents can be made either in the Free State or as microcapsules predominantly to enhance the durability and controlled release of these herbal extracts from fabric^{5, 7}.

II. MATERIALS AND METHODS

Single Jersey Knitted Fabric with the following specifications,

FABRIC	- polyester
COLOUR	- black
GSM	-150
CPI	- 32
WPI	- 30
COUNT	- 50 Denier

The purchased fabric was pretreated for removal of hydrophobic nature of the fabric. The fabric was treated with soap soda (0.5%), soda ash (0.5%) and was heated in the boiling temperature for half an hour followed by cold wash and hot wash.

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And was again treated with 0.5% of hcl at 40 to 50°C for half an hour for removing the hydrophobic agents present in the 100% polyester fabric.

Polyester fabrics were cut into 7 samples of measurement 1*1 each (30cm*30cm) and those 7 samples were given to 7 helmet users and were made used for 10 days consecutively by them.

After 10 days the used samples were analyzed through naked eyes for determining the fabric which contains significant amount of bacterial growth in it. Three samples were determined to have positive significant growth and those samples were given in the laboratory for laboratical isolation and determination of the genes of the bacteria.

After 10 days the used samples were analyzed through naked eyes for determining the fabric which contains significant amount of bacterial growth in it and out of 7 samples, 3 samples were found to have very good change in appearance and hence those samples were given in the laboratory for laboratical isolation and determination of the genes of the bacteria.

Polyester fabric was padded with 6.5 gpl and 19.5 gpl nano silver solution with the aid of 5 gpl acrylic binder using pad dry cure technique employing 80% wet pick up . Drying was carried out at 110°C for 15 mins curing was carried out at 150°C for 10 mins. The sample were dried at ambient temperature without washing . The quantity of nano silver content present in the fabric after drying was found to be 2.88% owm and 9.44% owm . Then the treated (unwashed) samples were washed using the soap solution repeatedly for twenty times and dried. Both the treated and washed samples were taken for antibacterial testing.

III. RESULTS AND DISCUSSION

The results from the aerobic bacteria culture method for 3 samples were concluded that the 3 used helmet swabs have a mixed growth of the following two bacteria

A. Presence of bacteria in used helmet interlining fabrics

TYPE OF BACTERIA	SWAB 1	SWAB 2	SWAB 3
Staphylococcus Aureus	Present	Present	Present
KlebsiellaPneumoniae	Present	Absent	Absent

B. Result from Antibacterial Activity Test

Two samples were finished with Nano silver and corresponding acrylic binder in two different concentrations and the following cases of the two different samples were checked for efficiency:

Case 1:

25gpl of Nano silver with binder. Efficiency check was carried out in the following way:

1. Zone of Bacteriostasis in the unwashed 25gpl treated sample.
2. Zone of Bacteriostasis in the 5 washes 25gpl treated sample
3. Zone of Bacteriostasis in the 20 washes 25gpl treated sample

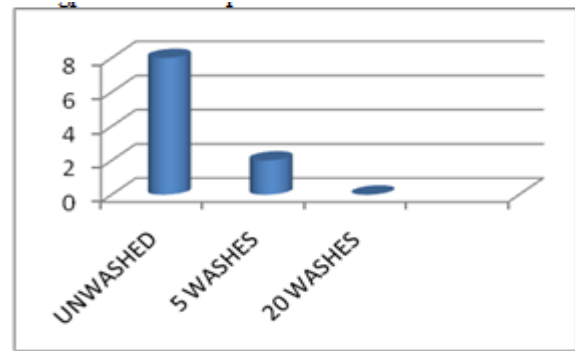


Fig 1. Graph Depicting Relation Between Zone Of Inhibition And Number Of Washes

From the above Fig. 1, it is clear that the antibacterial efficiency of the fabric is indirectly proportional to the number of washes the fabric has underwent and the zone of inhibition was 7 to 8 mm for un washed , 3to 2 mm for 5 washes.

Case 2:

75gpl of Nano silver with binder. Efficiency check was carried out in the following way:

- 1) Zone of Bacteriostasis in the unwashed 75gpl treated sample.
- 2) Zone of Bacteriostasis in the 5 washes 75gpl treated sample
- 3) Zone of Bacteriostasis in the 20 washes 75gpl treated sample

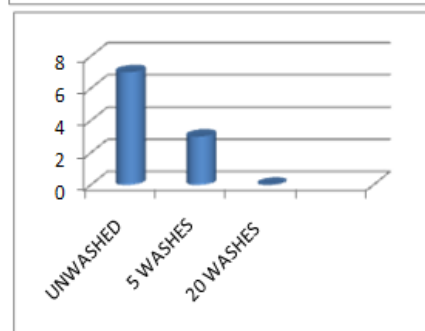
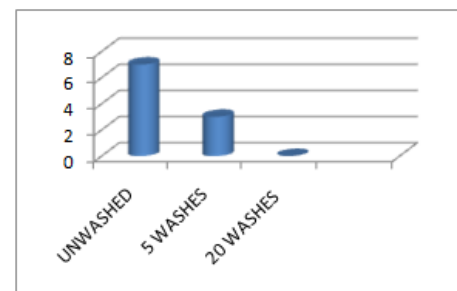


Fig 2. Graph Depicting Relation Between Zone Of Inhibition And Number Of Washes.

From the above Fig. 2, it is clear that the antibacterial efficiency of the fabric is indirectly proportional to the number of washes the fabric has underwent and the zone of inhibition was 13 to 14 mm for unwashed, 5 to 6mm for 5 washes and 1mm for 20 washes.

Thus the results depict that the antibacterial activity of the treated samples are very good depending on the concentration level, higher the concentration more is the efficiency and the acrylic binder used retains the antibacterial agents to the fabric.

IV. CONCLUSIONS

Staphylococcus aureus and klebsillapneumoniae were found to be present in the used helmet interlining samples. Nano silver was found to be one of the best anti bacterial agent and the fabrics were finished with Nano silver. Anti bacterial efficiency was imparted to polyester fabric in two concentration levels-25gpl and 75gpl. The unwashed treated fabric has good antibacterial activity with zone of inhibition of 7 to 8 mm for 25gpl and 13 to 14 mm for 75 gpl concentration of antibacterial agent. It was concluded that higher the concentration more is the efficiency and from the various results it's clear that the fabric finished with higher concentration level of the antibacterial agent (75gpl) has high and noticeable antibacterial efficiency to resist the growth of bacteria. The acrylic binder used retains the antibacterial agent to the fabric.

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