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# Development of sand/graphene composite and its application for MCPA pesticide adsorption from water

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This research endeavours to synthesize a novel adsorbent, sand/graphene oxide composite (M-GO/S), achieved through the iterative deposition of graphene oxide layers on river sand employing a thermal annealing process. Scanning electron microscopic (SEM) and Fourier-transform infrared spectroscopy (FT-IR) characterization studies revealed the presence of a non-uniform graphene oxide coating on the surface of the sand and the incorporation of oxygenated functional moieties within the structure. Comparative evaluations show the heightened adsorption capacity of this new composite entity with alternative sorbent materials, such as activated carbon, graphene oxide, and sand to adsorb neutral 2-methyl-4-chlorophenoxyacetic acid (MCPA) pesticide molecule. To analyse the MCPA adsorption parameters, High-performance liquid chromatography (HPLC)was used (Solvent mixture - Acetonitrile: Distilled water (1:1); Flow rate - 1.5µLmin-1; Wave length - 275nm). The retention time for the MCPA was reported as 1.538s. The optimization studies and adsorption modelling were carried out, focusing on the adsorption of MCPA onto the M-GO/S. Accordingly, the optimum concentration, dosage, and contact time were 75 mg/L, 0.05 g, and 105 minutes respectively, at neutral pH values. The investigation of adsorption equilibrium isotherms has highlighted the Freundlich model's (multilayer adsorption) superior explanatory capacity in characterizing the adsorption phenomenon. Concurrently, the analysis of adsorption kinetics has demonstrated a favourable fit with the pseudo-second-order model (with a correlation coefficient denoted as 0.9754), implying a prevailing chemical sorption mechanism underlying the adsorption process. Although MCPA possesses either neutral or negatively charged (upon dissolution) surfaces, the M-GO/S composite exhibits significant adsorption capability towards MCPA. Consequently, the synthesized composite emerges as a viable candidate for effectively mitigating MCPA pesticide contamination from water.

**Keywords:** Adsorption, Graphene oxide, Kinetics, Sand, Pesticide

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