Low-cost antimicrobial with durability

By **Dr Naresh M Saraf**, Sarex – India

Abstract

WE USUALLY THINK about textiles as the clothes we wear, but there is a new trend towards functionality. Market research shows that most of us are very conscious about our hygiene and cleanliness. Therefore, textile finishes with added value, particularly for medical clothes, are greatly appreciated and there is an increasing demand on a global scale. Consumers want a hygienic lifestyle and there is a need for textile products with antimicrobial properties. Textile commodities, especially those made from natural fibres, provide an excellent environment for microorganisms to grow; they can be found almost everywhere and are able to multiply quickly, depending on the moisture, nutrients and temperature. With the advent of new technologies and the growing needs of the consumer in the area of health and hygiene, antimicrobial finishing has become inevitable.

Introduction

Antimicrobial textiles have garnered a great deal of interest in recent years, in virtue of their potential to reduce the transmission of pathogens in medical and healthcare environments. Antimicrobial active ingredients in treated textiles prevent the colonisation and growth of microbes and thus enable a longer shelf life of products. Antimicrobial properties help to improve the performance and lifespan of consumer products, and so these fabrics are increasingly finding applications in the wider textile and apparel industry.

Microorganisms are ubiquitous, as there are substances everywhere for the microorganism to feed on. For example, substances added to fibres, such as lubricants, antistatic and natural-based auxiliaries — including sizes, thickeners and hand modifiers — and dirt provide a food source for microorganisms. Antimicrobials play a role in preventing, inhibiting or killing microbes.

The colonisation of microbes on surfaces leads to material damage, spot formation, or staining and odour development, because of their metabolic function. Microorganisms produce a by-product, a colouring agent or dye, which gives its the characteristic of discolouration on awnings, shower curtains, tarpaulins or technical textiles etc. Shoes, sports or outdoor clothing under heavy wear possess a pungent, unpleasant odour, which is a result of the wearer's perspiration and normal flora of the individual.

Prevention of fabric damage caused by staining coupled with reducing odour development means that individuals can enjoy wearing their sports gear, socks, shoes or outdoor clothing for longer periods at the highest comfort. It also implies a need for fewer washes thereby conserving time, energy and ultimately making the whole process of the antimicrobial product from market to user, cost effective.

Looking at the consumer demand for hygiene textiles, Sarex has developed economical antimicrobial Saraguard-FL, which is suitable for all substrates and is highly durable.

Saraguard-FL shield ensures the protection of the treated textile, passively protecting the user. Saraguard-FL imparts freshness, comfort and ensures material protection. The concept behind this shielding technology is to reduce and prevent the colonisation and multiplication of bacteria, mold and mildew etc – the cause of undesirable odours, staining and material fatigue – through the antimicrobial treatment.

Saraguard-FL is a polymer-based, non-leaching antimicrobial. Its features include:

1. Economical
2. Suitable for all substrates including cotton, polyester, polyamide and their blends
3. Can be applied by padding, exhaust, soaking and spraying methods
4. Effective against gram-positive and gram-negative bacteria
5. Passes AATCC 100, JIS L 1902 test methods
6. Non-leaching
7. Does not cause shade change
8. Does not affect the absorbency of the fabric
9. Excellent durability

Materials and methods

Fabrics consisting of 100% cotton, polyester and polyamide were treated with Saraguard-FL at various concentrations, with 65% pick-up. The pH of 5.5 was maintained and the fabrics were dried at 150°C for two minutes.

Test method

Finished fabrics were subjected to 25 and 50 home launderings by the AATCC 135A test method 'Evaluation of finished fabrics for antibacterial activity', and were tested using the AATCC-100 method against Staphylococcus aureus, Escherichia coli and Klebsiella pneumoniae.

The AATCC-100 antimicrobial standard test method is used to quantitatively test the antimicrobial activity of the textiles over the contact period of 24 hours against Staphylococcus aureus, Escherichia coli and Klebsiella pneumoniae.

Microbial culture is prepared in growth enrichment broth followed by 24 hours of incubation to obtain a high titre of the test organisms.

High inoculum of the test organisms

Recipe	Antimicrobial activity								
	(Initial)			After 25 HL			After 50 HL		
	S. aureus (%)	E.coli (%)	K. pneumoniae (%)	S. aureus (%)	E.coli (%)	K. pneumoniae (%)	S. aureus (%)	E.coli (%)	K. pneumoniae (%)
Unfinished	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20g/l Saraguard-FL	100	100	93.05	87.04	61.53	92.70	87.79	66.55	77.90
50g/l Saraguard-FL	100	100	93.54	90.08	81.53	93.11	89.66	75.53	79.20
80g/l Saraguard-FL	100	100	99.85	100	99.82	96.85	98.74	96.83	89

Table 1: Antibacterial activity on cotton fabric: Padding application

Recipe	Antimicrobial activity								
	(Initial)			After 25 HL			After 50 HL		
	S. aureus (%)	E.coli (%)	K. pneumoniae (%)	S. aureus (%)	E.coli (%)	K.pneumoniae (%)	S. aureus (%)	E.coli (%)	K. pneumoniae (%)
Unfinished	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10g/l Saraguard-FL	100	100	100	90.37	81.55	89.25	88.97	58.92	86.05
20g/l Saraguard-FL	100	100	100	91.32	95.69	94.70	90.21	89.95	89.72
50g/l Saraguard-FL	100	100	100	99.82	98.34	95.50	96.44	91.51	93.11

Table 2: Antibacterial activity on polyester fabric: Padding application

Recipe	Antimicrobial activity								
	(Initial)			After 25 HL			After 50 HL		
	S. aureus (%)	E.coli (%)	K. pneumoniae (%)	S. aureus (%)	E.coli (%)	K. pneumoniae (%)	S. aureus (%)	E.coli (%)	K. pneumoniae (%)
Unfinished	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10g/l Saraguard-FL	100	100	100	86.10	91.51	87.11	81.24	86.40	81.02
20g/l Saraguard-FL	100	100	100	99.82	99.63	99.82	97.52	98.06	98.94
50g/l Saraguard-FL	100	100	100	99.91	99.89	99.96	99.24	98.64	99.89

Table 3: Antibacterial activity on polyamide fabric: Padding application

Chemical name and recipe	Price/kg in padding
10gpl to 80gpl Saraguard-FL*	0.065$ to 0.52$

* Depending on the durability required

Price of finish per kg of fabric

is inoculated onto the antimicrobial test fabric swatches and untreated control fabric swatches.

Bacteria counts on the fabrics are monitored at the initial stage ie zero hours by standard microbiological techniques.

Organism-inoculated fabrics are then incubated for 24 hours under favourable conditions of nutrients and temperature. Untreated control fabrics used in the test will assure the increase in microbial growth. Surviving microbial counts are then monitored after neutralisation and extraction, and percent reduction is calculated by using initial count and surviving count data.

Results and discussion

It is evident from Tables 1, 2 and 3 that the treated fabrics showed excellent antibacterial activity, while on the unfinished fabric there was heavy growth of bacteria. This is because fabrics finished with Saraguard-FL will bind microorganisms to their cell membrane and disrupt the lipo-polysaccharide structure resulting in the breakdown of the cell, thus providing an antimicrobial effect. Also, because of the binding capacity of Saraguard-FL, the fabrics will show durability against home laundering. In addition, it can be seen that by increasing the concentration of Saraguard-FL the antibacterial activity increases.

Conclusion

In the last few years, the customer's desire for comfort, hygiene and wellbeing, concerning odour control and microorganisms protection, has created a large and rapidly increasing market for the expansion of antimicrobial textiles. As discussed in this article, Sarex has reacted to this demand by launching Saraguard-FL as a low-cost antimicrobial agent for different textile substrates, which can be applied by exhaust and padding at the finishing stage. The effectiveness and durability of Saraguard-FL depends on the concentration used, the type of textile fibre and the method of application.