Norfloxacin and IR-780 Iodide Dye Ionic Combination Drug and Near-Infrared Photothermal Therapy as a Dual Mechanism Antibacterial Treatment Against Escherichia coli

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Antibiotic resistance is a growing issue with many harmful impacts on individuals and society as a whole, and one major cause of this is medical nonadherence regarding periodical prescriptions. Solutions must be sustainable, consistent, and not require aspects that cause further resistance to antibiotics. The purpose of this experiment is to solve this issue by creating an ionic combination drug and utilizing photothermal therapy. The ionic combination drug combines the anionic norfloxacin and the cationic IR-780 dye, a photosensitizer that allows for photothermal therapy to occur. Photothermal therapy involves shining a near-infrared light on the bacteria and treatment, which then inhibits bacteria through the generation of heat. The hypothesis for this experiment is that this dual mechanism treatment will decrease the amount of bacterial growth compared to other treatments. The procedure for this experiment included creating the ionic combination drug. Then, 5 treatments were tested in 96-well plates: norfloxacin alone; IR-780 dye alone; the ionic combination drug; IR-780 dye + photothermal therapy; and the ionic combination drug + photothermal therapy. The ionic combination drug + photothermal therapy treatment had the highest average inhibition % regardless of concentration, thus the hypothesis was supported by the data and it was determined the most effective treatment. The results also suggest that this treatment is reliable and does not require a large concentration. Thus, it has the potential to play a major role in the fight against antibacterial resistance.

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