Physicochemical Parameters Driving Arsenic Mobilization in Groundwater under Anthropogenic Influence

Mohd Musahib[1,2,#] and Abhas Singh[1,2]

[1]Department of Civil Engineering, Indian Institute of Technology Kanpur, India

[2]Environmental Geochemistry Laboratory, Centre for Environmental Science and Engineering, Indian Institute of Technology Kanpur, India

[#]Presenting author phone: +91-9068454690, email: musahib23@iitk.ac.in

Abstract

Despite extensive research on the mobilization and speciation of arsenic (As) in groundwater, local spatial heterogeneities in As prevalence remain poorly understood. The objective of this study was to assess whether recharge from a polluted surface water body (pond) could impact the heterogeneous distribution of As in underlying mixed oxic aquifers in a semi-urban site in Kanpur. A hydrological survey was conducted to understand the dynamics of the hydraulic gradient in the study area. Hydrochemical parameters and stable isotopes ($\delta^{2}H$ and $\delta^{18}O$) in groundwater and the pond were systematically monitored for one year. Further, groundwater and colloidal/solid samples were collected to evaluate the role of secondary precipitated solids/colloids on As speciation. Enriched isotopic signatures, elevated concentrations of nitrate, phosphate, and total organic carbon in shallower aquifer indicate higher surface water ingress and anthropogenic impact compared to the deeper aquifer. Hydrological measurements showed variations in groundwater levels and flow directions, which result in complex and spatially variable biogeochemical environments controlling the distribution of As species. Geochemical analysis of groundwater and characterization of colloids imply that the fate and transport of arsenic is impacted by solubility-driven secondary dissolution/precipitation of solids/colloids. This study will likely enhance current understanding of local variations in As distribution in polluted areas.