

Efficient removal of lead from aqueous using hybrid graphite nanoflakes/mesoporous silica nanoparticles, amine functionalized mesoporous silica and graphite nanoflakes as adsorbents

ABSTRACT

Noxious heavy metal ions contamination has become a serious environmental problem nowadays. Among all the toxic heavy metal ions, lead(II) ion, is the most commonly encountered in industrial and agricultural wastewater and in acidic wash-away from landfills site. Hence, the removal of lead traces from the environment has gained a special concern due to their persistence. In this study, batch experiments were conducted to study the capability of hybrid graphite nanoflakes/mesoporous silica nanoparticles (GNP-MSN), amine functionalized mesoporous silica (NH₂-MSN) and pristine graphite nanoflakes (GNP) as adsorbents for removal of lead from aqueous. The influence of several parameters such as pH of the aqueous sample, amount of adsorbent, initial concentration of the lead(II) ions and contact time were examined to optimize the adsorption efficiency of the adsorbents under study. Lead(II) ion can be extracted at pH 4 from sample volume of 10 mL with concentration of 10 ppm by utilizing 10 mg of each respective adsorbent. The analysis of the sample was done by using Flame Atomic Absorption Spectroscopy (FAAS). Furthermore, GNP-MSN also has greatly reduced the aggregation of pristine graphite in water in which GNP-MSN is more easily to be removed from tested sample by centrifugation process compared to pristine graphite. In term of consistency and selectivity of the lead(II) ions removal, GNP-MSN show the highest efficiency since it is able to remove lead(II) ions with higher adsorption capacity (23.940 mg/g) compared to NH₂-MSN (9.230 mg/g) and GNP (1.113 mg/g). Based on kinetic study, both GNP and NH₂-MSN were best-fitted with pseudo-second order while GNP-MSN fitted well with pseudo-first order.

Keyword: Adsorption; Mesoporous silica nanoparticles; Graphite nanoflakes; Lead; Hybrid nanoparticles