EFFECT OF AN ELECTRIC BIAS ON THE ANTIBACTERIAL PROPERTIES OF AG-GQD NANOCOMPOSITES

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Ag-Graphene nanocomposite solution exhibits antibacterial activity against both Gram positive and Gram Negative bacteria. The functionalization of this Ag-Graphene nanocomposite with polyethylene glycol provides stabilization and higher solubility in aqueous solution. The Ag-Graphene nanocomposite was characterized by UV-Vis spectroscopy, transmission electron microscopy (TEM), Raman spectroscopy, X-ray photoelectron spectroscopy (XPS), field emission scanning electron microscope (FE-SEM) coupled with energy dispersive spectrometry (EDS), and Fourier transform IR spectroscopy (FT-IR). The antibacterial property of this nanocomposite was previously tested by Kirby-Bauer assay disk diffusion and Minimum Inhibitory Concentration (MIC) assay using Pseudomonas aeruginosa and Staphylococcus aureus as model strains for both types of bacteria. We hypothesize that by applying and external electric bias; a decrease in the bacterial inhibition time (less than 6 hrs.) can be attained. Gram positive and negative bacteria cell wall differ greatly in structure; therefore concentrations of the Ag-GQD solution will vary for both types of bacteria. The success of this method allows us to propose a mechanism that describes the bactericide effect in terms of the ion transport between the solution and the time exposed to the bacteria cell wall. Preliminary data from this method suggests a significant difference in terms of decreased bacterial growth between control and experimental groups treated with the bias electrical field. As expected, the concentration of Ag-GQD had to be different between strains due to their cell wall composition and different interactions between the Ag ions and the negatively charged proteins in their cell wall. Taking advantage of the high biocompatibility of graphene and the antibacterial activity of silver, the Ag-GQD nanocomposite becomes an effective nontoxic biomaterial suitable for numerous applications, such as self-sterile textiles, biomedical devices, coatings, and cosmetics.

Keywords: Electroporation, Ag-Graphene Quantum Dots (Ag-GQD), Electric Bias

References:

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