



QuickMedTechnologies

Antifungal and Antibacterial Medical Textiles to Interrupt Pathogen Transfer

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Antimicrobial Textiles in Healthcare Settings

Antimicrobial textiles are a natural fit for healthcare settings, where patients with compromised ability to fend off pathogens represent a very high risk population for acquiring infections. Healthcare facilities are under increasing pressure to reduce instances of nosocomial infections, and antimicrobial textiles can help to reduce the available transfer vectors for pathogens. Hand sanitation, by washing or by using sanitizers, is one facet of helping to interrupt bacterial transfer, but as soon as clean hands contact any bacterially colonized surface they can become transfer vectors again. Textiles such as scrubs, linens, towels, etc. can easily harbor bacteria for significant periods of time. These provide an easy transfer path from one person to another, and there is no ready way to quickly sanitize the textile. Since most textiles are fluid absorbent and are in close contact with skin, conditions for bacterial growth are nearly ideal. One study of healthcare associated textiles (surgical scrubs) showed that home laundered scrubs showed bacterial colonization levels similar to single-use scrubs that had been worn for an entire day (study published by Mölnlycke in support of their single-use scrubs line of products, Twomey et al. 2009). Since industrial laundering or the exclusive utilization of single-use garments is not feasible for the complete range of textiles worn by all patients and staff in a healthcare facility, the use of antimicrobial textiles can be an important element of plans to interdict the transfer of pathogens.

In addition to health considerations, antimicrobial textiles can prevent the generation of bacterially produced odors and stains on fabrics (bacterial metabolites can include ammonia species and volatile organics). This can not only increase comfort, but can also improve the aesthetic appeal and lifetime of the textile.

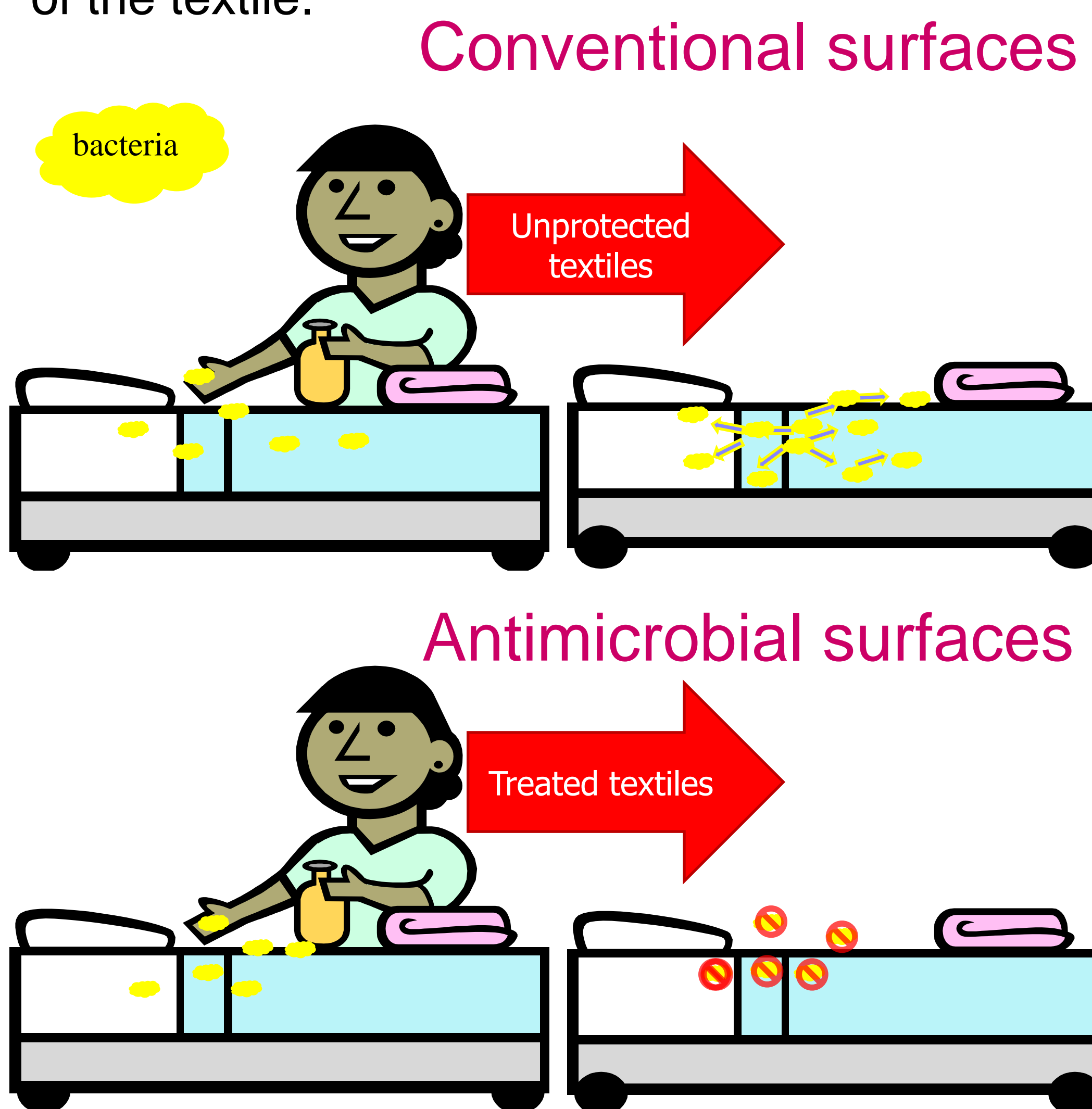


Figure 1: Pathogen transfer on unprotected surfaces, vs. antimicrobial surfaces. Antimicrobial surfaces are able to prevent pathogen transfer by suppressing microbes. Microbes on a conventional surface can easily multiply and transfer to a person or secondary carrier surface, while antimicrobial surfaces are able to arrest this process at the source. The figure at right shows how bacteria shed onto bedding are suppressed on the treated textile.

Bacteriocidal Efficacy of Stay Fresh After 25 Launderings

Table 1: Antimicrobial efficacy of Stay Fresh cotton jersey tested per AATCC method 100-2004.

Organism	% killed	ATCC#
Common pathogenic organisms implicated in nosocomial infections		
<i>Staphylococcus aureus</i>	>99.999%	6538
<i>Staphylococcus epidermidis</i>	>99.999%	12228
<i>Enterococcus faecium</i>	>99.999%	19434
<i>Escherichia coli</i>	>99.999%	15597, 8739
<i>Pseudomonas aeruginosa</i>	>99.9%	15442
<i>Klebsiella pneumoniae</i>	>99.999%	4352
<i>Streptococci</i>	>99.99%	10096
Resistant bacterial species tested		
MRSA	>99.999%	BAA-44
VRE	>99.99%	51299
Additional common bacterial species associated with [body] odor		
<i>Corynebacterium diphtheriae</i>	>99.99%	43145
<i>Micrococcus luteus</i>	>99.9%	21102
<i>Proteus vulgaris</i>	>99.999%	13115

Stay Fresh Technology

The Stay Fresh™ chemistry was designed to be durable to repeated laundering cycles while maintaining very high antimicrobial efficacy. The mechanism for antimicrobial efficacy is through an oxidative degradation of the bacterial cell wall.

Commercial Testing Colored cotton jersey material was prepared for a client wishing to meet a stringent military specification after 25 laundering cycles (AATCC method 135, hot water home laundering with AATCC detergent, performed at Precision Testing Laboratories of Nashville, TN). Antimicrobial efficacy exceeded the specification of 99.9% on *E. coli*, *S. aureus* and *K. pneumoniae* (Wuxi-Apptec laboratories, Marietta GA, Quick-Med Technologies' laboratory, Gainesville FL). **Table 1** shows data collected from 25x laundered samples.

Barrier Function The barrier function of these materials is provided by the highly effective Stay Fresh chemistry. Antimicrobial efficacy is durable, long-lasting, and continues to work after repeated inoculations. The antimicrobial chemistries are permanently bonded to the materials' surface, so there is no depletion of activity over time.

The durable Stay Fresh technology has proven effective for a wide range of microbes, including antibiotic-resistant bacteria that are particularly problematic in healthcare facilities. These textiles can help to preserve public health by interrupting pathogen transfer involving textile surfaces, providing effective support for facility programs to combat nosocomial infections.

Table 2. Properties of Stay Fresh Textiles

Property	Testing performed
Laundering durability	Tested up to 75 cycles by AATCC method 135, retaining >99.9% per AATCC method 100
Broad spectrum antimicrobial activity	Tested against fungi (AATCC method 30, ASTM G-21) and bacteria (AATCC method 100)
Safety Testing	ISO 10993-05 tests including cytotoxicity (agar overlay method), primary skin irritation and wear tests
Commercial Application	Can be padded on during normal textile finishing

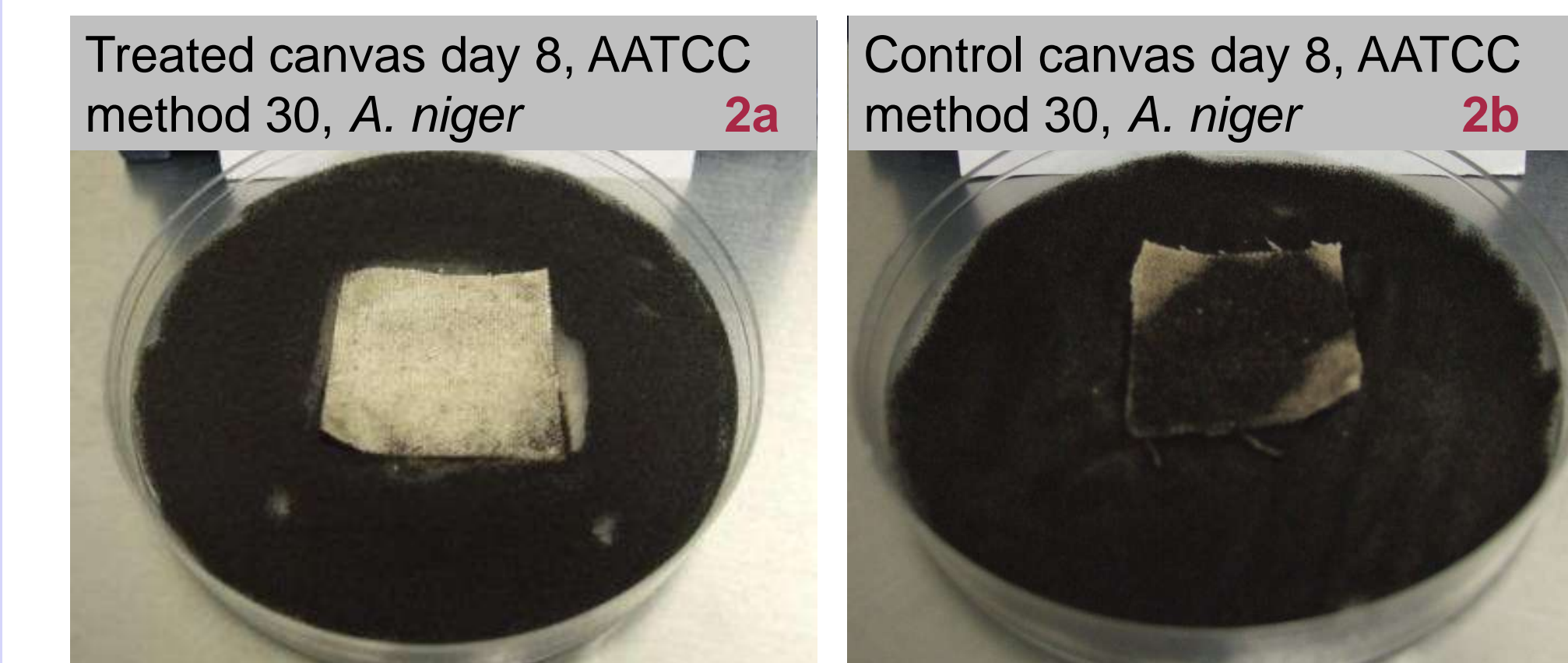
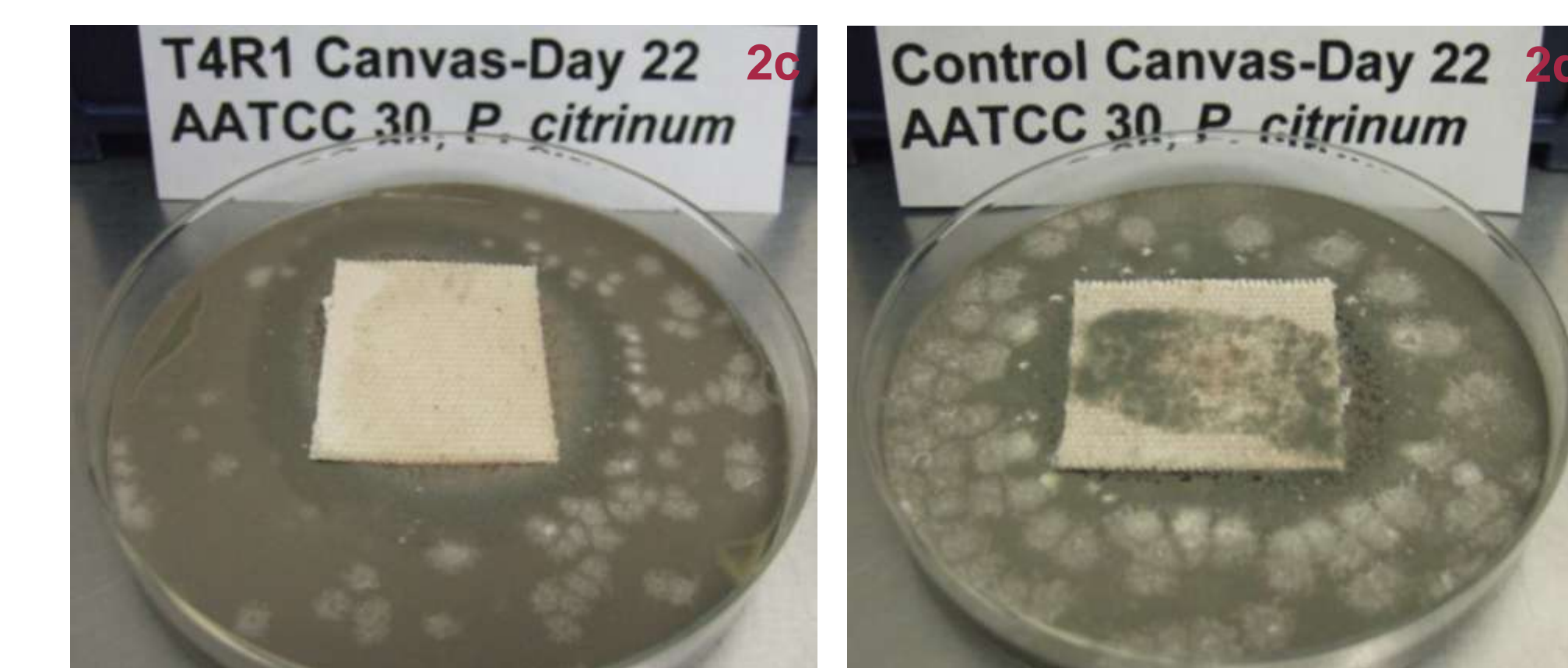
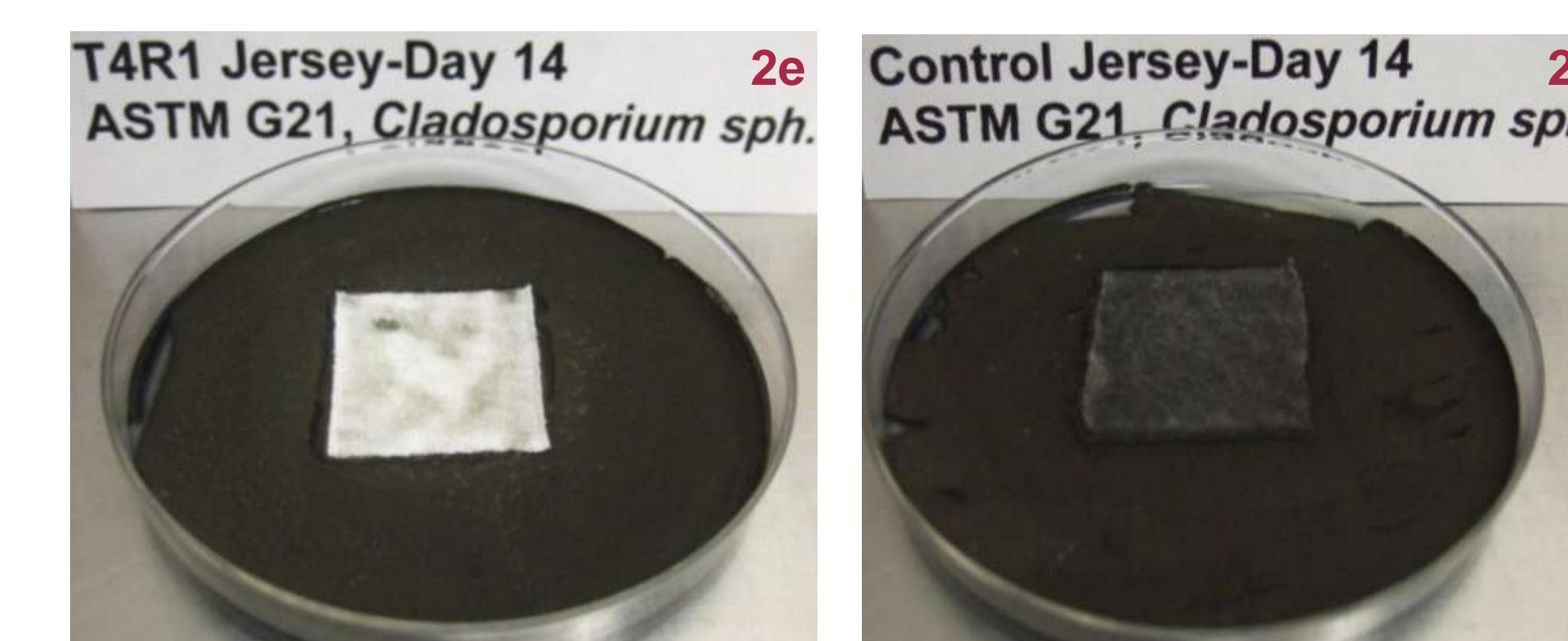


Figure 2: Images showing antifungal activity of Stay Fresh treated fabrics (always in left column) compared to identically tested controls (right column).

Figures 2a and 2b show treated and control canvas tested against *Aspergillus niger* on agar plates per AATCC method 30 (test method 3).



Figures 2c and 2d show Stay Fresh treated canvas 8 days into AATCC method 30 test, compared to overgrown control canvas, testing against *Penicillium citrinum*.



Figures 2e (Stay Fresh treated) and 2f (untreated control) show cotton jersey after 14 days, tested per ASTM G-21 method using *Cladosporium sph*.

Antifungal test methods. Stay Fresh™ treated materials (both canvas and cotton jersey were tested) were assessed using fungal species shown, by AATCC method 30 (lawn spread of fungus on growth plate) and ASTM G-21 (direct inoculation of fungus onto textiles on growth plate).

Reference Information

*Infection Control Today, Bacterial Contamination of Surgical Scrubs and Laundering Mechanisms: Infection Control Implications, C Twomey, H Beitz, and H Johnson, <http://www.infectioncontrolday.com/article/s/bacterial-contamination-of-surgical-scrubs.html>.

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