

Accepted Manuscript

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PII: S0045-6535(18)30366-7

DOI: [10.1016/j.chemosphere.2018.02.154](https://doi.org/10.1016/j.chemosphere.2018.02.154)

Reference: CHEM 20912

To appear in: *ECSN*

Received Date: 27 October 2017

Revised Date: 23 February 2018

Accepted Date: 25 February 2018

Please cite this article as: Mushtaq, N., Younas, A., Mashiatullah, A., Javed, T., Ahmad, A., Farooqi, A., Hydrogeochemical and isotopic evaluation of groundwater with elevated arsenic in alkaline aquifers in Eastern Punjab, Pakistan, *Chemosphere* (2018), doi: 10.1016/j.chemosphere.2018.02.154.

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Hydrogeochemical and Isotopic Evaluation of Groundwater with Elevated Arsenic in alkaline Aquifers in Eastern Punjab, Pakistan

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Abstract

Geochemical investigation was carried out for delineating factors responsible for the mobilization of arsenic (As) from aquifer material into the groundwater. Four sites along Ravi River, (Samada, Sarai Chimba, Kot Maiga and Chah Fatehwala), were selected based on the blanket survey. Groundwater-rock interaction and evaporation were the key phenomena controlling groundwater chemistry, as shown by the hydrogeochemical data. Groundwater was predominantly Na-Cl type, with other principle facies being Na-HCO₃, Na-Ca-HCO₃ and Ca-Mg-Cl. The groundwater As concentration ranged between below detection level (2 µg/L) to 548 µg/L with 59 % samples exceeding the World Health Organization (WHO) guidelines for As in drinking water (10 µg/L) and 31 % having higher concentrations than the National Environmental Quality Standard (NEQS, 50 µg/L). Moderate to high concentrations of SO₄⁻² averaged at 244 mg/L and moderate NO₃⁻ concentrations averaged at 8 mg/L, together with alkaline pH (7.3-8.8) and high Eh values (113-402 mV) suggest partial oxidizing nature of the aquifers. The values for δ¹⁸O and δ²H in groundwater varied between -9.14 to -5.51‰, and -56.57 to -39.5‰ respectively, and suggests meteoric origin of the groundwater with some evaporative loss. This effect could be partly responsible for

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