Shirley Technologies Ltd

THE LAYMAN'S GUIDE TO ANTIMICROBIAL FABRICS AND TESTING METHODS

ANTIMICROBIAL textile products continue to increase in popularity as demand for fresh smelling, skin friendly, high-performance fabrics goes on. Modern performance fabrics are required in many specialist applications, sports textiles is one example. These need to exhibit high degrees of performance in terms of longevity and durability, and by imparting antimicrobial properties to the fabric these properties can be improved as well as increasing the comfort and hygiene factor making them more pleasant to wear. Odours can be neutralised and skin problems caused by microbial growth reduced thus emphasising the "hygienic" nature of the treated product.

MICROBES DEFINED.

Microbes fall into three categories; bacteria, fungi and algae, although only the first two are generally applicable to textiles. The table below outlines the main differences of these and the problems they can cause in textiles.

MICROBE TYPE	Description	Causes	Treat With
Bacteria	Simple structure/ Fast Growing in warm and wet conditions	Unpleasant Odours (e.g. E. Coli)	Antibacterial agent
Fungal (moulds and mildews)	Complex structure/ Slow Growing	Staining and loss of performance Skin Infections (e.g. Candida, Athlete's Foot)	Antimycotic agent

Bacteria and fungi can cause deterioration in a range of textiles including sports textiles, leading to loss of performance and ageing, as well as unsightly staining, unpleasant odours and potential skin infections caused by fungal growth.

The use of antimicrobial finishes and treatments within textiles can help to avoid or control cross infection, and by stopping microbial growth, can extend the lifetime of the product and control the problems listed above.

ANTIMICROBIAL TREATMENTS

Antimicrobial treatments can be added in a number of ways including as a coating to the finished fabric or fibre or by incorporating the antimicrobial agent within the fibre during the spinning process, as in the manufacturing of polyester and nylon.

Antimicrobial agents used to treat textiles fall into two categories, known as "static" and "cidal" and the table below outlines the main differences. Many traditional treatments fall into the "cidal" category and because of their leaching action need to be evaluated for their health and environmental effects. New development tends to favour the "Static" type agents as these are of lower risk.

Fungi / Bacterio-static Agents	Fungi/Bacteri-cidal Agents
Non-Leaching or “bio-static” – provides a textile surface structure unsuitable for microbial growth	Leaching – diffuses out of the fabric and kills any microbes present, inhibiting further growth
Slower acting Work by Inhibition of microbial growth	Faster Acting Causes significant destruction of microbes
Good Durability Less Health &Environmental Risk Increased Microbial development to resistance	Poorer Durability Potentially higher health & environmental risk Decreased microbial development of resistance
Example : silver based compounds, Tributyltin maleate – controls bacteria and fungal growth	Example : Chloroxynol (both fungicidal and bactericidal)

Antimicrobial fabrics can deter microbial growth in one of two ways. Either “passively”, by inhibiting the growth of micro-organisms through inherent surface structure without the use of agents – linen for example displays such characteristics, as well as lambs wool, or “actively”, using antimicrobial agents to either kill or inhibit the growth of any microbes present such as in treated cotton/denim fabrics.

TESTING ANTIMICROBIAL EFFICACY OF TREATED TEXTILES

Due to the nature of the antimicrobial agents, testing should be carried out to assess both the antimicrobial effects imparted to the textile and the performance characteristics of the final product to ensure no loss of textile performance as a result of the treatment.

Antimicrobial performance should also be substantiated, since exaggerated product claims may result in unwelcome challenges. Long term effects of the antimicrobial should also be considered since there is a school of thought that suggests that certain agents may in the long term, particularly with the “static” class of agents, actually promote the growth of micro-organisms which develop resistance to the agents themselves.

Apart from assessing antimicrobial effectiveness, wash and wear durability as well as fitness for purpose, should also be considered as well as other physical tests which would be relevant to the final intended use of the products- in the case of swim wear resistance to sunlight and chlorinated water should also be included.

Compliance to relevant legislation should also be considered to ensure overall safety to both the consumer and environment. Antimicrobials are limited to those listed within EC Directive 98/8/EC referring to the placing of biocides in general on the market.

TESTS AVAILABLE FOR ANTIMICROBIALS

These comprise of either, a relatively quick qualitative test to establish whether antimicrobial function exists and longer quantitative testing which may include a “challenge testing” where comparisons are made between treated and untreated materials to quantify the effectiveness of the treatment. Many textiles are treated with diffusible agents and are qualitatively tested using an Agar Diffusion Test – a number of recognised standard tests exist and are outlined below. Other tests also exist including soil burial to determine rot resistance.

Examples of commonly used standard tests for assessing antimicrobial function are given below.

Test Title	*Description*	*Examples of Textiles Tested*
AATCC-147-1998 (USA)	**Qualitative** Antibacterial Activity Assessment of diffusable antibacterial agents ("quick" method)	Clothing : socks, tee shirts, training shoe interlinings Other : Dish cloths, floor coverings, Bedding and towels, wall papers upholstery, leather, plastics and rubber materials
SNV-195 920,1994 (Swiss)	**Qualitative** - Agar Diffusion Test Assessment of antibacterial effect of agents and impregnated textiles	AS ABOVE
SNV-195 921,1994 (Swiss)	**Qualitative** - Agar Diffusion Test Assessment of anti-fungal agents and fabrics impregnated by them-"antimycotic" effect	Clothing : swimwear, clothing liable to get wet Other : Textiles, upholstery, leather, plastics and rubber materials
AATCC-100-1998 (USA)	**Quantitative** assessment of antibacterial finishes on textiles- measures the degree of anti-bacterial activity	Clothing : socks, tee shirts, training shoe Interlinings, underwear Other : Dish cloths, floor coverings
JIS L 1902 – 1998 (Japan)	Quantitative assessment of fibres and fabrics with inherent antibacterial properties (static and cidal) (e.g. zeolites)	Clothing : Clothing : socks, tee shirts, training shoe interlinings Other : Furnishings, Bedding
BS EN ISO – 14119,2003	Resistance of textiles to action of microfungi Cellulosic (cotton) and man made fibres	Tenting materials, Sand bags
BS 6085 Part 5, 1992	Mildew and Fungal Growth Analysis	Clothing : Swim wear, clothing in contact with water Other : Outdoor fabrics , usually waterproofed for above ground use – tents and awnings
BS 6085 Part 4, 1992	Resistance of Textiles to bacterial Degradation	Clothing : woollen articles
BS EN ISO 11721,2001	Soil Burial Test Severe test conditions	Cellulose containing products in contact with soil – sandbags, shoe liners, tarpaulins, textile based sports equipment

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Sources of Information: Antimicrobial Testing – an Overview September 2003. Dr. T. Ramachandran et al.
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