Niche Testing: Testing of Antimicrobial Treated Materials

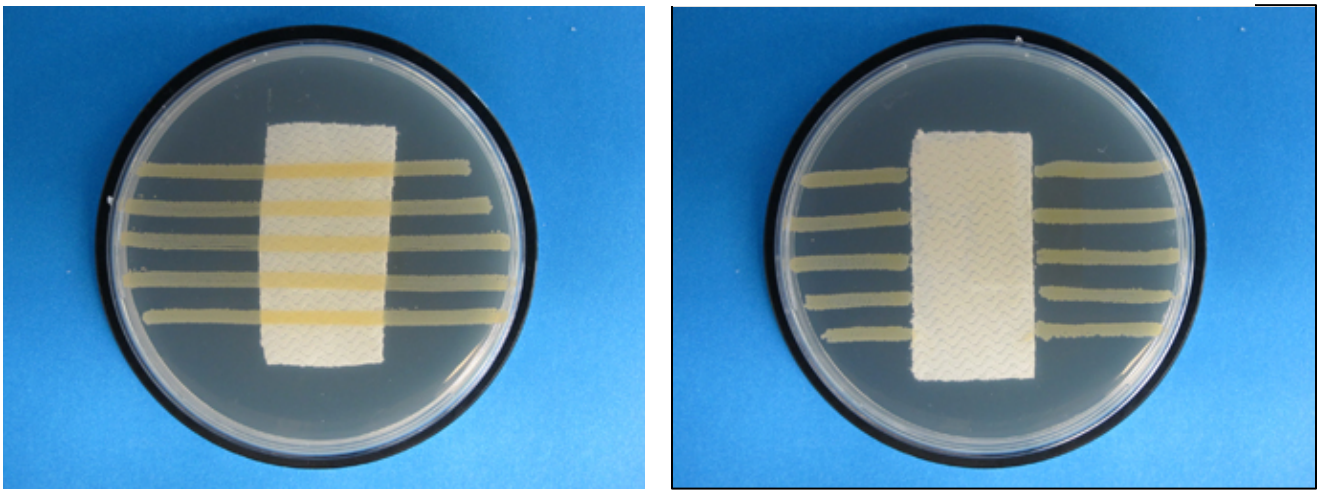
By: Chris Liu

Antimicrobials have been incorporated into a wide variety of materials such as textiles and non-woven fabrics; plastics, polymers and composites; foams; carpets and flooring materials; paints, inks, and coatings. The antimicrobial is added at the point of manufacture to inhibit the growth of undesirable microorganisms, such as bacteria or fungi that cause staining, odors and/or material degradation. In this global economy, products are often manufactured in one country and transported to another, presenting the opportunity for materials to come into contact with a wide variety of microorganisms and environments during manufacture, shipping, and finally usage, thus making the need for antimicrobial protection even more necessary.

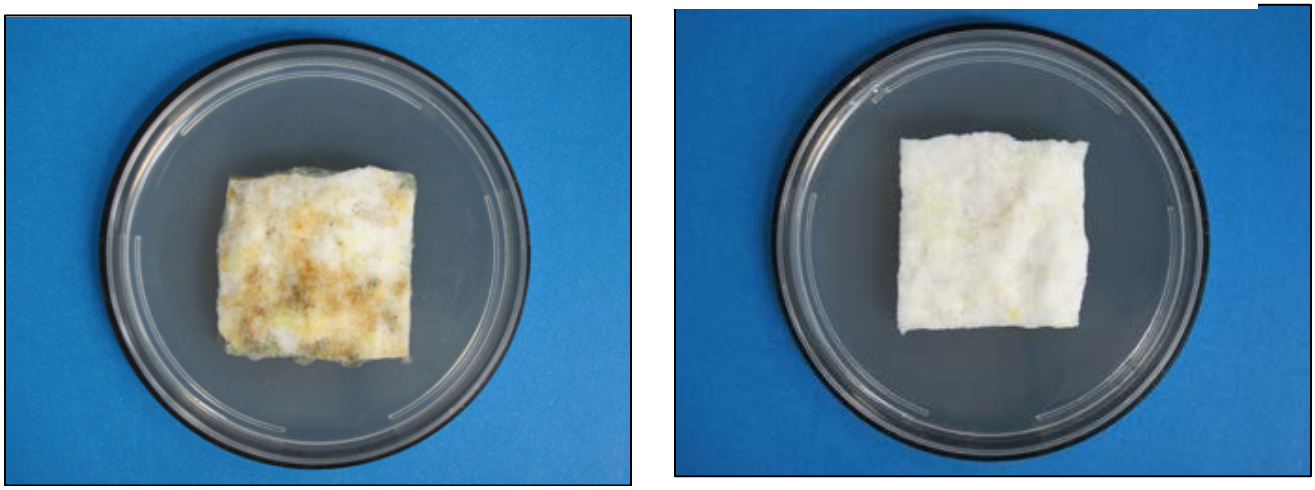
It is important that antimicrobial treated materials undergo laboratory testing to confirm efficacy and to provide scientific evidence to support manufacturer claims. Since there is a wide variety of materials and antimicrobials, a number of testing methods have been developed by organizations such as the American Association of Textile Chemists and Colorists (AATCC); American Society for Testing and Materials (ASTM); International Organization for Standardization (ISO); and Japanese Industrial Standard (JIS). Some of these standard testing methods have been developed for specific types of materials and therefore choosing the correct test method is crucial. For example, in the case of porous versus non-porous materials, some testing procedures have optimized the contact between the microorganism and the material being assessed.

Testing methods have been grouped into two general categories: qualitative and quantitative. Qualitative tests are based on visual observations of microbial growth or stain. This visual observation makes these test methods easier to understand for manufacturers that may not have a science background. However, this type of testing cannot be used for all antimicrobial types. AATCC Test Method 147, AATCC Method 30, and ASTM G-21 are examples of antibacterial

and antifungal qualitative test methods. AATCC Method 147 and ASTM G-21 are outlined in the photographs below.



Pictured above: Untreated (left) and treated (right) fabrics tested in the **AATCC Test Method 147** using *Staphylococcus aureus*



Pictured above: Untreated (left) and treated (right) foams tested in the **ASTM G-21** using a mixed suspension of *Aspergillus niger*; *Aureobasidium pullulans*; *Chaetomium globosum*; *Penicillium funiculosum; Trichoderma virens*

Quantitative test methods determine the degree of antimicrobial activity using a numeric value (such as percent reduction or log reduction). The ISO 20743 and JIS L 1902 are frequently used bacterial efficacy tests for porous materials such as fabric, thread, sponges, and open-cell foams. For non-porous surfaces such as plastic, metal, ceramic, hydrophobic coatings, or closed-cell foams, the ISO 22196 and JIS Z 2801 are often employed. These methods involve placing a bacterial suspension directly onto the material. After a defined incubation period, the bacterial suspension is released

into a solution and the number of viable bacterial cells that have survived is determined. These tests are more sensitive and can be used for a wider range of antimicrobial products; however they are more expensive and time consuming to perform compared to qualitative tests.

Antimicrobial test methods often have one or more organisms included in the standard. *Staphylococcus aureus, Klebsiella pneumoniae*, and *Esherichia coli* are the most common bacterial organisms cited in these testing methods. Other organisms can also be used to help understand how an antimicrobial treated material will perform in its specific end use. For example, the food industry may find antimicrobial treated sponges or cutting boards tested against *Salmonella* sp. or *Listeria* sp. important, while the building industry would find testing against a cellulolytic fungus such as *Chaetomium* sp. of value for wood flooring or fiber insulation. It is therefore imperative that laboratories specializing in this type of testing have a large microbial library at their disposal. Microbiologics is an excellent source for microorganisms since they have a large and diverse line of quality control options, including organisms specified in many methods for the assessment of antimicrobial treated materials.

Biography:

Chris Liu is the microbiology lab manager at Thomson Research Associates Inc. He received his B.Sc. from the University of Guelph and M.A.Sc. from Ryerson University.

Thomson Research Associates Inc. is an antimicrobial company providing antibacterial, antifungal, antialgal, and anti-dust mite treatments and offering their products under the Ultra-Fresh and Silpure brands. For more information, please visit www.ultra-fresh.com