WATER CHEMISTRY OF NATURALLY OCCURRING ARSENIC IN GROUNDWATER OF THE SUBURBAN AREAS OF COCHABAMBA-BOLIVIA AND TECHNICAL FEASIBILITY EVALUATION OF ARSENIC REMOVAL PROCESSES

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ABSTRACT

This study deals on a hydro-chemical interpretation of groundwater samples from 18 deep wells located in the west suburban area of Cochabamba, Bolivia. We also evaluated the technical feasibility of different arsenic removal processes considering the groundwater physical and chemical characteristics of the most contaminated wells. The geochemical evolution tendency towards the Na-Ca-HCO_3 type, indicates the mineralization/dissolution of halite [NaCl], dolomite [$CaMg(CO_3)_2$], calcite [$CaCO_3$], and/or magnesite [$MgCO_3$]. Dissolved As in groundwater spans over 3 orders of magnitude (3-582 µg/L), representing high health risks by As exposure. The seasonal-spatial high variability of arsenic concentrations can be explained by the lithological variability of the ground, where the different clay, lime and sand layers probably contain variable and heterogeneous As compositions. The moderate positive correlation between iron and arsenic suggests the dissolution/mineralization of amorphous phases of iron oxi-hydroxides associated with As, thus facilitating the mobilization of As species towards the aquifers. The physical and chemical nature of almost all the highly contaminated wells favors the technical feasibility of most of the compared arsenic removal processes: Fe(III) and Al(III) coagulation, activated alumina adsorption, iron coated sand filtration (IHE-ADART) process, nano-filtration and reverse osmosis. The most contaminated well which also has high salinity, presents the most unfavorable conditions for efficient arsenic removal. In this case, membrane processes could be technically feasible; nevertheless, the IHE-ADART, adsorption on activated alumina and Solar Oxidation Assisted Removal of Arsenic, SORAS processes are potentially feasible. It will be necessary to evaluate the economic feasibility of the implementation of the different processes, considering investment and operation/maintenance costs for an installation size adequate for the population served.

Keywords: Groundwater Chemistry, Arsenic, Cochabamba, Arsenic Removal Technologies.

DOI: 10.23881/idupbo.017.1-3i