

Use of acrylic based hydrogels for pre-concentration of trace level lead ions

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The analysis of ultra-trace level (ppb) lead requires either sensitive and expensive analytical instrumentation (GFAAS, ICP-MS etc) or extraction and preconcentration to higher levels (ppm) for analysis in relatively low cost instrumentation (FAAS or spectrophotometry). The adsorption of Pb(II) ions from aqueous solutions onto poly(acrylic acid-co-acrylamide) (PAAAM) hydrogels was investigated to assess the preconcentration potential of PAAAM for lead ions. Crosslinked copolymers of acrylic acid (sodium acrylate) and acrylamide were synthesized by free radical polymerization. The polymerization process was initiated by ammonium persulphate (APS). N,N,N,N-tetramethylethylenediamine (TMEDA) was used as an accelerator and N,N'-methylenebisacrylamide (MBA) was employed as a crosslinking agent.

The swelling ratio was found to be affected by the change in acrylamide (AM) content and ionic strength. The effect of acrylamide (AM) content in the copolymer hydrogel, pH, initial lead level, ionic strength and contact time on Pb(II) ion adsorption were investigated. With an increase in the content of acrylamide (AM) in PAAAM, the swelling ratio of PAAAM hydrogel decreased. The swelling ratio also decreased rapidly with the ionic strength at the room temperature. The acrylamide content and the ionic strength showed significant effect of Pb(II) adsorption on prepared hydrogel. The ability of the PAAAM hydrogels to bind Pb(II) ions was examined at different pH values and lead levels at room temperature. The maximum Pb(II) ion adsorption was observed in the pH range of 5 - 6. Variation of contact time of metal ion solution with PAAAM hydrogel showed that equilibrium was reached within first two hour time period.

The adsorption equilibrium data were better fitted by a Langmuir isotherm, while the adsorption kinetics was better described by the pseudo second order model at the room temperature. FT-IR spectra before and after adsorption of Pb(II) on PAAAM hydrogel was obtained to identify the possible functional groups responsible for the metal ion adsorption. Ultimately this study showed that the prepared poly(acrylic acid-co-acrylamide) (PAAAM) hydrogel can be used as a direct solid phase extraction tool to pre-concentrate Pb(II) ions in the range of 10-100 ppb to 2- 10 ppm.

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