

Antibacterial compounds in clothing articles

When we are active we create the heat and humidity that is heaven for bacteria, but textiles themselves are carriers of bacteria and fungi. Fabric producers can control bacterial or fungal growth on fabric a number of ways. One is through finishing, using resins to fix the antibacterial/antifungal agents to the textile surface. Another is to graft antimicrobials/antifungal agents on the cellulosic chain, i.e. viscose, Lyocell, etc. In many ways antibacterial activity is closely related to soil-repellent and soil-release qualities of textiles. Fluoro-polymers represent the class of polymers usually used in anti-soil finishes. They consist of perfluorinated hydrocarbon units and fluorine-free polymer structures, which are linked together by spacers containing perfluorinated groups. These spacers can also act as bi-functional polymer linkage and can be polymerised and co-polymerised through unsaturated groups.

It is well known that in ancient Greece, Rome, Phoenicia and Macedonia, silver was used extensively to control infections and spoilage. It is recorded that Hippocrates taught that silver healed wounds and should be used to control disease. In the mediaeval Middle East silver was widely used for blood purification, as well as for heart conditions and to control halitosis. In the 16th century silver nitrate was successfully applied in the treatment of syphilis. In the 1800s, the antibacterial properties of silver were further described and clinically demonstrated. More recently, silver products have been investigated with special regard to wound-healing properties whereby silver appears to have two key advantages: it is a broad-spectrum antibiotic and drug resistance is hardly found. Silver-coated materials are also routinely used in surgery. It has been shown that a consistent therapy performed with dry wound dressings containing silver is superior to the conventional treatment without silver-containing dressings. As such it is not

Omniflex odour-control films can prevent fungal growth, making them ideal for footwear applications.

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surprising that silver is one of the most used materials when adding an antibacterial content to textiles.

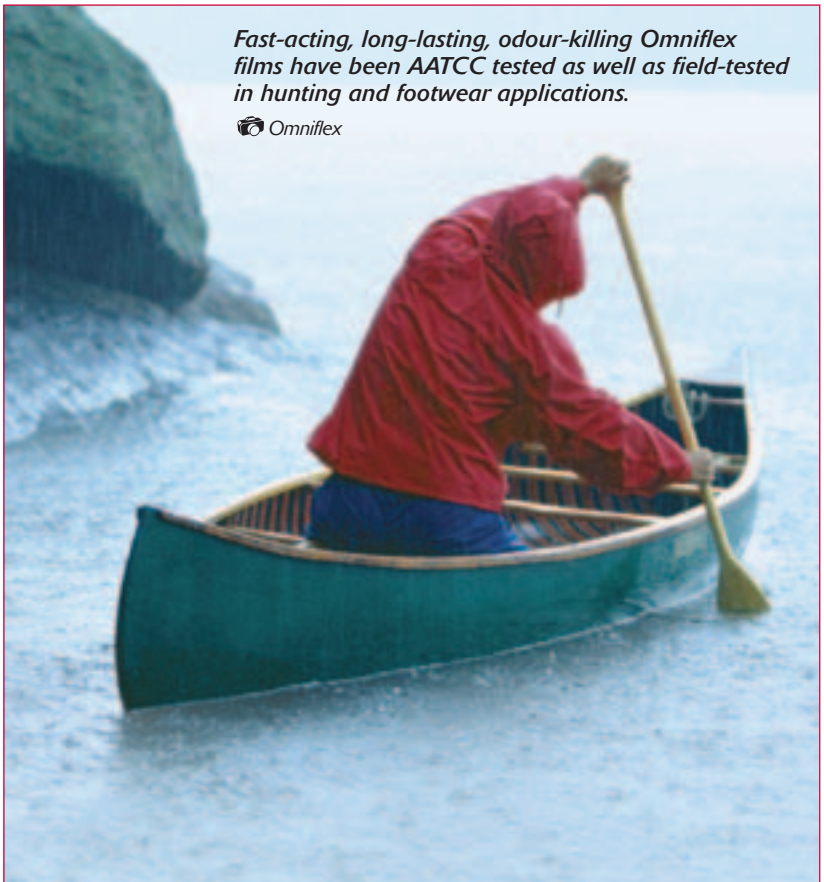
One major area alongside soil resistance is moisture management and the medical industry takes a close interest in new fabrics which transmit humidity across the material and thereby help to keep the skin dry, as this can help to prevent fungal infections. One interesting point is that while these new sweat management systems or moisture transport systems have been developed using a large number of synthetic fibres – acetate, nylon, polyolefin, acrylic, polyamide – antibacterial materials appear able to work with all of them. Likewise, textiles with antimicrobial coatings may use further means to prevent such infections. For instance, the admixture of chitosan to cotton fibres can be used to manufacture fabrics with antimicrobial properties.

These approaches to dealing with bacteria from silver through to bamboo shoots have slightly different objectives. Some are intended to kill the bacteria, some to kill the body odour they cause and some just to slow their breeding. Adding more and more obscure chemicals to materials that sit against the body has been a cause of concern for some years. Issues of unexpected consequences and allergies frequently arise. The Danish Environmental Protection Agency has a strong history of trying to look at these matters from a consumer point of view. The perspective in many of their studies is to buy items in the shop and to look for the level of active chemical involved and then draw conclusions from there. They are now up to over 60 studies of different areas. Study number 24 took a close look at antibacterial compounds in clothing articles.

The investigation gathered information on the use of antibacterial substances in clothing, aiming to identify and measure the commonly used substances. It then tried to determine the contents of a number of antibacterial substances to measure the amounts of these substances in the products, and finally had planned to investigate the loss of target substances from clothing by washing. This latter project was abandoned.

The antibacterial treatment of clothing it looked at fell into two groups. In the first the antibacterial chemicals are built-in the textile fibres during their manufacture where it is intended that the antibacterial property of clothing manufactured using such fibres should last the whole life of the product. In the second the clothing is coated with some antibacterial compound using a variety of techniques.

The agency worked initially to identify some of the commonest antibacterial products used in brands and textile fibres and antibacterial clothing:



Fast-acting, long-lasting, odour-killing Omniflex films have been AATCC tested as well as field-tested in hunting and footwear applications.

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Omniflex films now with antibacterial odour control

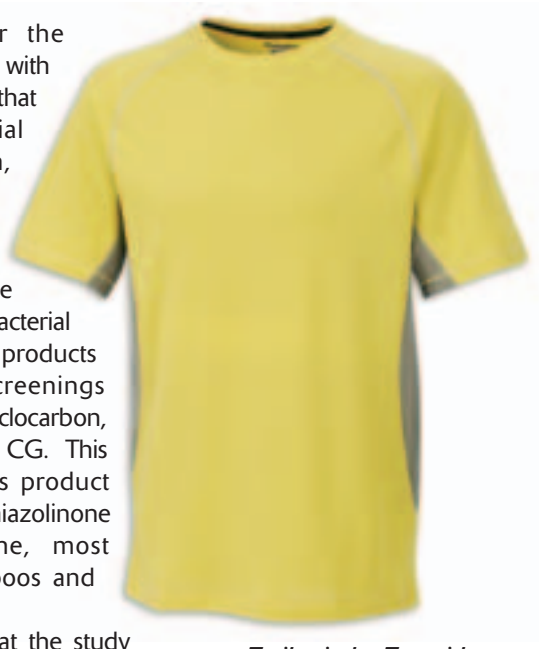
Indicative of the importance of anti-odour and antibacteria, Omniflex LLC of Greenfield, Massachusetts, has introduced new antibacterial odour control versions of its widely used Transport waterproof breathable and Vacuflex barrier films. The intention is that these new films will allow designers and laminators to create waterproof-breathable, odour-killing textile composites with a single film lamination. The result is offered as an economical way to achieve odour control in waterproof- breathable apparel, footwear, work-wear, bedding, medical textiles, medical devices, and upholstery.

To achieve this Omniflex formed a joint venture with Etcetera of Northampton, MA. Etcetera LLC has odour and infection control additives that can be incorporated in films, adhesive systems, yarn or a surface treatment for fabrics. The technology utilises a variety of silver, copper or blends of each, or proprietary non-metallic additives to meet the particular odour-control needs of a specific apparel application. This approach does not absorb or mask odour but actually kills odour-causing bacteria. The formulation of these films can be tailored to provide slow to fast activation and/or short to long lasting protection. The resulting products are able to eradicate infection-causing microbes in a variety of wound care applications, as well as kill odour-causing bacteria.

Omniflex odour-control films have been tested under AATCC method 100 and AATCC method 147 and found to prevent the bacterial growth that can cause odours; they provide ongoing antimicrobial protection. Additionally, certain versions of these films prevent fungal growth, making them ideal for use in footwear applications. Omniflex notes that in the past, odour control had to be achieved in a separate layer. It can now be incorporated in an existing layer to reduce the cost of materials and fabrication. This new technology, therefore, keeps the weight and bulk low in the end product, allowing waterproof-breathable, odor-controlled garments to drape and move more freely.

- ***Actigard***: an olefin fibre is used in the production of mattresses (both cover and filling). The antibacterial compound is 1,2,3-benzothiadiazole-7-thiocarboxylic acid-s-methylester (CAS No. 135156-54-2).
- ***Amicor:*** textile fibre used for the manufacture of clothing for hospital workers, bedding in the hospitals, sports clothing, etc. This fibre is used for the manufacture of sports clothes by Reebok, Fila, and Arena. The antibacterial compound is triclosan.
- ***AM/P2 Polyolefin***: is used in the production of, for example, ladies tights and underwear.
- ***Bio-Fresh:*** acrylic fibre used for the manufacture of 'activewear' and lingerie. The antibacterial compound is triclosan.
- ***Dryz:*** antibacterial treatment used for the manufacture of clothes, shoes, sports clothing, etc.
- ***Helapso:*** Hygienic fibre with anti-bacterial/deodorant treatment is used for the manufacture of all types of clothing.
- ***Innova AMP:*** antimicrobial polyolefin is used, for example, for the manufacture of 'activewear', winter clothing, clothing for water-sports, etc.
- ***Microban:*** antibacterial treatment used in sports clothing, etc. It is described as an organic compound in the same family as triclosan and the study assumes that the active substance may be a chlorophenol derivative.
- ***Microsafe:*** acetate fibre used for the manufacture of 'activewear', sports clothing, underwear, socks, gloves, armbands, etc.
- ***MicroSpreme:*** acrylic fibre is used for the manufacture of 'activewear', which is mildew resistant and free of malodour.
- ***Polartec Polar Strech textiles:*** are produced with an 'odourless antimicrobial finish'.
- ***Sanitized:*** antibacterial treatment is used in the production of sports clothing, workwear, socks, tights, etc. The antibacterial components of Sanitized treatment are 5-chloro-2-(2,4-dichlorophenoxy)-phenol and 2-Noctyl-isothiazoline-3-one.
- ***Ultra-Fresh:*** antibacterial treatment is used in the manufacture of sports clothing, shoe soles, etc.
- ***Tinosan:*** antibacterial treatment is used in the manufacture of textiles. The antibacterial compound is triclosan.
- ***Thinsulate Lite Loft Thinsulate Ultra:*** used in gloves, caps, sleeping bags, etc., are hypoallergenic and they provide odourless comfort.

The finished articles purchased in the stores included base layers or underwear, cycle shorts with inserts, swimwear, socks, footwear, and ankle protectors and tests were carried out to look for Trichlorsan and 2-N.octyl-isothiazoline-3-one were selected for the analysis in all products along with dichlorophen. It was noted that some other antibacterial compounds (triclocarbon, hexachlorophen and Kathon CG) could also be analysed with the same methods, which were selected for the analyses of the target antibacterial compounds. Therefore, all products were also subjected to screenings analysis for the content of triclocarbon, hexachlorophen and Kathon CG. This latter is a Rohm and Haas product based on methylchloroisothiazolinone and Methylisothiazolinone, most commonly used in shampoos and such personal products.



Trail grinder Tee with anti odour treatment.
Columbia

What was curious was that the study was only able to detect active content in one-third of the products although some 90 stated that they had been treated. The argument was that since the content was so active only a miniscule amount is required which falls below the <ppm target detection limit. With so little content and the material being so hard to detect there was little likelihood of learning anything from a washing test and it was abandoned.

While this is interesting, somewhat disturbing was the discoveries made on suppliers' knowledge. In doing the study more than 30 Danish manufacturers and importers of textile fibres and sports clothing as well as sports associations were requested to supply information about the antibacterial treated products marketed by them. About half of the companies responded to the request. "In general, the impression is that the marketing of antibacterial treated clothing articles is relatively new. However, according to several clothing manufacturers, the growth is eminent in the marketing of fibres treated with antibacterial compounds. The antibacterial treated fibres are relatively expensive and they are to a great extent used only for the manufacture of clothing for physical activities. Only a few of the clothing manufacturers, with the knowledge of antibacterial treated fibres, knew the antibacterial compound(s) used for the treatment of fibres. The clothing retailers knew about the antibacterial treated products mainly by publicity" the report concluded.

With consumers taking much more interest in the environment and the materials that are contained in the products they buy, if this knowledge is representative then the sports industry needs to start to improve the education of retailers and distributors so that consumers can get detailed and accurate answers to their questions.