The Effects of Photo-Activated Graphene Quantum Dots on Bacterial Deactivation

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With the growing levels of anti-bacterial resistant pathogens spreading in society, new forms of treatments and therapies are needed to effectively deactivate bacteria. A biocompatible photodynamic therapy agent that generates a high amount of singlet oxygen with high water dispersibility is desirable to increase effectiveness of the therapies. In this work, a graphene-based biomaterial was produced as a less-toxic alternative to other photosensitizing agents. Methylene blue was used as a photosensitizer for comparison to evaluate the total effectiveness of the graphene in bacterial elimination. Graphene quantum dots (GQDs) were synthesized by irradiating benzene and nickel oxide mixture using nanosecond laser pulses. GQDs were prepared at different laser powers, wavelengths, and times. Atomic force microscopy (AFM), Raman spectroscopy, transmission electron microscopes, and scanning electron microscopes were used for characterization of GQDs. Results show that GQDs with size less than 10 nm with excellent photoluminescence property were obtained. Initial results show that photodeactivation of *E. coli* can be achieved with MB-GQD. The results of these studies can potentially be used to develop therapies for the eradication of pathogens in open wounds, burns, or skin cancers.