Protecting against pathogens, viruses and bacteria

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Abstract

The Covid-19 pandemic has sparked global fretfulness. The concern is that the virus is spreading too far, too fast and medical scientists can't seem to find a way to contain it. Juan Dumois, a pediatric infectious-diseases physician at Johns Hopkins All Children's Hospital in St. Petersburg, Florida reported that "coronavirus in general will last a lot longer on a solid, nonporous surface compared to porous fabrics". He also suggested they would survive for longer on artificial fibres such as polyester rather than cotton, which is one of the mediums for spreading infection. In concurrence with an increasing public awareness of infectious diseases, the textile industry, including Sarex, would like to re-introduce two of its effective antimicrobial agents which are effective against a broad spectrum of microbes, pathogens and viruses. In this study, Sarex have treated various textile substrates – cotton, polyester and polyamide fabrics – with these anti-microbial agents and have tested them for durability using the AATCC 100 test method. The results are very encouraging and can help in controlling the spread of the infections, thus contributing to the well-being of humankind.

Keywords: Textiles, antimicrobial, durability, health impact

1. Introduction

We are surrounded by countless viruses and bacteria. While some of these microorganisms are beneficial, others pose a threat to human health, plants and animals. We therefore need to take steps to protect ourselves from them.

Coronavirus is one such example. Corona viruses are a large family of viruses that usually cause mild-to-moderate upper-respiratory tract illnesses like the common cold. However, on three occasions in the 21st century coronavirus outbreaks have emerged from animal reservoirs to cause severe disease and global transmission concerns. There are hundreds of corona viruses which circulate among animals like pigs, camels, bats and cats. But sometimes those viruses jump to humans – this is known as

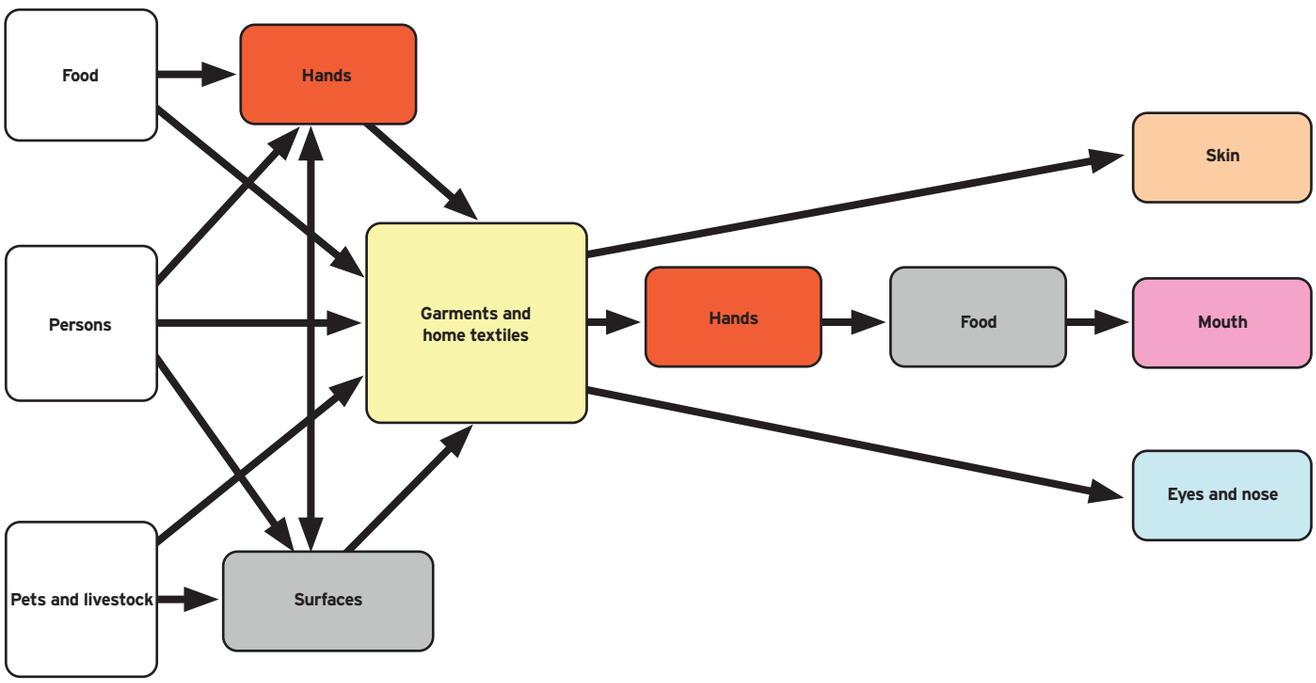

Figure 1: Scheme of transmission routes of germs via hands and textiles (following Bloomfield, 2011)

Medical care

Home furnishings

Sportswear

Seat covers

a spillover event – and can cause serious illness.

Figure 1 shows the transfer of germs from hands to textiles to nose, eyes and mouth. To stop this infection from spreading via droplets from sneezing and smear, it is necessary to wash hands with alcohol-based sanitizer and soaps. Meanwhile, textiles should be clean, should not allow the infection to spread and whenever possible kill the virus upon first contact.

Nowadays, it could be said that textiles are vectors of infections in hospitals or communities. The making of antimicrobial textiles could prevent them from becoming a reservoir of microbes in the transmission of infections like the human Coronavirus, H1N1 and SARS.

Particularly in a hospital environment, there is increasing concern of over exposure to various microorganisms that can be easily transmitted from environment to man causing different diseases. A sterile operating theatre is not enough to prevent pathogens transferring to a human, so it is necessary to additionally protect people by using face masks, gowns and drapes: textiles are therefore an essential tool in this area of medical practice.

The type of textile material is dependent on whether a product is classified as reusable or disposable. For so called disposable products, non-woven materials are often used with various fibre compositions like viscose/polyester, or polypropylene composites. On the other hand, there are reusable materials, mostly composed of cotton/polyester blends, polyester or cotton. The greater advantage with reusable surgical gowns

Recipe	Antimicrobial activity					
	(Initial)			After 50 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
40g/l Saraguard-5700	100	100	100	98.79	96.55	92.32
80g/l Saraguard-FL	100	100	100	95.74	94.83	90.10

Table 1: Antimicrobial activity on 100% cotton fabric

Recipe	Antimicrobial activity					
	(Initial)			After 50 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
40g/l Saraguard-5700	100	100	100	98.79	96.55	95.32
80g/l Saraguard-FL	100	100	100	99.74	92.83	93.10

Table 2: Antimicrobial activity on polyester fabric

Recipe	Antimicrobial activity					
	(Initial)			After 50 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
40g/l Saraguard-5700	100	100	100	97.52	98.06	99.94
80g/l Saraguard-FL	100	100	100	99.24	98.64	98.89

Table 3: Antimicrobial activity on polyamide fabric

Technical briefing: Antimicrobial finishes

includes less solid waste from limited disposal and more comfort to the wearer because of their better water vapor transmission. However, they lose durability and barrier protection after repeated washing.

The current Covid-19 pandemic has highlighted the importance of creating innovative textile products that can act as effective barriers to reduce the risk of human infection – it is particularly important for people with impaired immune systems. In a hospital environment there are many variables that affect the occurrence of human infection, whether hospital protocol is accurately executed or not. Nevertheless, with well-constructed textile materials it is possible to reduce the risk of pathogens that may cause harm to patients.

Thanks to recent governmental media campaigns, consumers are more aware than ever of the importance of good hygiene and in response there has been a spike in demand for textile products with antimicrobial properties. Textile commodities, especially those made from natural fibres, provide an excellent environment for microorganisms to grow. Microorganisms can be found almost everywhere and are able to multiply quickly, depending on the moisture, nutrients and temperature of the environment that surrounds them.

With the advent of new technologies and the growing needs of the consumer, antimicrobial finishes have become inevitable. There is a strong argument that antimicrobial textile finishes should be applied to many textile products from the medical, technical, industrial, home textile and apparel sectors. Antimicrobials are also used on functional clothing which is also known as personnel protective equipment (PPE). The clothing, which consists of aprons, workwear, gowns and face masks, is used to protect the wearer against harmful pathogens. The Covid-19 outbreak has highlighted that there are significant PPE shortages for health professionals around the world.

Antimicrobial agents enhance the functionality and value of textiles by keeping microorganisms, pathogens and viruses that cause infections under control, and may stop them from transmitting from one person to another.

To provide such functionality to fabrics, Sarex has developed antimicrobial agents like Saraguard-5700 and Saraguard-FL which are suitable for all substrates and have proven to be durable and effective against pathogens, viruses and bacteria. Saraguard-FL is a non-leaching antimicrobial agent, but Saraguard-5700 is a Quaternary Silane, methanol free, non-leaching antimicrobial agent.

Both antimicrobial agents can be used for the finishing of all types of textile substrate and can be applied by padding, exhaust, soaking and spraying methods and are effective against a broad spectrum of microbes, pathogens and viruses. The products have also passed AATCC 100 and JIS L 1902 test methods.

Saraguard-FL and Saraguard-5700 provide a barrier shield which ensures the protection of the treated textile. They also impart freshness, comfort and ensure

material protection. The concept behind this shielding technology is to reduce and prevent the colonisation and multiplication of bacteria, pathogens and viruses.

2. Materials & Methods

100% cotton, polyester and polyamide fabrics were treated with Saraguard-FL and Saraguard-5700 at various concentrations with 65% pick-up. The pH of 5.5 was maintained and the fabrics were dried at 150oC for two minutes.

2.1. Test Method

Finished fabrics were subjected to 50 home launderings by the AATCC 135A test method. Evaluation of the finished fabrics for antimicrobial activity was then performed by the AATCC-100 test method against Staphylococcus aureus, Escherichia coli and Klebsiella pneumoniae.

3. Results and discussion

It is evident from Table 1, 2 and 3 that treated fabrics showed excellent anti-microbial activity, while on the unfinished fabric there was heavy growth of bacteria. This is because fabrics finished with Saraguard-FL and Saraguard-5700 will bind with microorganisms to their cell membrane and disrupt the lipo-polysaccharide structure resulting in the breakdown of the cell, thus providing antimicrobial effect. Additionally, because of the binding capacity of the anti-microbial agents, the fabrics will show durability against home laundering.

4. Conclusion

Increasing public awareness about effects of pathogens on health creates a growing demand of antibacterial materials. In present and in future, this novel functionalisation will be of great importance and will be carried out as a mandatory finish rather than specialised finish and will be made compulsory for all textile articles which are used in hospitals, care homes, communal facilities and in protective clothing for the fire brigade, emergency services and military. Customer desire for comfort, hygiene and well-being, concerning odor control and protection against microorganisms, has created a large and rapidly increasing market for the expansion of antimicrobial textiles.