



Antimicrobial textile treatments can prevent unsightly discoloration caused by interactions between bacteria and perspiration. Image Source: Unsplash user Michael

Two years ago, the MIT Media Lab's Tangible Media Group, New Balance, and The Royal College of Art teamed up to do something remarkable; make bacteria attractive. The cohort designed a line of clothing – called Second Skin – infused with the *bacillus subtilis natto* bacterium. Wired Magazine explains that the natto bacterium “expand and contract depending on the amount of humidity in the air – the more humidity present, the bigger the bacteria get.”<sup>1</sup> This expansion opens up air vents within the clothing, allowing for increased breathability as the wearer becomes active and perspires. “By printing natto cells onto a biofilm, then printing that biofilm onto spandex fabric, scientists can control exactly how the fabric will behave,” says Anna Green of *Mental Floss*.<sup>2</sup> The result is a lineup of garments as innovative as they are beautiful.

But as forward-thinking as Second Skin is, most microbes found on clothing aren't quite as useful. In fact, they can be dangerous, as fabrics act as a convenient transportation service for dangerous microbes like *Staphylococcus*, which can lead to a number of serious illnesses in both humans and animals. But even benign living organisms found on textiles can have undesirable effects like unsightly discoloration, including underarm yellowing and the infamous ring-around-the-collar. As such, a growing number of clothing manufacturers are now introducing antimicrobial treatments to their textiles, minimizing or eliminating bacterial proliferation. Spectrophotometers are playing a vital role in the development of these new antimicrobial technologies, helping to protect health and safety while minimizing unwanted color shifts.



Antimicrobial textile treatments are particularly valuable for the healthcare environments to protect health and safety. Image Source: Pexels user Pixabay

### The Growth of Antimicrobial Textile Treatments

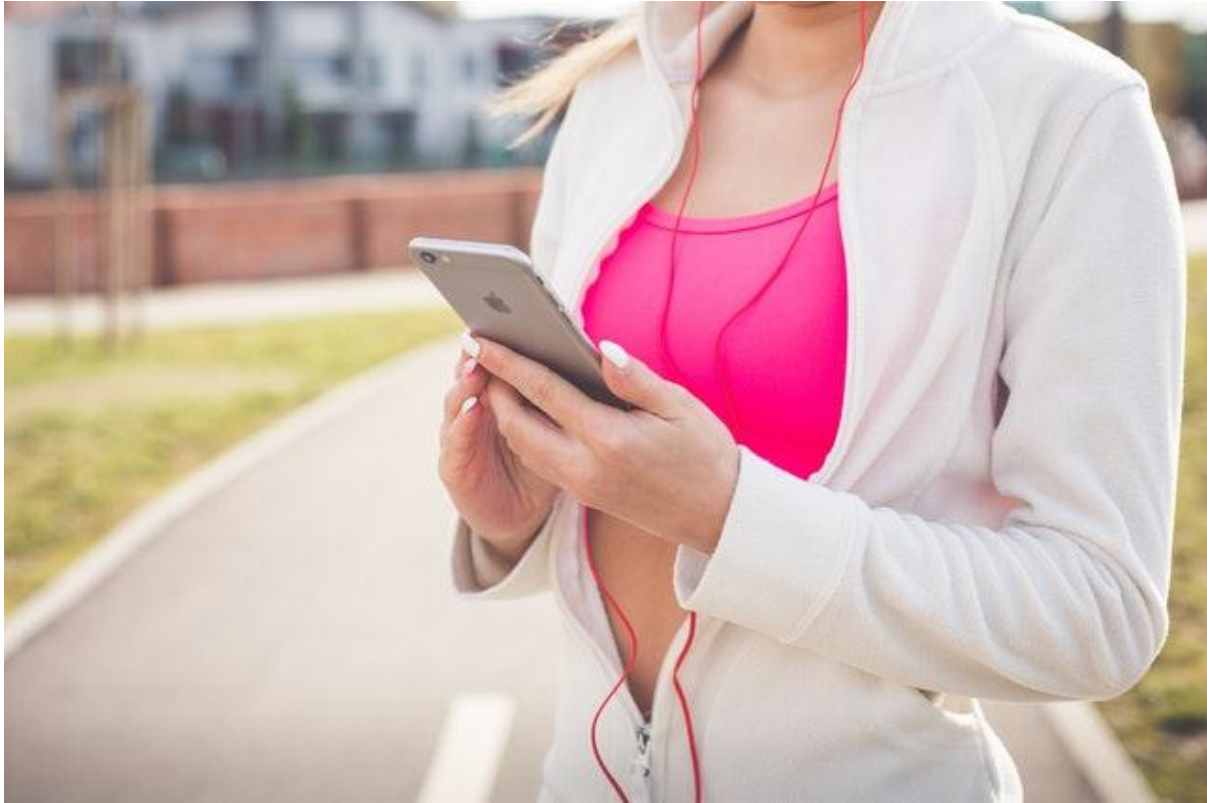
The interactions between bacteria, textiles, and the human body can lead to unappealing discoloration in all types of fabrics and garments. While antimicrobial treatments are particularly valuable in healthcare environments, even everyday consumers stand to benefit from improved antimicrobial technologies. This is especially true when it comes to clothing regularly exposed to heat, humidity, and perspiration. “Sweat is normally colorless but might turn a yellowish color due to interaction with bacteria on your clothing,” explains Katherine Mariaca of *Livestrong*.<sup>3</sup> As such, [athletic apparel](#), socks, and underwear are often at the forefront of antimicrobial textile innovations. In fact, antimicrobial treatments are now a standard feature in high end sportswear products, as consumers seek higher quality items that will resist undesirable color shifts and odors.

### Evaluating the Performance of Antimicrobial Textile Treatment in Use

The majority of antimicrobial textile treatments are solutions applied to fabrics after the dyeing process is complete to “control the growth of microbes by various mechanisms ranging from preventing cell reproduction, blocking of enzymes, reaction with the cell membrane to the destruction of the cell walls and poisoning the cell from within.”<sup>4</sup> The minimization or elimination of microbial growth means that there is nothing for perspiration and other environmental factors to interact with in order to cause discoloration, effectively stabilizing textile color and extending the life of the garment. These treatments must be safe and durable, standing up to washing, drying, and everyday wear without disrupting aesthetic quality.

While measuring the number and kind of microbes found in antimicrobial textiles is the primary mode of efficacy investigation, a separate evaluation process must occur to determine the color stabilization effects of antimicrobial treatments. Spectrophotometers are ideal instruments for this

evaluation process, owing to their ability to [accurately capture color data of all fabric types](#) using objective parameters that go beyond the unreliable human eye. By spectrophotometrically measuring the color of the textile after exposure to environmental stressors such as heat, humidity, perspiration, and laundering and comparing it to a baseline measurement, you can identify and quantify color shifts. This information can then be used to fine-tune formulations and optimize color stabilizing effects.



Antimicrobial textile treatments can cause undesirable color shifts, particularly yellowing in white and light-colored fabrics. Image Source: Pexels user jumbopic.com

#### Evaluating the Effects of Antimicrobial Treatments on New Textiles

Although the purpose of antimicrobial treatments is partially to prevent discoloration when the garment is in use, they can also cause inherent color shifts upon production, particularly in white and light-colored garments. Silver-based treatments are known for yellowing, for example, compromising aesthetic appeal in individual garments while potentially causing color disharmony within a clothing line. This is especially true when the line is comprised of a number of different fabric types, which may interact with the treatment in different ways.

Spectrophotometers allow you to [precisely monitor color behavior](#) caused by the introduction of antimicrobial textile treatments to determine which treatments are best suited for your purposes. Certain types of antimicrobial treatment may require additional stabilizing agents to counteract the yellowing effects of the primary agent. For example, researchers employed a spectrophotometer to determine that chitosan (CS) and montmorillonite-dihydroxy ethylene urea (MDEU) “increased the [whiteness index values of cotton fabrics](#) treated with KSF containing different silver concentrations.”<sup>5</sup> 1,2,3,4-butanetetracarboxylic acid (BTCA) has also been found to prevent color variation in cotton fabrics treated with colloidal nano silver.<sup>6</sup> Such findings are invaluable to perfecting treatment processes and creating textiles that perform aesthetically as well as they do

functionally. Because spectrophotometers allow you to accurately correlate process variables with color behavior, you can easily tailor formulations to meet your exact requirements.

HunterLab Innovation

HunterLab has been at the forefront of color measurement innovation for over 60 years. Today, we offer a comprehensive lineup of [portable, benchtop, and in-line spectrophotometers](#) to suit the unique needs of the textile industry. When combined with our [customizable color software packages](#), our instruments offer the highest level of insight into textile color behavior possible, allowing you to perfect formulations and processes. [Contact us](#) to learn more about our renowned technologies and let us help you select the right spectrophotometer for your purposes.

1. "This Living Clothing Morphs When You Sweat", October 28, 2015, <https://www.wired.com/2015/10/this-living-clothing-morphs-when-you-sweat/>
2. "Living Clothing That Responds To Your Sweat", October 30, 2015, <http://mentalfloss.com/article/70575/living-clothing-responds-your-sweat>
3. "What Are the Causes of Yellow Perspiration?" March 3, 2017, <http://www.livestrong.com/article/107724-causes-yellow-perspiration/>
4. "Antimicrobial Performance of Cotton Finished with Triclosan, Silver and Chitosan", August 27, 2015, <https://link.springer.com/article/10.1186/s40691-015-0040-y>
5. "Development of Antimicrobial Cotton Fabric Using Bionanocomposites", December 2013, <https://link.springer.com/article/10.1007/s10570-013-0057-6>
6. "Durable Antibacterial and Cross-Linking Cotton with Colloidal Silver Nanoparticles and Butane Tetracarboxylic Acid Without Yellowing", January 2012, <http://www.sciencedirect.com/science/article/pii/S0927776511005388?via%3Dihub>