

A method for fast evaluation of sorption and flow dynamics of trace toxic species in water by Continuous Flow Hydride Generation Atomic Florescence Spectrometry (CFHG-AFS)

Sad Ahamed and Abul Hussam*
Centre for Clean Water and Sustainable Technologies
George Mason University, Fairfax, VA 22030
ahussam@gmu.edu

Recently we have developed a Continuous Flow Hydride Generation Atomic Florescence Spectrometry (CF-HGAFS) for rapid evaluation of sorption and flow dynamics of trace arsenic in groundwater. The apparatus (Figure 1) and the developed manifold consist of a column (length 9.0 cm, dia 1.5 cm) packed with 1.0 g of the desired active material between two sand layers connected to sampling valve and a peristaltic flow system. The column outlet is mixed with acid and fed into the HGAFS for trace analysis. A typical dynamic sorption isotherm is shown in Figure 2. While a conventional batch experiment can take days to complete the isotherm, the system developed in our lab can be used to generate a complete isotherm in less than 100 minutes using only 1.0 g of the active material. It also takes much less reagent and the entire experiment is done under computer control. The isotherm shown in Figure 2 can be used to obtain solid/solution distribution coefficient, capacity of the sorbent, intra-particle diffusion coefficient and other parameters based on theoretical models. The present instrumental setup can be used to study chemical species containing As, Sb, Hg, and Bi at sub ug/L with detection limit of ng/L. The experience gained in developing the flow manifold in our lab can be used to study porous and semi-porous active materials, soil, concrete and any organic or inorganic species interfaced to AAS, ICP, and HPLC as the detector.

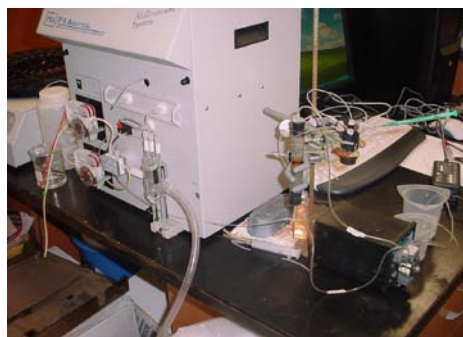


Figure 1. A Continuous Flow Hydride Generation Atomic Florescence Spectrometer (CF-HGAFS) is shown interfaced to a column and flow-manifold. The column contains 1.0 g of active material between two sand layers to mimic real filters in the field.

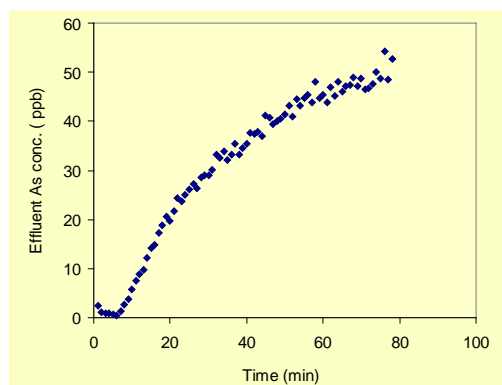


Figure 2. Dynamic sorption isotherm for 1.0 g of active material through which 300 ppb of As(III) passed at a flow rate of 1.5 mL/min. The effluent As(III) is shown in the ordinate. The estimated contact time with the active bed was 100 ms within which 99% of As(III) was removed.