Sarex

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# Saraquest

Exclusive Insight

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## Chemistry Behind Good Feelings

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# Technical Textiles - Growth Sector with Optimistic Future

Technical textiles are 'advanced materials' for which the technical performance and physical properties are more important than features such as appearance, feel and price. Technical textiles growth and evolution is driven by the amalgamation of customers demand and increasing awareness about safety. India is the second largest textile economy in the world after China but its contribution in the global technical textile industry is only 9% to the total consumption. Technical textiles are an important part of the textile industry and its potential is still largely untapped in India. Technical textiles represents a multi-disciplinary field with numerous end use applications. The wide range of applications, lack of competition and growing consumer and industrial demands make Technical textiles a big opportunity area and an attractive option to invest in. Technical textiles are growing at twice rate of textiles for clothing applications and now providing more than half of total textile production. The production of different items of Technical textile industry has been slowly but steadily increasing in the country. Textile industry is not only experiencing resurgence in conventional clothing application but also continuing a major outlook towards non-clothing application of textiles known as Technical textiles.

Technical textiles include textiles for automobile application, medical application, geo application, agriculture application, protective clothing etc.. Technical textiles are textile materials and products used for their technical performance and functional properties. There are some large domestic players in this industry like Kusumgar corporate, Supreme Nonwovens Pvt. Ltd., Advanced Textiles-Welspun India Ltd, Garware wall ropes, Pacific nonwoven, Khosla Profil, Pvt. Ltd. etc. Size of the manufacturing units that are producing Technical textile products in India varies to a large extent. There are also number of multinational companies engaged in Technical textiles who have set up their manufacturing facilities in India viz., Du Pont, 3M, SKAPs, Procter & Gamble, Johnson & Johnson, Kimberly Clark etc.

India can play a major role in this field because of the availability of abundant raw materials and highly skilled and technical work force. India is a largest producer of Clothtech, Packtech, and Sportech segments of Technical textiles. The constraints in the growth of Indian Technical textile industry are, lack of basic infrastructure and testing facilities, lack of comprehensive database on Technical textiles and lack of awareness of wet processing of Technical textiles. A textile fabric undergoes a series of wet processing operations to make it functional. Wet processing has been and will remain an important operation in the textile value chain. Specialty finishes in the form of functional finishes play a significant role in the value addition of Technical textiles. The challenges faced by the finishing industry has intensified in the last one decade, with finishers facing uphill task of striving to endure in this global and highly competitive market to meet the consumer demands of durability and functionality from their clothing.

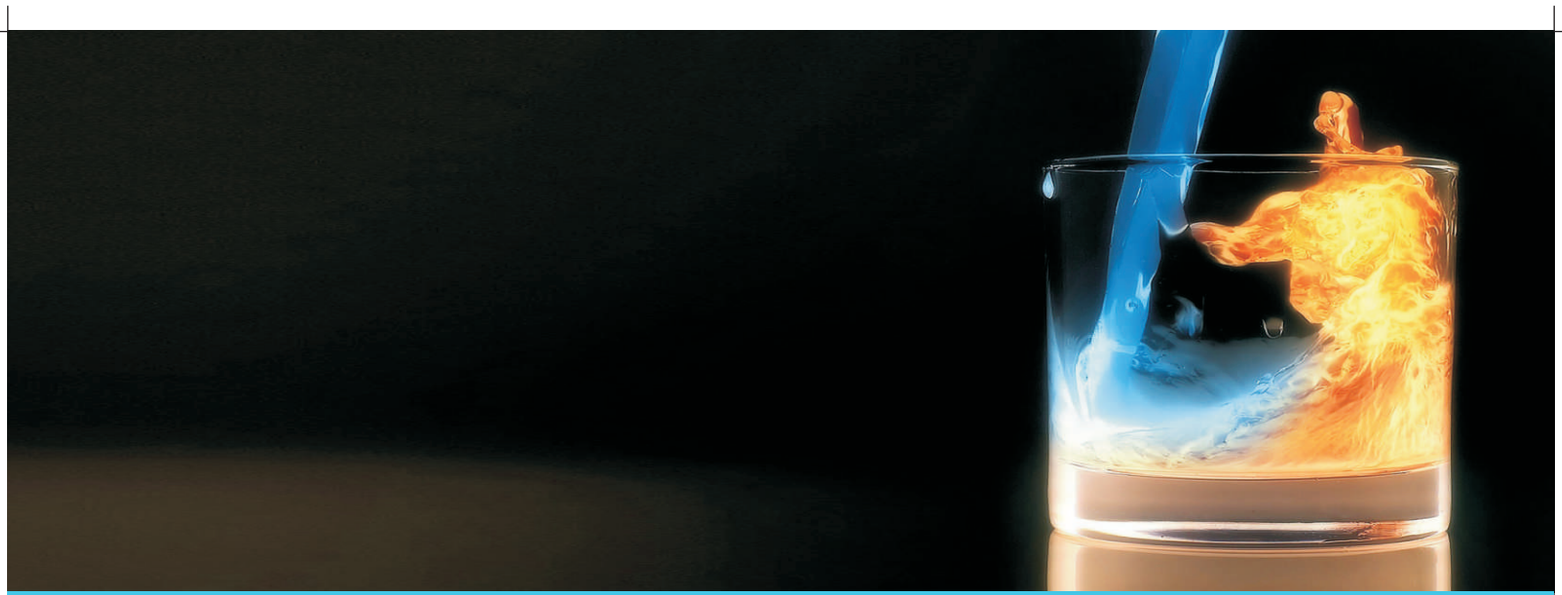
Functional finishes represent value creation in the area of Technical textiles making the textile materials act by themselves. Value addition on Technical textiles can be in the form of functional finishes which provide protection against UV rays, Micro-organisms, Fire, Oil and Water, Insects etc. Technical textiles made of synthetic fibres viz., polyester, nylon, acrylic also require functional finishes.

Below are some of the functional finishes and their applications:

| Functional finishes | Applications |
|---|---|
| Water & Oil repellent finish | Table cloth, curtains, furniture, seat fabrics, artificial turfs, sleeping bags, tents, seat covers, car interiors, carpets, table clots, home furnishings, tarpaulins, awning, canopies and umbrella |
| Flame retardant finish | Seat covers, seat belts, car interiors, carpets of the car, artificial turfs, ballooning fabric, parachutes and tents, curtains, table cloths, bed linens, Protective textiles-Fire fighters and work wear |
| Anti-microbial finish | Footwear, sleeping bags, seat covers, bedding and medical textiles, tent, tarpaulins and truck covers, mattress, pillow components, stuff toys, upholstery, Geo cells and Geo bags |
| UV- protection finish | Sports wear, beach wear, work wear and sun parasols |
| Insect repellent finish | Tent fabrics, sleeping bags, bed sheets, home furnishing, curtains & mosquito nets |

Below are some of the functional finishes which are developed by Sarex, for application on Non-woven and Technical textile materials:

| Sr. No. | Sarex Products | Description |
|---|---|---|
| 1 | UV Protective Agents | **Yuvi-Cell** is an UV protector for cellulosic fabrics. Exhibits excellent ultraviolet absorbing properties. Durable to home launderings. Treated fabric shows UPF rating up to 50+. |
| 2 | Water and Oil repellents | **Careguard-66 (NEW)** is based on C6 fluorocarbon chemistry. Durable oil and water repellency effects. |
| 3 | Antimicrobial Agents | **Saraguard-5700** is a methanol free durable antimicrobial and fungicide for broad spectrum microbes. Suitable for all types of substrate. Applicable by pad, exhaust, spray application and coating. |
| 4 | Flame Retarding Agents | **Flamguard-DPS** is a halogen free durable flame retardant. Suitable for 100% Polyester and Polyester rich blends. Applicable by padding and by spray method. Does not lead to fogging. |
| 5 | Microencapsulated Products | **Saraguard-MOSQ** is a microencapsulated DEET based mosquito and insect repellent finishing agent which provides long lasting repellant action. **Superfresh series** is a new range of micro encapsulated aroma finishes. It imparts durable fragrance to the fabric. |



# Flamguard-PS - Flame Retardants

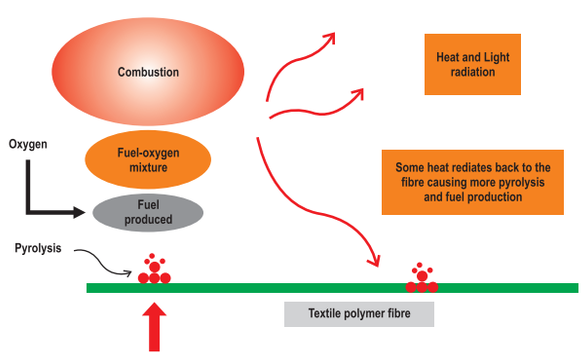
Mankind has invented ways of keeping ourselves safe from fire, a process which began thousands of years ago. Hazards associated with the ready combustibility of cellulosic materials were recognized as early as the 4th century BC, when Aeneas is said to have recommended treatment of wood with vinegar to impart fire resistance. The development of flame resistant fabrics didn't really accelerate until the military found a use for it. Commercial ventures also brought about the invention of methods that chemically altered the cellulose molecules of the cotton increasing the fire resistance while maintaining strength and durability.

In the early 1970's, electronics, plastics, and other synthetic materials were increasingly becoming mainstays of modern living and it just so happen that all of these things were extremely flammable. Recognizing the growing risk of coexisting with so many combustibles, in 1971, children's sleepwear became the first consumer product to be required to meet flammability standards.

Flame retardants are the key components in reducing the devastating impact of fires on people, property and the environment. They are added to or treat potentially flammable materials, including textiles and plastics. Flame retardants are compounds added to combustible materials, such as textiles and plastics to render them more resistant to ignition. Flame retardants act both, by preventing the initial start of a fire or by impeding ignition and by delaying the spread of the fire.

There is a wide range of different chemicals which are used for this purpose. Flame retardants are thus necessary to ensure the fire safety of a wide range of materials including plastics, foam and fibre insulation materials, foams in furniture, floor coverings, upholstery and drapery, mattresses, wood products, and natural and man-made textiles.

## Mechanism of Flame Retardancy




*Ignition / Combustion cycle for fibres*

When textile fibres are heated by an ignition source, the polymer molecules starts to break down (pyrolysis) into smaller molecules. Some of these pyrolysis products are "fuels" capable of burning. Because the fibres from different textiles are made of different polymers, the type and amount of fuel produced is different for each textile type. This can be important with regard to how vigorously a type of textile burns, the amount of smoke and fume produced and the type of flame retardant system required to treat the fabric. A generalized representation of the "ignition cycle" is shown.

These reactions are highly exothermic and produce large amount of heat and light. Part of the heat generated is lost to the surrounding and part of the heat generated within the flame is transferred to the fabric providing the additional thermal energy needed to continue the pyrolysis of the fibre, thereby supplying more flammable gases for combustion and perpetuating the reaction.

**Sarex** has developed novel exhaustible type of Flame Retardant **Flameguard-PS** for 100% Polyester & Polyester rich blends.

## Unique features:

- Flamguard-PS is durable and halogen free flame retardant. Applicable by exhaust application and hence can be used during dyeing process with disperse dyes.
- Shows minimum effect on shade.
- Posses good fastness to home laundering and dry cleaning.
- Does not have any effect on the drape of the treated fabric.
- Has low volatility and does not lead to fogging.
- Suitable for protective work wear, furnishing fabrics, curtains and automotive textiles.

## Recommended procedure:

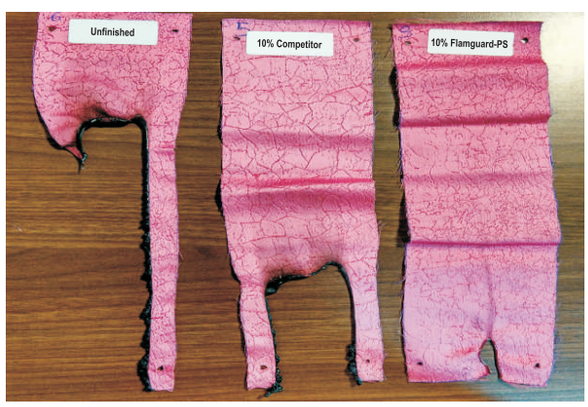
### Exhaust application:

Recommended dosage: 5-10% Flamguard-PS at 130°C. It is applied during dyeing process with disperse dyestuff.

**Test Method:** Standard Test Method for Flame Resistance of Textiles (Vertical Test) - ASTM D6413.

**Results:**

Table below shows the flame retardancy of 100% Polyester fabric treated with Flamguard-PS during dyeing. It can be seen that the after glow time of treated fabric is zero indicating it is not propagating the flame. Flamguard-PS is also found to be much better then the competitor product.




**Flame Retardancy of Flamguard-PS**

| Finishing agents | Char length (cm) | After glow time (sec.) |
|---|---|---|
| **10% Flamguard-PS** | | |
| Unfinished | 20.8 | 56 - 57 |
| 10% Competitor | 9.0 | 15 - 16 |
| 10% Flamguard-PS | 3.3 | 0 |

**Conclusion:**

This unique formulation is capable of achieving high specification flame retardant properties. Since the product is applicable during dyeing it has major environmental advantages, offering faster processing and reduced energy utilization. This enables the production of sustainable textiles.

# Helafin-42 - Anti-Pilling Finish

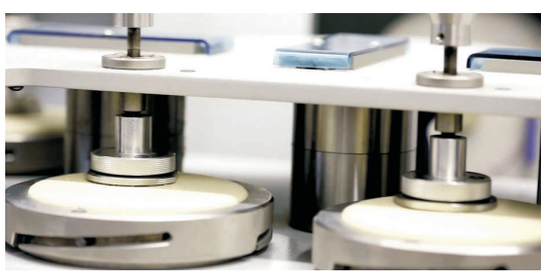
Surface appearance of a textile material is very important to the consumer. Pills are an aesthetic and physical nuisance. The pilling of textile material fabric refer to an appearance caused by bunches or balls of tangled fibres held to the surface. This unpleasant appearance can seriously compromise the fabrics acceptability for apparel.

Ever since the invention of the loom, fabric producers have observed the phenomenon known as "pilling" a process that results in the formation of small fuzzy balls or "pills" on the fabric surface. In the short term, pilling may lead to unattractive "fuzzy" fabric. Over time, especially with natural fabrics, it can lead to a complete wear-through of the fabric.

Pills are developed on a fabric surface in four main stages: *Fuzz formation, Entanglement, Growth,* and *Wear-off.*

Textiles are made with yarn, a spun thread used in both knitted and woven fabrics. With every wash, wear and the ticking of time, the tiny fibres that make up the yarn, breaks. These broken fibres, ball-up to create pills on the fabric surface. They then proliferate in high-friction areas like the under-arms, sleeves, bust area, and inner thighs.

Pilling normally happens on the parts of clothing that receive the most abrasion in day-to-day wear, such as the collar, cuffs, and around the thighs and rear on trousers.



All fabrics pill to some extent but degree of pilling varies depending on type and quality of fabric. The primary drivers of pilling are the physical characteristics of the textile (fibre denier, twist factor of the yarn and fabric construction), the method of textile processing, habits of the textile's wearer, and the environment in which the textile is used.

Fine denier fibres tend to pill more as they possess less stiffness. The yarn with lower twist factor will pill more than the yarn with higher twist factor. Closed weave fabric with a high set, pills less. A very tight, compact construction, such as denim, usually pills very little. However, a loosely knitted or woven fabric will show

more pilling with both wear and cleaning. Pilling is often more noticeable on knitted fabrics, such as sweaters, than on woven. This accounts to greater distance between yarn crossings in knitted fabrics than in woven ones.

Blended fabric made of a pair of strong and a relatively weak fibre, tends to pill more, as the weaker fibre wears and breaks, and the stronger fibre holds the pills onto the cloth. Fabrics and knitted products made from yarns with a synthetic fibre are inclined to pilling as a virtue of their considerable strength, flexibility and resistance to impact. Pilling can critically compromise a textile's acceptability for consumers, and hence is the focus of significant industry research. Pilling prevention is an ongoing challenge for manufacturers of cotton, polyester and blended fabrics.

There are many methods for reducing the pilling tendency of the fabric. Physical processes such as shearing, singeing, brushing and thermosetting. Chemical processing such as application of polymers or enzymes, use of anti static finish or special treatments such as sanforizing or UV treatment help to remove pills. Out of these, surface modification by using different chemicals is the most acceptable method. Anti pilling finish is based on the use of chemical treatments which aim to suppress the ability of fibres to slacken and also to reduce the mechanical resistance of synthetic fibre.

Sarex has developed innovative product viz., **Helafin-42** used as finishing agent for cotton, polyester and their blends. It improves resistance to pilling, snagging and also reduces the tendency of seam slippage. Fabric finished with Helafin-42 is resistant to washing and dry cleaning.

**Unique features:**

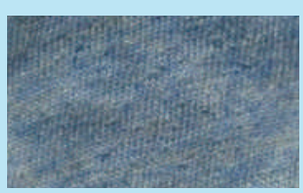
- Anti-pilling, Anti-slip and Anti-snag finish can be achieved.
- Suitable for natural and synthetic fibres and their blends.
- Finish applied is resistant to washing and dry cleaning.
- Can be used with non ionic softeners and resins.

**Recommended procedure:**

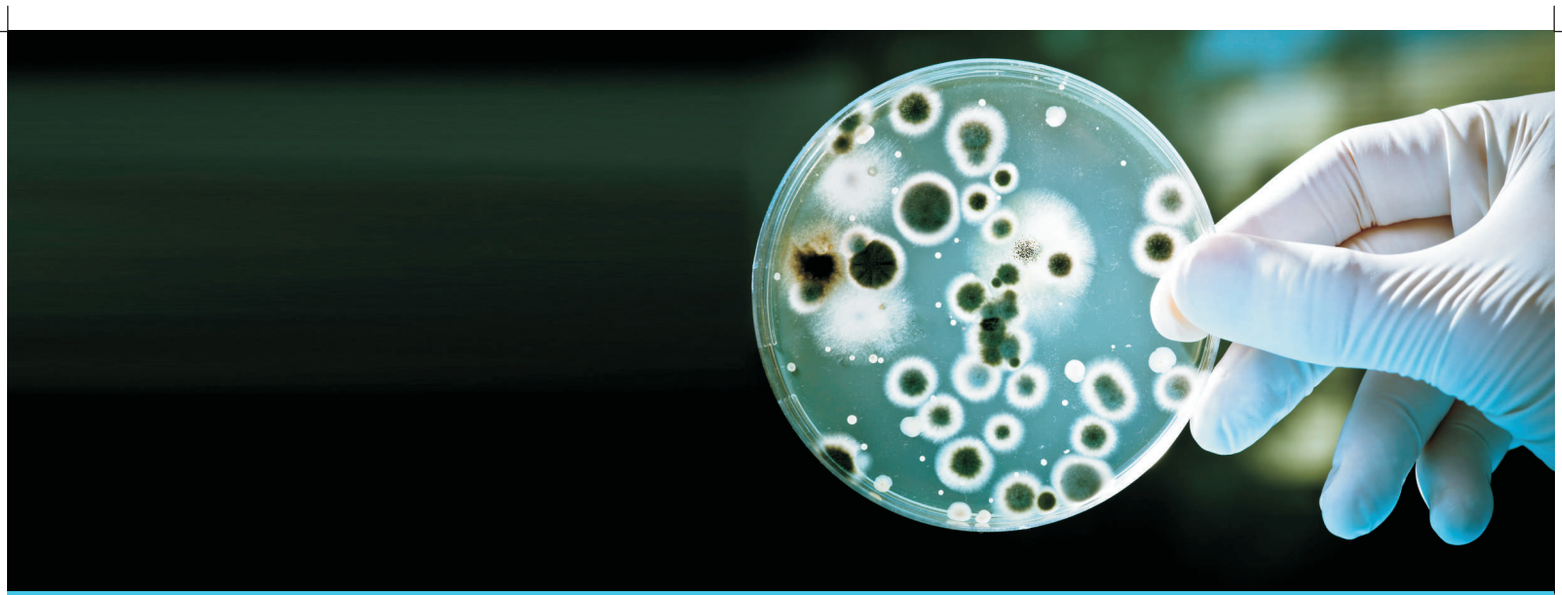
| | |
|---|---|
| Helafin-42 | : 10-20 g/l |
| Pick up | : 65-70% pick-up |
| pH | : 5.0-6.0 with acetic acid |
| Drying | : Dry below 160°C |

The Anti-pilling efficiency of the treated fabric was evaluated with the standard Test method: ASTM D4970 (500 rpm) on Martindale Abrasion cum Pilling Tester - James H. Heal.

**Anti -pilling efficiency of Helafin-42 on Polyester / Cotton fabric**

| | | |
|---|---|---|
| |  |  |
| Polyester / Cotton fabric | Unfinished | 20g/l Helafin-42 |
| Rating | 1 (very severe pilling) | 4-5 (very slight pilling) |

**Conclusion:** Helafin-42 appears to be a promising chemical treatment that prevail over pilling problem.



# Saraguard-HP - Non Leaching Antimicrobial Agent

Mould, mildew, fungus, yeast, and bacteria (microorganisms) are part and parcel of our everyday life. Thousand of species of microorganisms are found in the environment, on our garments and on our bodies. Natural fibres like cotton and wool are more prone to microbial attack due to their inherent characteristics such as moisture regain and chemical composition providing a perfect environment for microbial growth. The microbial growth is influenced by relative humidity and temperature.

The growth of microorganisms impairs the functional, aesthetic and hygienic properties of textiles such as staining and degradation of textiles, obnoxious smell from the inner garments, socks and eventually a risk to humans wearing or coming in contact with these fabrics.

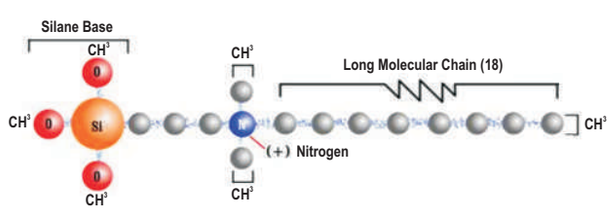
Odour is an unpleasant phenomenon which is caused not by human perspiration but it is the bacteria that grows in the sweat that causes it . They break down the urea, protein or lactic acid contained in the perspiration, releasing butyric acid. This penetrating odour is extremely unpleasant to the human sense of smell. The sweaty odour can be prevented if the growth of bacteria on the textiles or skin is managed.

Antimicrobial finishes prevents the growth of bacteria and textile products finished with them have been proved to be environment-friendly and health-protecting, preventing diseases. The applications of antimicrobial textiles are expanding from industrial textiles to even daily use sports or outdoor wear.

**Factors influencing the growth of microbes in textiles:**

Cotton textiles in close proximity to the human body, provide an ideal living environment for bacteria, yeast and fungi viz., nutrients, water, oxygen and warmth. In addition to providing these conditions, textiles are continuously exposed to microbial contamination from the skin, dust and airborne particles and other sources. It is not surprising that large populations of microorganisms have been isolated from textiles.

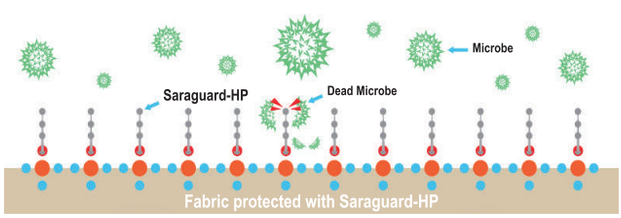
Generally silane based antimicrobials impart hydrophobicity to finished fabrics. Consumers attitude towards hygiene, better lifestyle and comfort has created a rapidly increasing demand for antimicrobial textiles which in turn has inspired Sarex to develop an Antimicrobial finishing agent, **Saraguard-HP**, which is a non-leaching type antimicrobial agent based on Silane chemistry which will not impair the hydrophilicity of the treated fabric unlike conventional silane based antimicrobial agents.




*Silane Quaternary Ammonium Compound in Saraguard-HP*

There are 2 modes by which Saraguard-HP attaches itself to a textile substrate. The hydrolysable groups on the silicon atom in Saraguard-HP is hydrolyzed to silanols and the silanols form chemical bonds with each other and the substrate. Secondly, the silicon functionality enables the product to polymerize, after they have coated the surface, to become almost irremovable. The non-leaching behavior of such a reactive surface allows for the control of surface microbial contamination without the continuous release of toxic components into the environment which can promote the formation of resistant organisms. Further hydrophilicity of the fabric finished with Saraguard-HP is not adversely affected.

## Mode of action of Saraguard-HP:




*Mechanism of microbial cell destruction by Saraguard-HP*

When a microbe contacts the positively charged organo-functional silane treated fabric surface, the cell membrane is physically ruptured by a sword like action and then electrocuted by a positively charged nitrogen molecule.

Antimicrobial activity will be effective as long as the surface of the treated substrate remains intact. Since it is not consumed and does not leach-out, the antimicrobial activity is not depleted and continues to control microbial growth.

## Unique features:

- Saraguard-HP does not impair the hydrophilicity of the original fabric.
- Outstanding durability and effectiveness on all fibres.
- Ease of application in the usual textile application processes.
- Effectiveness against a broad spectrum of microbes such as *Escherichia coli, Staphylococcus aureus* and *Klebsiella pneumoniae.*
- Acts indirectly against dust mites.
- Readily combined with many textile effects.

## Recommended procedure:

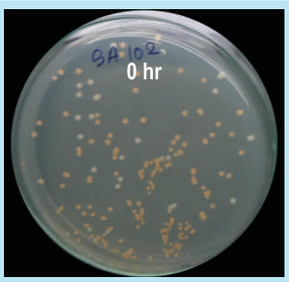
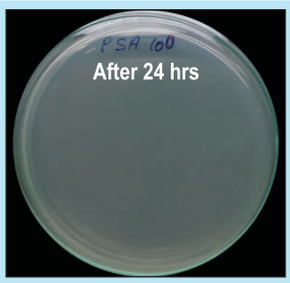
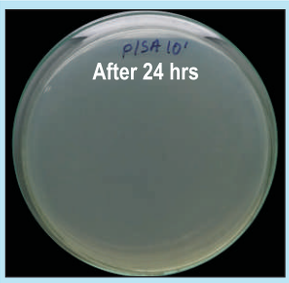
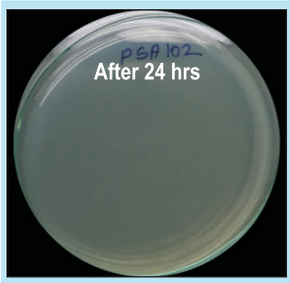
| | |
|---|---|
| Saraguard-HP | : 30-70 g/l |
| Pick up | : 65-70% |
| pH | : 5.0-6.0 |
| Drying | : 140-160°C, 1 min (for all substrate) |
| | : 120-130°C, 1 min (for polypropylene) |

**Results: Antibacterial activity with 60g/l Saraguard-HP treated fabric by AATCC-100 test method**

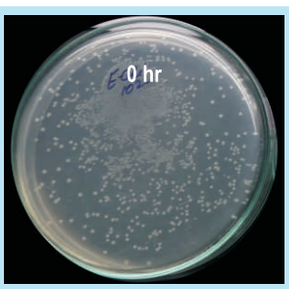
| Samples | % Reduction in bacteria | | | |
|---|---|---|---|---|
| | *S. aureus* | | *E. coli* | |
| | Initial | 10 wash | Initial | 10 wash |
| Unfinished | 0% | 0% | 0% | 0% |
| 60g/l Saraguard-HP | 100% | 80% | 100% | 81.53% |

| Finishing agent | Absorbency (sec.) |
|---|---|
| Unfinished | 3 - 4 |
| 60g/l Saraguard-HP | 35 - 40 |
| Conventional silane based antimicrobial | > 2 min |

**Antibacterial activity of Saraguard-HP against *S. aureus***

| | | | |
|---|---|---|---|
|   |   |   |   |
| Unfinished fabric ($10^{-2}$dilution) | 60g/l Saraguard-HP finished fabric (as is) | 60g/l Saraguard-HP finished fabric ($10^{-1}$ dilution) | 60g/l Saraguard-HP finished fabric ($10^{-2}$ dilution) |

**Antibacterial activity of Saraguard-HP against *E. coli***

| | | | |
|---|---|---|---|
|   |   |   |   |
| Unfinished fabric ($10^{-2}$dilution) | 60g/l Saraguard-HP finished fabric (as is) | 60g/l Saraguard-HP finished fabric ($10^{-1}$ dilution) | 60g/l Saraguard-HP finished fabric ($10^{-2}$ dilution) |

60g/l Saraguard-HP shows very good antimicrobial activity against *S.aureus* and *E.coli.*

The antimicrobial finish is durable upto 10 home laundering.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