New Anti-Microbial Paint for the Air Duct Systems of Hospitals

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Introduction

The CDC estimates that 2 million people in the U.S. are infected every year by hospital-acquired infections, resulting in over 23,000 deaths annually (1). The use of antibiotics in the past has led to short term solutions that are then revoked by the mutation of existing bacteria into antibiotic-resistant bacteria, creating a repetitive cycle with no effective solution (2). The use of an alternative method would then result in a more efficient solution. One primary source of infection within public health settings is the attachment of bacteria to surfaces of synthetic materials that we interact with very often (3,4,5). Therefore, a solution that acts in these surfaces over a long period of time is of major importance.

Goal

The goal is to create an anti-microbial paint that will attract and destroy pathogenic microbes in the air for applications in the air ducts of hospitals, to reduce the number of hospital acquired infections.

Hypothesis

Our hypothesis is that if we test the four methods, we believe that the most effective one will be the the Silver-DNA combination because it is a combination of two of the more effective methods of killing bacteria, and even after one of them no longer will become functional, the other will still be taking effect long after.

Objective

To synthesize materials that naturally attract bacterial spores via electrostatic interactions. Bacteria has been shown to be attracted to positively charged materials via electrical charges (coulombic charges), therefore we will prepare positively charged polymers with long-distance attraction to bacteria. To develop materials that destroy bacteria and viruses on contact. For this objective, we will experiment the use of silver ions on the high-surface area pigments, the use of DNA materials with their bacterial-disruption properties, and the use of titanium oxide with their light-induced production of radicals. To study the antimicrobial properties of the paint nanocomposite against three bacterial strains: E-coli, salmonella, and MRSA.

References/Work Cited

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Methods

Since ancient times, silver has demonstrated to have antibacterial properties, preventing the growth of bacteria in its surface (6,7). DNA, on the other hand, provides a very effective way to kill already existing bacteria, but lacks the long lasting effect that many other substances have. The combination of the two would result in the most effective way to combat bacteria in common surfaces, as DNA would rid existing bacteria from surfaces while the silver compound will prevent it from growing in the future. The ionization of the silver will also provide a very practical function, which is to attract bacteria in surrounding areas, as the cell wall of bacteria has been found to have a negative charge and the solution will act as a magnet to bacteria (8). Another method would be to use Titanium Dioxide in the solution, as it is self-cleaning (9).Titanium Dioxide is photo-activated, meaning that it needs light in order to help with killing bacteria.

Significance

The reason we are doing this in the first place is because of the fact that illness could be around any corner, waiting to strike people when they are most vulnerable. By creating a solution that can effectively make any building environment clean and safe from bacteria, this product will make the world a healthier place, specifically by killing more harmful, dangerous bacteria that threatens the health of many people.