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Discovery of Novel Antimicrobial Fabrics

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As the earth's population continues to increase, the dangers of disease transmission are also increasing. One example of this is hospital acquired infections, which are diseases that patients pick up once they are inside a healthcare setting. These account for up to 100,000 deaths in the US each year and a primary way they are spread is through contaminated fabrics, everything from a doctors coat to the pillow on a patients bed. In this light, my research aims to develop new low-cost antimicrobial fabrics that can self-disinfect and help limit the spread of these diseases.

To do this this, we need an antimicrobial material we can coat directly onto conventional fabrics like cotton and polyester. My background is in chemistry, so I began by looking at the synthesis of our target material. But, if we want something that's realistic for everyday use, we also need to consider this project from both an engineering and biology point of view. Our fabrics need to remain durable and strong after being chemically treated, while still being breathable and comfortable if someone is going to wear them or slept on them. We also need our fabrics to be effective at killing viruses and bacteria while being non-toxic to humans and to ecosystems. So, we need to simultaneously consider this project all three of these disciplines, and allow these disciplines to interact and balance each other.

Towards this goal, the antimicrobial material I synthesized is a liquid silicone polymer. This polymer is covered in amine molecules that are really effective against the kinds of bacteria that might cause infections. But it's not really practical to put a liquid material directly onto clothing. I developed a new chemical reaction that uses light and oxygen, both readily available, to convert this liquid polymer into a crosslinked elastic solid so now we can take cotton fabric, dip it into this solution and after one hour of shining light on it, it becomes a dry, durable, coating that's tightly bound to the cotton surface. This whole procedure is low cost, it's non-toxic, and it's highly scalable. Because we're working with flexible silicone there's no change to the fabric's mechanical properties after being treated. And, we've already demonstrated that our treated fabrics have more than 99% effectiveness against the kinds of antibiotic resistant bacteria that are a huge danger in hospitals.

In conclusion, its my hope that by continuing with this multidisciplinary research we can help limit the spread of deadly diseases in hospitals by deploying antimicrobial fabrics that are practical, effective, and responsible. Thank you.