STABILIZATION OF ARSENIC IN MINE TAILINGS WITH NANO-SIZED ZERO VALENT IRON AND MAGNETITE[1]

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Abstract. The technology using nano-sized iron particles have received considerable attentions to remediate groundwater contaminated with toxic metals or metalloids. The present study applied surface-modified and nano-sized zero valent iron (nZVI) and iron oxides (magnetite) to stabilize arsenic in mine tailings. The nZVI was prepared through the iron reduction by sodium borohydride under nitrogen. The mixture solution of iron chloride and iron sulfate (2:1 of molar ratio) was adjusted to high pH with sodium hydroxide to produce iron oxide colloids. Anionic surfactant, sodium dodecyl sulfate (SDS), was added to the parent solution to modify the surface properties of iron colloids. Transmission Electron Microscopy (TEM) measured the size of nano particles; the nZVI was 50 – 100 nm and magnetite was 10 nm in diameter. Due to its smaller size, surface-modified magnetite penetrated into the sand column deeper than surface-modified nZVI. Surface modification enhanced the mobility of magnetite through the sand column (1.46 times higher in iron concentration at the effluent of sand column when compared with the unmodified magnetite). Leachability of arsenic by TCLP in mine tailings decreased from 1.12 mg L^{-1} to 0.29 mg L^{-1} by the amendment of magnetite, while nZVI reduced arsenic concentration in the leachate (0.54 mg L^{-1}) by 52.27 %. Arsenic adsorption with surface-modified magnetite followed Langmuir adsorption isotherm.

Additional Key Words: zero valent iron, magnetite, surface modification, arsenic, sabilization

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