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Photodeactivation of pathogenic bacteria using methylene blue and graphene quantum dot ZACHARY THOMAS, KHOMIDKHODZHA KHOLIKOV, SAIDJAFARZODA ILHOM, SKYLER SMITH, WILLIAM CRADDOCK, ALI ER, Western Kentucky Univ — A biocompatible photodynamic therapy agent that generates a high amount of singlet oxygen with high water dispersibility and excellent photostability is desirable. In this work, a graphene-based biomaterial which is a promising alternative to a standard photosensitizers was produced and its efficiency compared to a standard photosensitizer, methylene blue. Graphene quantum dots (GQDs) were synthesized by irradiating benzene and nickel oxide mixture using nanosecond laser pulses. High-resolution transmission electron microscopy (HR-TEM) results show GQDs whose size less than 5 nm with very good water dispersibility were successfully obtained. UV-Vis spectra and photoluminescence spectra shows that GQDs have an absorption peak around 270 nm and maximum emission at 430 nm with the excitation wavelength of 310 nm. Deactivation of Escherichia coli (E. coli) a gram-negative bacterium with methylene blue and carbon nanoparticles was studied by irradiating with different wavelengths. The results show a significant decrease in the number of colony forming units of E. coli. Our results show that GQDs can potentially be used to develop therapies for the eradication of pathogens in open wounds, burns, or skin cancers.

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