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Functionalized graphene oxide for significantly enhanced antibacterial activity of Cephalexin

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Introduction & Aim: Cephalexin, an antibiotic in cephalosporin family is used to treat respiratory tract, middle ear, skin and urinary tract infections. It has a relatively low solubility in water and significant instability at physiological pH. The bioavailability of oral cephalexin tablets decreases due to antimicrobial resistance therefore to maintain its therapeutic level drug administration has to be repeated 3-4 times per day in order to obtain the effective therapy. The purpose of this study is to develop a controlled release system for cephalexin using functionalized Graphene Oxide (GO) to enhance the drug bioavailability with lower doses.

Methodology and Theoretical Orientation: GO made by a modified Hummer's method starting from Sri Lankan vain graphite, was functionalized with a branched polyethylene glycol (PEG) to improve the solubility of GO in various physiological solutions. Loading of cephalexin onto Pegylated GO (GO-PEG) was carried out by stirring overnight with different amounts of cephalexin (0.02 mg to 0.2 mg) with GO-PEG at a GO concentration of (0.2 mg/ml) in deionized water. The pegylation and loading of cephalexin into GO-PEG were characterized using FTIR spectroscopy, Raman spectroscopy, UV-Visible spectroscopy, thermogravimetric analysis. The release characteristic of cephalexin from PEG-GO composite was monitored in pH 7.4 buffer at 37 °C for 4 days. The antibacterial activity of GO-PEG and cephalexin loaded GO-PEG was examined by determining % inhibition of 4 bacterial strains; two Gram negative (*Escherichia coli, Pseudomonas aeruginosa*) and two Gram positive (*Bacillus cereus, Staphylococcus aureus*).

Findings: The initial burst release followed by sustained release up to 96 hours proved the controlled release of the drug. After 24 hours, both GO and GO-PEG-cephalexin had an inhibitory action on each selected bacterial strains at very low concentrations when compared to free cephalexin.

Conclusion & Significance: GO can significantly increase the antibacterial activity of cephalexin. Lower MIC value can be obtained with cephalexin loaded composite with respect to free cephalexin.

Biography

Nuwanthi P Katuwavila has her expertise in improving the bioavailability of bioactive components for drug and cosmetic based applications. She has developed a controlled release system for the drug Doxorubicin using biopolymers (chitosan and alginate) and a potential iron delivery system with alginate nanoparticles. Presently she is working with graphene oxide to develop it as a potential carrier system for several drugs.

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