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Characterization of sorption efficiency of graphene oxide and quartz with heavy metals

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Groundwater contamination sources are ubiquitous, with the heavy metal ion lead being released to the aquifer systems as a common anthropogenic contaminant. Lead can cause serious damage to both human and ecosystem health. In this sense, its remediation through sorption technologies, such as Permeable Reactive Barriers (PRBs), is basic to minimize its impact. Quartz as the most common and economically heavy metal adsorbent has been widely studied. However, the new generation of potential adsorbents, here including graphene oxide (GO), has not been fully researched. Particularly, there is little research on how to set surface adsorption models of GO, with most studies limited to batch and transport experiments.

The main objective of this study is to investigate the adsorption of lead ions by quartz and GO as adsorbents. Batch experiments were designed to characterize sorption capacities of both sand and GO under different conditions, such as contaminant and adsorbent concentration, pH, competing ions, and contact time. Experiments were validated with a surface complexation model coupled to precipitation developed with the code Phreeqc, incorporating all the main and secondary geochemical reactions. The findings from the batch experiments will also be used as calibration data for the Phreeqc model, and the code (PEST) were used for parameter estimation. The data fit and accuracy will be analyzed by means of a sensitivity analysis. Additionally, the relationship between the active sites on the adsorbents and the contaminants will be explored, as well as the adsorption potential of the adsorbents as PRBs fillers.