Noncovalent assembly of maghemite- multiwalled carbon nanotubes for efficient lead removal from aqueous solution

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Maghemite embedded multiwalled carbon nanotubes (MWCNT) nanohybrids / nanocomposites were synthesized, characterized, and evaluated their applicability in the removal of Lead (Pb II) from aqueous solutions in batches magnetically. The nanohybrids were prepared using wet-chemical procedures and characterized by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), field emission scanning electron microscopy (FE-SEM), Zeta potential, and gas adsorption measurements (BET). Magnetic characteristics of maghemite –MWCNT nanohybrids were studied by Vibrating sample magnetometer (VSM).Effects of pH of the aqueous solution, contact time, adsorbent dosage, and agitation speed on the Pb removal were studied in detail and the parameters were optimized for near complete removal of Pb from the water. Kinetics rate and adsorption isotherms of the system were also studied. Repeated adsorption–desorption cycles conducted using samples isolated from a previous cycle demonstrated that the nanohybrid structures developed here could be used for a prolonged cycles.

References

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Figures

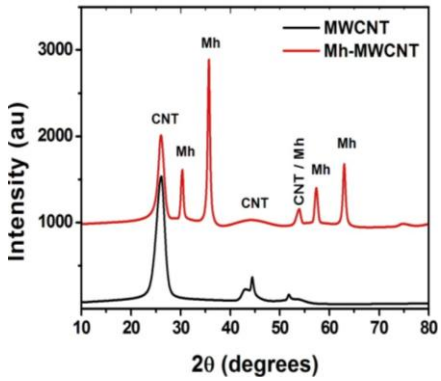


Fig. 1. X-ray diffraction of uncoated MWCNTs (black lined graph) and maghemite- coated MWCNTs (red lined graph) where Mh: Maghemite

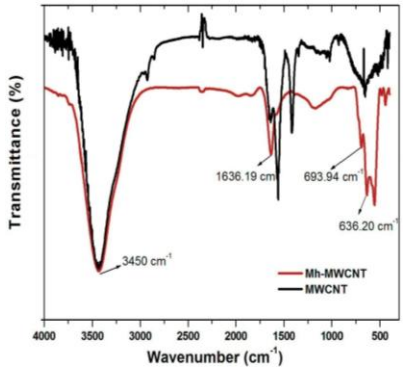
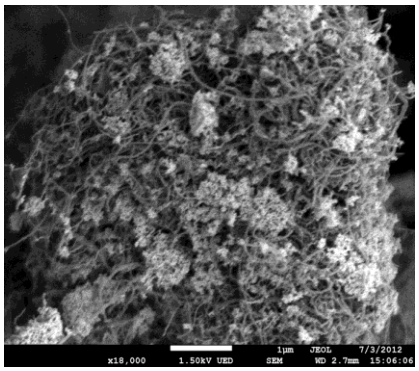
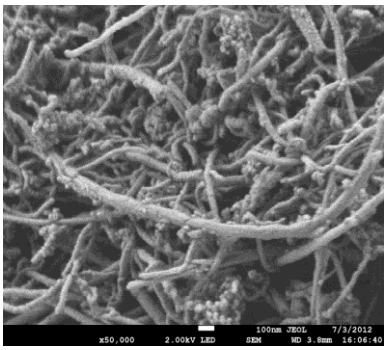


Fig. 2. FTIR Spectra of uncoated MWCNTs and Maghemite-coated MWCNTs.



(a)



(b)

Fig. 2. SEM images of MWCNTs/maghemite. (a) at lower magnification (b) at higher magnifications

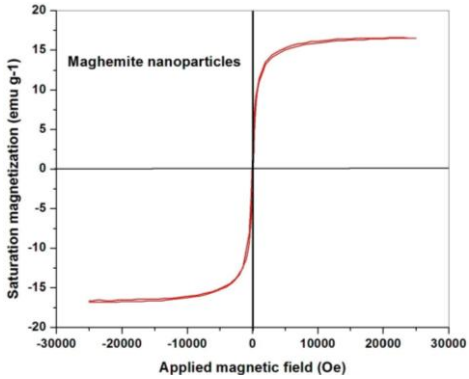


Fig. 5. Hysteresis loop of superparamagnetic maghemite nanoparticles

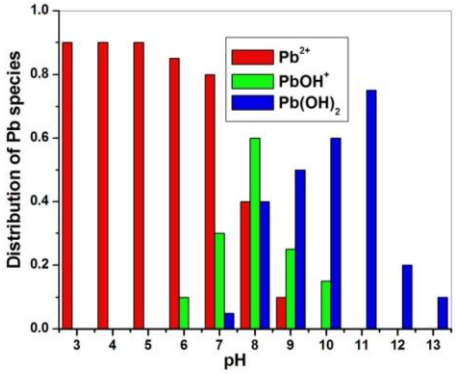


Fig. 6. Bar graph of Pb (II) species as a function of pH.

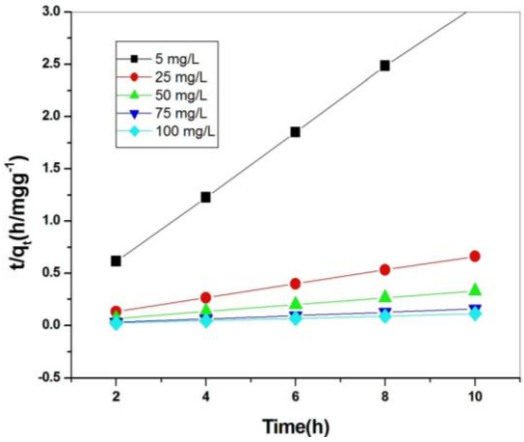


Fig. 11. Pseudo-second order sorption kinetics of Pb (II) on to MWCNT/maghemite composite at various initial concentrations.

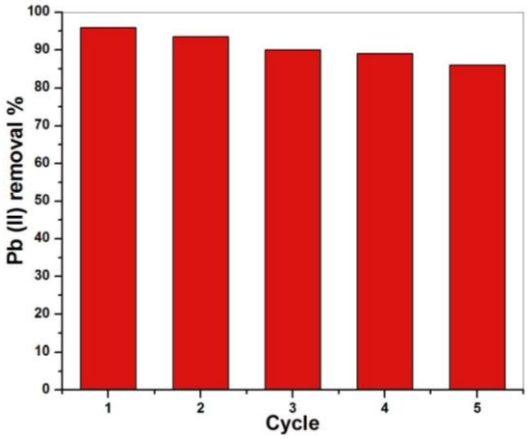


Fig.13. Removal capacities on recycling MWCNT/maghemite.

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