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Adsorption of malachite green dye on graphene oxide nanosheets from aqueous solution: Kinetics and thermodynamics studies

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In this study, graphene oxide (GO) nanosheets have been synthesized and characterized using different spectroscopic tools such as X-ray diffraction spectroscopy, infrared Fourier transform (FT-IR) spectroscopy, BET specific surface area and Transmission Electronic Microscope (TEM). The prepared GO was investigated for the removal of malachite green, a cationic dye from aqueous solution. The methods of removal of malachite green were carried out via adsorption process. GO nanosheets can be predicted as a good adsorbent material for the adsorption of cationic species. The adsorption of the malachite green onto the GO nanosheets has been carried out at different experimental conditions such as adsorption kinetics, concentration of adsorbate, pH, and temperature. The kinetics of the adsorption data were analyzed using four kinetic models such as the pseudo first-order model, pseudo second-order model, intraparticle diffusion, and the Boyd model to understand the adsorption behavior of malachite green onto the GO nanosheets and the mechanism of adsorption. The adsorption isotherm of adsorption of the malachite green onto the GO nanosheets has been investigated at 25, 35 and 45 °C. The equilibrium data were fitted well to the Langmuir model. Various thermodynamic parameters such as the Gibbs free energy (ΔG°), enthalpy (ΔH°), and entropy (ΔS°) change were also evaluated. The interaction of malachite green onto the GO nanosheets has been investigated by infrared Fourier transform (FT-IR) spectroscopy.

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Decoration of silica-based mesoporous nanoparticles with PEG and folic acid via disulfide bond for controlled doxorubicin delivery

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Porous nanosilica (PNS) applied for drug controlled release have attracted more and more scientists due to their ordered large pore volume, high chemical and thermal stability, excellent biocompatibility, and versatile chemistry. Moreover, PNS is composed of highly ordered porous structures with uniform but adjustable pore size, which make it an excellent candidate for accommodating guest molecules, to provide a physical encasement that can protect the entrapped drugs from degradation and denaturization. However, the loading bioactive molecules would burst release from the unmodified PNS, and could not release in a controllable manner to precisely match the actual physiological needs at the proper time/site. Here, self-assembly folic acid-poly(ethyleneglycol)-adamantylamine (FA-PEG-ADA) functionalized PNS was fabricated by host-guest inclusion with cyclodextrin (CD) which modified on PNS via disulfide bond for targeted and controlled doxorubicin (DOX) delivery. The PNS prepared by so-gel method was formed with spherical shape and an average diameter of 40 nm determined by TEM. The drug loading efficiency and drug loading content of PNS-PEG/DOX were 51.4 ± 5.7% and 18.2 ± 1.3%, respectively. The release test showed that there were significant time prolongations of DOX release from the PNS-PEG/DOX compare to PNS/DOX and a considerable amount of DOX was released from PNS-PEG/DOX after glutathione treatment. The MTT assay indicated that PNS was a biocompatible delivery vehicle which reduces the cytotoxicity of DOX. Furthermore, FA functionalized on PNS exhibited higher cellular uptake than unmodified particles. The results indicated that such PNS-CD/DOX/PEG have great potential as a novel drug delivery system for cancer therapy.

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