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Saraquest

Exclusive Insight

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Chemistry Behind Good Feelings

Contents

Fabcoat-WB - *PU coating for Outdoor Textiles*

In current scenario of globalised trade, the need for speciality textiles are constantly growing, leading to more technical developments and innovations of advance textiles for multi-functionalities. The enhancement of textile performances according to the consumer's demand, includes a large array of properties with higher added value. To achieve this, the formulation and understanding of polymeric surfaces have progressed tremendously, allowing to obtain systems with well defined functionality. The use of coating technique for textiles, is one of the possible ways to manufacture functional textile products.

Textile coating can be defined as the process of depositing a resin over a textile substrate on one or two sides. The different characteristics between the substrate and the coating product are combined to produce a new structure that acquires the best properties of each component. There are different procedures for the coating of textiles and not all are suitable for all products or substrates. One of the procedures mostly used is Direct coating, which is based on the application of one or various layers of polyurethane, PVC, acrylic resins, etc., over the textile substrate using a *Knife over Air* and *Knife over Roll* coating technique.

Polyurethane polymers are macromolecules made up of smaller repeating units known as monomers. Generally, they consist of a primary long-chain backbone molecule with attached side groups. PU coatings are specifically preferred if abnormal impact and abrasion resistances are required as well as for various outdoor and marine uses (due to their good weather ability). PU coatings are used to produce tents of different sizes, in upholstery and in waterproof protective clothing. Other examples include luggage, footwear, glove and waterproof mattress covers, as well as imitation leather.

Jackets

Tents

Furnishing fabric

Luggage fabric

Polyurethane polymers are reaction products of a poly-isocyanate (materials containing more than one -NCO group) with atleast other species containing active hydrogen, often a polyol (materials containing more than one -OH group). Due to these two different groups, polyurethanes (PUs) consisting of alternating soft and hard segments are the most actively used

polymers with a unique combination of wide range of physical and chemical properties such as abrasion resistance, water repellency, leather appearance, etc. These properties provided by PU coating on textile substrates are very attractive in many textile applications.

Sarex have also developed a special PU based coating i.e. **Fabcoat-WB**. It is ready to use coating compound, for outdoor textiles viz., tents, luggage fabrics, cordura etc. It forms a clear and tack free film with high water column. To obtain high water column, double coating with Fabcoat-WB is recommended.

Unique Features:

- Easy to coat
- Forms clear and tack free film
- High water Column
- Efficient water proofing
- Gives shine to fabric

Application process:

Pre-impregnation of fabric with fluorocarbon is recommended before coating to avoid penetration of coating chemical. Predetermined quantity of Fabcoat-WB to be taken depending on the add-on required. Fabcoat-WB was coated on the fluorocarbon treated fabric using a lab coater using *Knife on Air* technique. The samples were dried at 120°C for 2 min and cured at 160°C for 3 min.

Note: For double and triple coatings, drying was carried out after each application of the coating, while the curing was carried out in the end (i.e. after drying of the last coating).

Test Methods:

Water Resistance:
Hydrostatic Pressure Test (Test Method: ISO 811:1981)

A specimen is subjected to a steadily increasing pressure of water on one face under standard conditions, until penetration occurs in three places. The water pressure may be applied from below or from above the test specimen.

The hydrostatic head supported by a fabric is a measure of the resistance to the passage of water through the fabric.

Moisture Vapour Transmission Rate (MVTR):
Test Method (ASTM-E96)

This test was conducted in a wind tunnel which is housed in an environmental chamber. The air temperature in the chamber is 23±0.5˚C, and the Dew point temperature is 12±1˚C (50% Relative Humidity). The air velocity in the wind tunnel is 2.8±0.25 m/s. Six circular specimens of 7.4 cm diameter were cut from the fabric. Each specimen was placed on a 155 ml aluminum cup that was filled with 100 ml of distilled water, covered with a gasket, and then clamped. Coated fabrics were placed with the coated side facing the water in the cup. Each cup was first weighed to the nearest 0.001g and then placed inside the wind tunnel. Subsequent weighing were made at 3, 6, 9, 13, 23, 26, and 30 hours after placement in the chamber.

The moisture vapour transmission rate (MVTR) was calculated using the following formula:

$$\mathbf{MVTR = (G/t) / A}$$

where,
G = weight change (g),
t = time during which 'G' occurred,
G/t = slope of the straight line for weight loss per unit time (g/h), and
A = test area (m^2).

Results and Discussion:

Treated samples were evaluated for Water resistance by hydrostatic test and Breathability by Moisture vapour transport rate (MVTR) at Wool Research Association, Mumbai and the results are collated in Table 1.

Table 1 - Water Resistance and MVTR test results of Coated fabrics

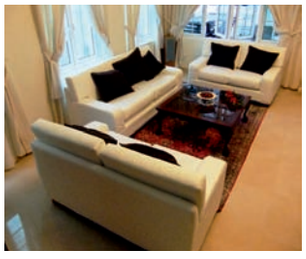
Sr. No.	Sample Code	Sample Description	Add-on (GSM)	Mean (cm water/min)	MVTR ($g/m^2/24hr$)
1	Untreated	White Nylon	-	34	1250
2	Treated	White Nylon	10	523.05	450
3	Untreated	Brown Polyester	-	0	1380
4	Treated	Brown Polyester	20	2005	212
5	Untreated	Black Polyester	-	0	1684
6	Treated	Black Polyester	15	1701.95	320
7	Untreated	Navy Blue Nylon	-	59.7	1303
8	Treated	Navy Blue Nylon	15	1827.85	257
9	Untreated	Grey Polyester	-	0	1312
10	Treated	Grey Polyester	18	1800.4	337

From Table 1 it is evident that unfinished fabric does not show any resistance to water and allows the water to pass easily while fabric treated with Fabcoat-WB shows higher water resistance as compared to unfinished fabric. Also, it is seen that, higher the add-on, better is the water resistance of the fabric.

The other parameter which is tested here is breathability. "Breathability" is the measurement of the amount of moisture vapor transported through the fabric, into the atmosphere. From the above results it is also clear that higher the add-on of the PU, lower is the breathability of the fabric which can be seen in the above table. The unfinished fabric shows higher MVTR while the coated fabric shows lower MVTR. This is because., On coating, the pores of the fabrics get blocked and thus does not allow the air or moisture to pass through it.

Zoroguard-ZP - *Antifungal and Antibacterial agent*

Mould, mildew, fungus, yeast, and bacteria (microorganisms) are part and parcel of our everyday lives. Thousand of species of microorganisms are found in the environment, on our garments and on our bodies. Substances added to fibres such as lubricants, antistatic agents, sizing agents, thickeners etc. and dirt act as a source of food for microorganisms. The microbial growth is influenced by relative humidity and temperature. The microorganism growth on textiles causes a range of undesirable effects, not only on the textile itself but also on the user. These effects include stains and discoloration of fabric, reduction in mechanical strength of fabric, generation of unpleasant odour and a risk of infection to the user. The microbial growth on textiles overall decreases the functional, hygienic and aesthetic value of textile.



Microbial attack on textile is of great concern in textile which are worn next to skin viz., apparels, socks, intimate wear, aprons, uniforms etc. Home furnishing textiles viz., carpets, shower curtains, mattress ticking and upholstery as well as Industrial fabrics viz., filter fabrics, fabrics used for awnings, screens, tents, tarpaulins, ropes, etc. are also susceptible to microbial attack as they are exposed to varied or harsh weather conditions.

Mould and mildew are major cause of damage to outdoor textile. Many antimicrobial technologies viz. Silver, Silane, Chitosan, Zinc pyrithione etc. are available for textiles. Out of these, Zinc pyrithione based antimicrobial act specifically against Fungi.

Zinc pyrithione was first developed in the 1930s for its antifungal and antibacterial properties and it is still commonly used today as a main ingredient in anti-dandruff shampoos and as an over-the-counter treatment for seborrheic dermatitis, psoriasis, eczema, athletes' foot, ringworm and other medical conditions. Zinc pyrithione is also used in paints, polymers and textile products to inhibit the growth of fungi as well as bacteria on susceptible surfaces.

Zinc pyrithione mediated growth inhibition is due to increased copper uptake. Zinc pyrithione in presence of copper forms copper pyrithione which is exogenous (outside microbial cell). This copper pyrithione is then transported inside cell (endogenous) which eventually targets Iron-Sulphur (Fe-S) proteins in microbial cell.

Fe-S proteins play key role in microbial metabolism. Deactivation of these Fe-S protein leads to stop in microbial metabolism eventually leading to cell death. (Fig.1)

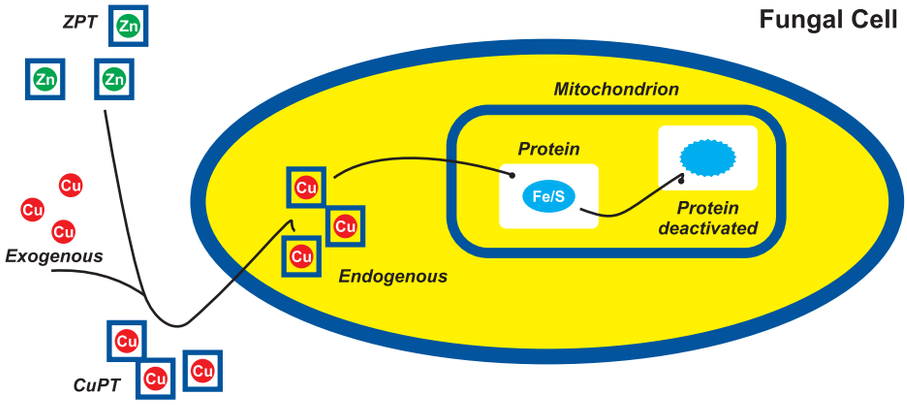


Fig.1 : Mechanism of action of Zoroguard-ZP

Looking at demand's of industry for antimicrobial finish exhibiting antifungal as well antibacterial finish for indoor as well as outdoor application such as Home textile, Sport textile and Technical textile, **Sarex** has developed a product **Zoroguard-ZP** based on Zinc pyrithione chemistry.

Unique features:

- Effective against broad spectrum of microbes viz. *Aspergillus niger, Escherichia coli, Staphylococcus auerus,* MRSA and *Klebsiella pneumoniae*
- Leaching type & Durable antimicrobial agent
- FDA approved microbicidal agent
- Passes AATCC-30 (Antifungal test), AATCC-147 (Qualitative antibacterial test) AATCC-100 (Quantitative antibacterial test), JIS L 1902 (Antibacterial) test methods
- Inhibits the odour generation and prevents the growth of mould and mildew
- Suitable for all types of substrate
- Suitable for spray, exhaust and pad application
- No skin irritation

Recommended dosage:

- Zoroguard-ZP : 10-30 g/l
- Pick up : 65-70%
- Bath pH : 5.0-5.0
- Drying : 160°C, 2 min (for all substrates)

Results:

AATCC-30 (Antifungal test method)

Fig. 2 shows unfinished fabric covered with *Aspergillus niger* growth, while zone of inhibition can be observed around Zoroguard-ZP finished fabric.

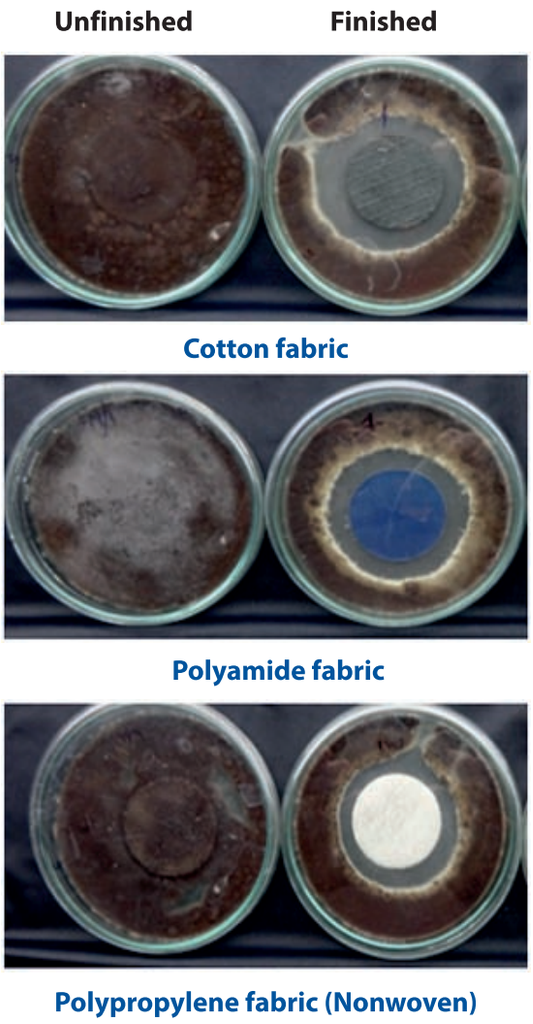


Fig. 2: Antifungal activity of 30g/l Zoroguard-ZP

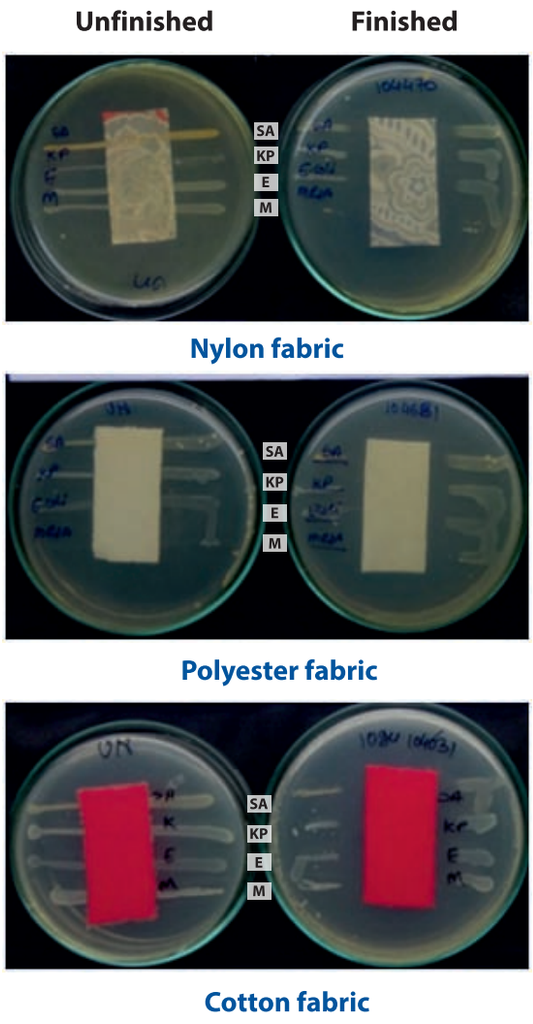


Fig. 3: Antibacterial activity of 30g/l Zoroguard-ZP against Staphylococcus aureus (SA), Klebsiella pneumoniae (KP), Escherichia coli (E) and MRSA (M)

AATCC-147 (Antibacterial test method)

In Fig. 3, Unfinished fabric shows no zone of inhibition while fabric finished with 30g/l Zoroguard-ZP shows a zone of inhibition against *Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae* and MRSA.

AATCC-100
(Quantitative Antibacterial test method)

Below table shows durability results of 30g/l Zoroguard-ZP finished fabrics.

Fabric	% Reduction in Bacteria			
	Staphylococcus aureus		*Escherichia coli*	
	Initial	10 wash	Initial	10 wash
Cotton	100	88.16	100	80.67
Polyester	100	100	100	100
Nylon	100	98.24	100	97.12

Zoroguard-ZP effectively exhibits Antifungal and Antibacterial activity on various substrates.

Saraguard-FL - *Unbelievably low cost Antimicrobial agent*

We usually think about textiles to be the clothes we wear but it has changed its trend to functional one. 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 global scale. The consumers are aware of hygienic life style and there is a necessity of textile product with antimicrobial properties. Textile commodities, especially those made from natural fibres, provide an excellent environment for microorganisms to grow, which can be found almost everywhere and are able to multiply quickly, depending on the moisture, nutrients and temperature. With advent of new technologies and the growing needs of the consumer in the wake of health and hygiene, antimicrobial finish has become inevitable. The application of antimicrobial textile finishes include a wide range of textile products for medical, technical, industrial, home furnishing and apparel sectors.

Most textile materials currently used in hospitals and hotels are conducive to cause cross infection or transmission of diseases caused by microorganisms. Microbes such as bacteria, viruses, fungi and yeast are present almost everywhere. Human beings have an immune system to protect against accumulation of microorganisms but material such as textiles can easily be colonized by high numbers of microbes or even decomposed by them. Textiles are carriers of microorganisms such as pathogenic bacteria, odour-generating bacteria, mould and fungi. Antimicrobials enhance the functionality and value of textile products by keeping the microorganisms that cause odour and fibre degradation under control. Antimicrobial fabrics are not only important in medical application but also in daily use conditions.

There is a great demand for antimicrobial textiles based on ecofriendly 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. But recently, there are lot of attraction towards natural based herbs as an antimicrobial agent because of its eco friendly and health hazardless. Though the use of antimicrobials have been known for decades, it is only the recent couple of years, several attempts have been made on finishing textiles with antimicrobial compounds.

Antimicrobial finish prevents the growth of bacteria, health protecting, preventing diseases. Clothing and textile materials are not only the carriers of microorganisms such as pathogenic bacteria, odour generating bacteria and mould fungi, but also good media for the growth of the microorganisms. Among various functional ability the antimicrobial property of fabric is being considered to be important with garments, which are in direct contact with human body.

Need for Antimicrobial finish:

- To control the infestation by microbes
- To avoid cross infection by pathogenic micro organisms
- To arrest metabolism in microbes in order to reduce the odour formation
- To safeguard the textile products from staining, discoloration and quality deterioration

Requirements for Antimicrobial finish:

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:

- Durability to washing, dry-cleaning and hot pressing
- Should not produce harmful effects to the manufacturer, user and the environment
- Compatibility with the chemical processes
- Easy method of application. No deterioration of fabric quality
- Resistant to body fluids and resistant to disinfections/sterilization

Socks

Apparels

Furnishing

Medical Textiles

Solution from Sarex:

Understanding the requirement of the end users, **Sarex** has developed a unique low cost antimicrobial agent **Saraguard-FL**. Saraguard-FL is a methanol free antimicrobial agent for finishing cellulosic substrate. It can be applied by padding, exhaust, soaking and spraying methods. Saraguard-FL is a non-leaching antimicrobial agent. It is effective against broad spectrum of microbes.

Saraguard-FL will bind microorganisms to their cell membrane and disrupt the lipo-polysaccharide structure resulting in the breakdown of the cell, thus providing antimicrobial effect.

Unique Features:

- Non-leaching
- Durable to multiple home launderings
- Works on all types of microbes such as *Staphylococcus aureus, Escherichia coli*
- Does not affect the hydrophilicity of the fabrics
- Concentrated and Economical

Method of application:

Substrate : 100% Cotton fabric

Padding process:

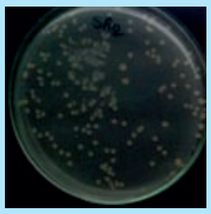
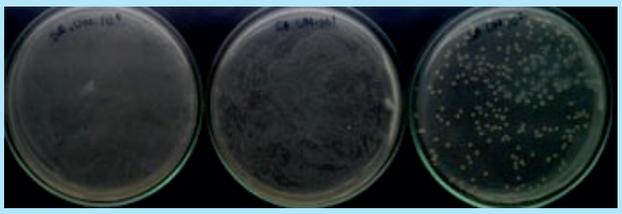
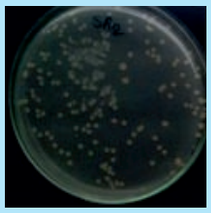
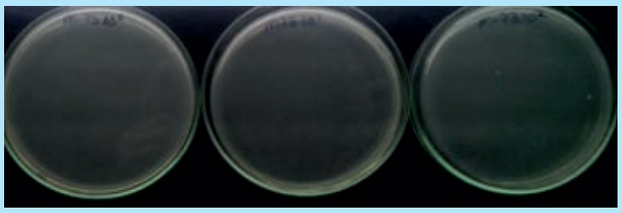
Saraguard-FL : 50gpl
Pick-up : 65-70 %
Bath pH : 5.0-6.0
Drying : 150°C for 2 min.

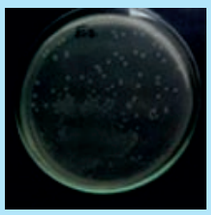
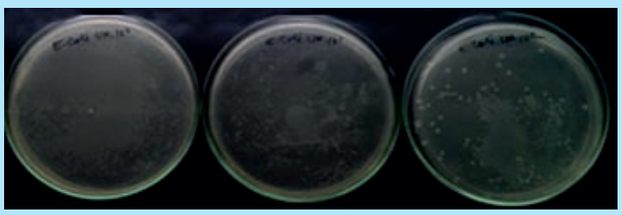
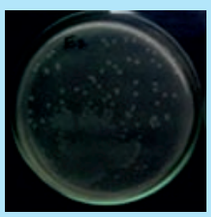
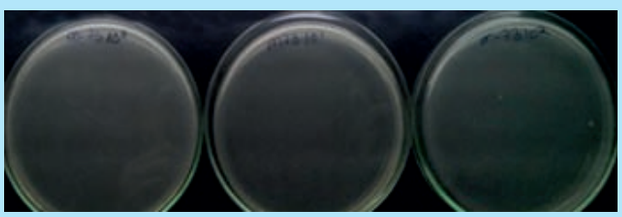
Antimicrobial Testing:

Samples treated with Saraguard-FL were evaluated using AATCC-100.

Results:

Recipe	% Reduction in Bacteria											
	Staphylococcus aureus						*Escherichia coli*					
	Initial	After 10HL	After 20HL	After 30HL	After 40HL	After 50HL	Initial	After 10HL	After 20HL	After 30HL	After 40HL	After 50HL
Unfinished	0.0	–	–	–	–	–	0.0	–	–	–	–	–
50gpl Saraguard-FL	100	97.39	94.96	92.58	90.48	87.69	100	92.68	88.20	80.00	78.00	72.72

	Staphylococcus aureus			
	0 hr	After 24 hrs		
	10^2	10^0	10^1	10^2
Unfinished				
50gpl Saraguard-FL				

	Escherichia coli			
	0 hr	After 24 hrs		
	10^2	10^0	10^1	10^2
Unfinished				
50gpl Saraguard-FL				

Saraguard-FL show effective Antimicrobial property upto 50 Home Launderings (HL).

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