

Solution against coronavirus

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Abstract

In 2020, the transmission of Covid-19 (nCoV) wreaked havoc around the world. The virus transfers from person to person via droplets in the air or by touching contaminated surfaces. Viruses are non-living organisms and require a living host to grow and multiply, so at this moment it becomes of utmost importance to wear a mask, or another means of protective clothing, to slow down the rate of transmission.

Using personal protective equipment (PPE) is the only way to safeguard health professionals against the infection. To help combat the crisis, Sarex has developed an antiviral and antibacterial agent called Saraguard-FL. When the solution is applied to a textile the material will deactivate the virus and prevent further transmission.

This article highlights the antiviral and antibacterial results of Saraguard-FL treated 100% cotton and 100% polyester fabric. The fabrics were tested at MSL, Laboratory UK for ISO 18184:2019 and showed effective protection >99% against Influenza

H1N1 (non-enveloped) and Feline Coronavirus, which belong to the same family of Covid-19 (SARS-CoV2) enveloped virus. Saraguard-FL has also been tested for Cytotoxicity using ISO 10993-5:2009 and it is found that when applied as per the recommended dosage it is non toxic to human cells.

Introduction

Presently, textiles can act as carrier for microorganisms such as viruses and bacteria that cause severe sickness and disease. Consequently, there are thousands of fatalities every year due to the transmission of pathogens. We usually think about textiles as the clothes that we wear, but their purpose is shifting to a more functional one. Market research shows that most of us are very conscious about our hygiene and cleanliness in this pandemic. Therefore, textile finishes with added value, particularly for medical clothes, are greatly appreciated and there is an increasing demand across the globe for such solutions.

Antiviral textiles have attracted a great deal of interest in recent years, in virtue of their potential to reduce the transmission of pathogens in medical and healthcare environments. Textiles treated with active antimicrobial ingredients prevent the colonisation and growth of bacteria and viruses which enables a longer shelf life for the products. Antimicrobial properties help to improve the performance and lifespan of consumer products, and so these antimicrobial-treated fabrics are now being used on a wider-variety of applications across the broader textile and apparel industry.

Medical textiles are also known as healthcare textiles. It is one of the most rapidly expanding sectors in the technical textile market. There is an increase in people's interest for protection against epidemic diseases like human coronavirus, H1N1 and SARS.

Moreover, it has been found that infectious pathogens can be transferred to healthcare personnel due to their over exposure to infected patients: through



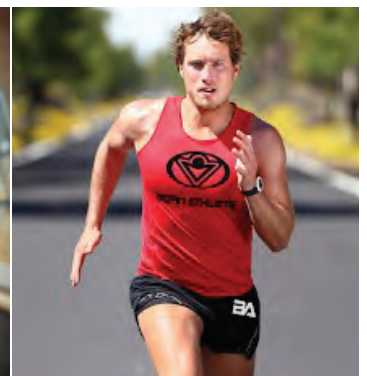
Personal protective clothing



Home furnishing



Apparel



Sportswear

Technical briefing: antiviral coatings

their respiratory organs and dermis via the air or fluids; and through mucus membranes, such as the eyes.

Additionally, the infection can easily transmit from one person to another in crowded indoor environments, such as on trains or buses. Therefore, respiratory, dermal and mucus membrane protection is essential for healthcare personnel but it is also important that antimicrobial solutions are used on everyday applications like home furnishings and apparel.

The Covid-19 pandemic has forced industries to innovate and develop cost effective antiviral agents.

To provide such functionality to fabrics, Sarex has developed the antibacterial agent Saraguard-FL. Saraguard-FL-treated fabric ensures protection of the treated textile and therefore passively protects the user. Saraguard-FL imparts freshness, comfort and longer life to the fabric. The concept behind this shielding technology is to reduce and prevent the colonisation and multiplication of bacteria and viruses that cause undesirable odors, staining, and material fatigue.

Salient features of Saraguard-FL:

- Economical
- Effective against enveloped and non-enveloped viruses
- Effective against gram-positive and gram-negative bacteria
- Passes ISO 1814:2019, AATCC 100, JIS L 1902 test methods
- Non-leaching

- Durability
- Suitable for all substrates - cotton, polyester, polyamide and their blends
- Can be applied with padding, exhaust, soaking and spraying methods

Materials & methods

100% cotton and polyester woven fabrics were treated with 50gpl Saraguard-FL at 65% pick-up. The pH of 5.5 was maintained and the fabrics were dried at 120°C for five minutes.

Test method

ISO 18184:2019 Textiles-Determination of antiviral activity of textile products

Finished fabrics were tested for antiviral activity at MSL Laboratory, UK against two viruses - Influenza H1N1 ATCC VR-1683 and Feline Coronavirus (strain Munich) - for two hours contact time.

The members of the family Coronaviridae are enveloped and have a positive sense RNA genome. Coronaviruses have a distinct morphology with an outer 'corona' of embedded envelope spikes. These viruses cause a broad spectrum of animal and human disease.

TM100-TM 100 Test Method for Antibacterial Finishes on Textile Materials: Assess

Finished fabrics were also tested with AATCC 100. This method is used to quantitatively test the antibacterial activity of the textiles over the contact period of 24 hours against *Staphylococcus aureus* and *Escherichia coli* and *Klebsiella pneumoniae*. These fabrics were also subjected to 25 home launderings by the AATCC 135A test method following which they were tested again for antibacterial activity.

Results and discussion

It is evident in Table 1 and 2 that treated fabrics showed excellent antiviral activity against Influenza H1N1 (Non-enveloped) and Feline Coronavirus (COVID-19 (SARS-CoV2) enveloped virus at two hours contact time.

It is evident in Table 3 and 4 that treated fabrics showed excellent anti-bacterial activity, while on the unfinished fabric there was heavy growth of bacteria. This is because fabrics finished with Saraguard-FL bind with bacteria to

	Feline Coronavirus	COVID-19 (SARS - CoV2)
Realm	Riboviria	Riboviria
Order	Nidovirales	Nidovirales
Family	Coronaviridea	Coronaviridea
Genus	Alphacoronavirus	Betacoronavirus
Species	Alphacoronavirus 1	COVID-19

Multiple strains of coronavirus

Table 1: Antiviral activity on 100% cotton fabric tested using ISO 18184:2019 against Influenza H1N1 and Feline Coronavirus at two hours contact time

Recipe	Influenza H1N1		Feline Coronavirus	
	Log reduction	Reduction (%)	Log reduction	Reduction (%)
Control	0.89	87.08	0.89	87.08
50g/l Saraguard-FL	1.93	98.83	2.50	99.68

Table 2: Antiviral activity on 100% polyester fabric tested using ISO 18184:2019 against Influenza H1N1 and Feline Coronavirus at two hours contact time

Recipe	Influenza H1N1		Feline Coronavirus	
	Log reduction	Reduction (%)	Log reduction	Reduction (%)
Control	0.71	80.43	0.93	88.27
50g/l Saraguard-FL	2.0	99.00	2.07	99.15

Technical briefing: antiviral coatings

their cell membrane and disrupt the lipo-polysaccharide structure resulting in the breakdown of the cell and thus providing an antibacterial effect. Additionally, because of the binding capacity of the anti-bacterial agent, the fabrics are durable to multiple home launderings.

Saraguard-FL treated fabric was tested for Cytotoxicity and from the above table and graph it is clear that

treated Saraguard-FL fabric is non-toxic to human cells as more than 70% of cells were alive even when exposed to a 100% extract from the Saraguard-FL treated fabric.

Conclusion

Blood and other bodily fluids are considered as the carriers of the several microorganisms and can be transferred through barrier material like

surgical fabrics, drapes, bed linens by wicking of fluids, pressure, or leaning on a flooded area. In order to protect the patients, hospital personnel and surgical teams from such cross infection, it is a primary requirement that the fabric for these applications should be treated with antiviral and antibacterial agents in order to provide better protection and comfort to the wearer.

Table 3: Antibacterial activity on 100% cotton fabric tested using AATCC 100:2012

Recipe	Antimicrobial activity					
	(Initial)			After 25 HL		
	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
50g/l Saraguard-FL	100	100	93.11	90.08	81.53	93.54

Table 4: Antibacterial activity on polyester fabric tested using AATCC 100:2012

Recipe	Antimicrobial activity					
	(Initial)			After 25 HL		
	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
50g/l Saraguard FL	100	100	100	99.93	98.34	95.50

Table 5: ISO 10993-5:2009- tests for in vitro Cytotoxicity

2002604/2	Neg Control	Pos. Control	Growth control	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
% Cell Viability	-	1.250	100	108.8	108.6	81.91	83.80	77.87	77.56	77.19	76.76	76.18	74.2
P value	-	-	-	0.35	0.35	0.31	0.32	0.22	0.22	0.22	0.21	0.21	0.21

Cytotoxicity test results of Saraguard-FL

