The Synergistic Effects of Silver Nanoparticles and Antibiotics on Drug-Resistant Bacteria

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Over time, antibiotics have become less efficient as a method to combat bacterial infections due to growing antibiotic resistance. New classes of antibiotics are constantly being developed to combat this issue, but they do not provide a definitive solution for antibiotic resistance. This lab conducted an investigation of the synergistic effects of antibiotics and silver nanoparticles on drug resistant bacteria. Drug resistance was a characteristic developed in an non-virulent strain of E. coli by playing evolutionary stress on the strain using ampicillin, making the strain also resistant to other beta-lactam antibiotics, such as penicillin and amoxicillin. Different concentrations of the minimum inhibitory concentration of differing antibacterial agents were applied to the bacteria, including ampicillin, silver nanoparticles, and ampicillin-coated silver nanoparticles. The growth of the bacteria was measured using qualitative and quantitative methods, through observation and a luciferase assay. A disk diffusion test was utilized to determine the minimum inhibitory concentration of each antibacterial agent. Toxicity tests were carried out on the antibacterial agents through an in vitro study on liver slices. The ampicillin-coated silver nanoparticles showed the lowest yield of cell growth, the lowest measured minimum inhibitory concentration, and a much lower cytotoxicity than silver nanoparticles and deemed as the most effective antibacterial agent. This was likely due to the high enhancing effects of the different agents due to the different mechanisms used to combat bacteria. This research provides an avenue for future research as it presents a new perspective to the age-long issue of antibacterial resistance.