

Arsenic accumulation in agricultural fields and its relationship with cultivation practices and crop type

S. H. FAROOQ^{1,2,3*}, D. CHANDRASEKHARAM²,
W. DHANACHANDRA² AND S. NORRA³

¹School of Earth, Ocean and Climate Sciences, IIT -
Bhubaneswar, Bhubaneswar - 751013, India
(e-mail- hilalfarooq@iitbbs.ac.in)

²Department of Earth Sciences, IIT Bombay, Mumbai -
400076, India

³Institute of Minealogy and Geochemistry, KIT, Karlsruhe -
76131, Germany

Arsenic (As) contamination of groundwater is a major problem across the globe and Bengal delta plain is one of the worst affected areas. In Bengal delta, As contaminated groundwater is generally used for irrigation purpose which causes accumulation of significant amount of As in agricultural soils. The accumulation and distribution of As in agricultural fields vary with irrigation modes, soil mineralogy and crop types. The present study investigates current state and distribution pattern of As in upper soil-horizons (0-15 cm) of two agricultural fields cultivating different crops in Bengal delta plain. In the first field (F-1), different varieties of paddy crops are grown throughout the year without any provision of crop rotation, while in the second field (F-2), wheat crops are cultivated predominantly along with some other crops in the same year. The groundwater irrigating F-1 and F-2 fields contains 137 $\mu\text{g/L}$ and 67.3 $\mu\text{g/L}$ of As, respectively. Results indicate different levels of As accumulation in the two agricultural fields. Paddy cultivation requires flooded field condition and thus are pumped with four-times higher quantity of contaminated groundwater than the wheat fields. Such a practice leads to a supply of ~ 8 -fold higher (2X As concentration and 4X water quantity) As content to paddy field. Despite higher influx of As in paddy field, average As concentration in paddy soils is only 16.0 mg/kg which is $\approx 30\%$ lower than that in wheat field (22.5 mg/kg). In paddy field, decomposition of organic matter of previous crop under flooded condition generates a strong reducing environment causing mobilization of accumulated As from top-soils to lower depth and prevents its buildup in the top-soil horizon. However, in absence of flooded conditions and lesser availability of organic matter in wheat field, As mobilization is prevented and a major fraction of accumulated As remains in upper-soils. The study highlights that accumulation and distribution of As in agricultural soils not only depends on As concentration in irrigation water and the quantity of water supplied to agricultural fields but also on the agricultural practices and crop type.