

Adsorption Isotherm of Arsenic by Selected Soils

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INTRODUCTION

Arsenic concentration of groundwater poses a significant threat to human, land and agricultural sustainability in Bangladesh. It is reported that 61 districts out of 64 and about 60% of the land area of Bangladesh are affected by arsenic contamination (Joarder et al., 2001). Elevated concentrations of naturally occurring arsenic have also been reported in groundwater and soils of Bangladesh. The mobility and solubility of arsenic in soil solution largely depends on soil physical and chemical properties that influence adsorption-desorption processes. Because of widespread distribution and toxicity of arsenic, its adsorption behaviour is of great interest. The current study presents the results of adsorption behaviour of arsenic on some selected soils.

METHODS

An experiment was carried out with some soils to study adsorption isotherms of arsenic. Eight soils, 3 from Paba (designated as P-1, P-2 & P-3), 3 from Faridpur sadar (F-1, F-2 & F-3) and 2 from Sonargaon (S-1 & S-2) Upazilas, were used in this study. The soils had varied contents of clay, OM, As, Fe, P and S contents. The total arsenic status varied from 10.8 to 38.7 mg/kg. An amount of 0.5 g soil was sampled into a series of 60 mL polyethylene bottles. The arsenic solutions at varying doses viz. 0, 25, 50, 100, 200, 500, 1000 and 2000 µg/L (i.e. 0, 0.5, 1.0, 2.0, 4.0, 10, 20 and 40 µg) were added to the bottles and the final volume was made to 20 mL with de-ionized water. The samples were then stirred for 16 h using a horizontal shaker. The suspension was centrifuged at 5000 rpm for 15 minutes and the supernatant was filtered using a 0.45 µm membrane filter and stored at below 5° C for arsenic analysis. The soil remaining in the bottle was shaken with 20 mL of 0.2 M phosphate buffer for 24 h and then filtered again using a 0.45 µm membrane filter. The samples were run in triplicate. The amount of arsenic in the soil extract was assessed by FI-HG-AAS.

RESULTS AND DISCUSSION

The amount of arsenic adsorption varied from soil to soil. Soil F-1 and P-1 had the highest amount (70.6 mg/kg) of arsenic adsorption and soil P-3 had the lowest (49.1 mg/kg) (Fig.1a). The phosphate extractant removed 19 - 95 % adsorbed arsenic from the soils (Figs 1b, 2a & 2b). This amount is expected to be available for plant uptake. The variation in arsenic adsorption onto soils can be attributed to the variation in clay contents, the higher was the clay content, the higher was the adsorption. The extraction efficiency of phosphate buffer varied over the soils. The efficiency of arsenic extraction by phosphate buffer tended to decrease with increasing arsenic additions.

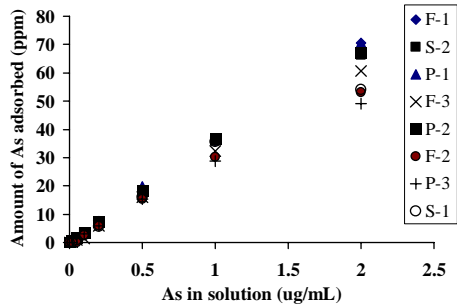


Fig. 1a Amount of As adsorbed by different soils

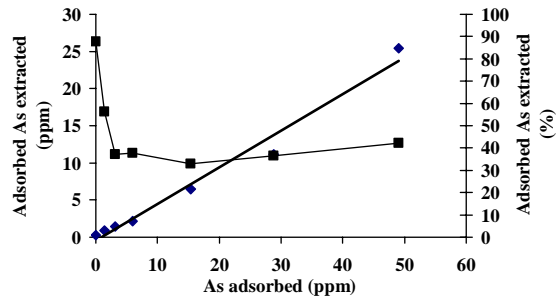


Fig. 1b Phosphate extractable As vs adsorbed As (soil P-3)

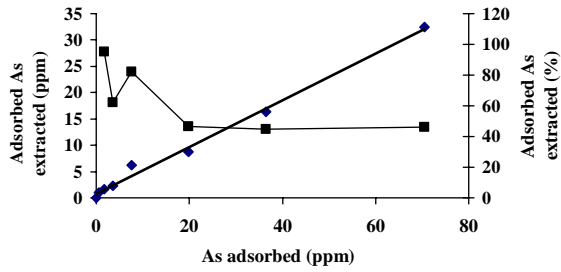


Fig. 2a Phosphate extractable As vs adsorbed As (soil P-1)

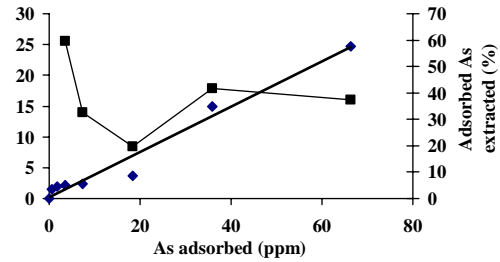


Fig. 2b Phosphate extractable As vs adsorbed As (soil S-2)

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Joarder, A.I., Rahman, M. Shahjahan, Salam M.A. and Asad, K.A. (2002) *In*. 4th International conference on arsenic contamination of ground water in Bangladesh: Causes, effect and remedy, Jan. 12-13, 2002, Dhaka.