

Arsenic Removal by Membrane Technology, Adsorption and Ion Exchange: An Environmental Lifecycle Assessment

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Abstract : Co-contamination of groundwaters by arsenic in different forms is often observed around the globe. Arsenic is introduced into the waters by several mechanisms and different technologies are proposed and practiced for effective removal. The assessment of three prominent technologies, namely, adsorption, ion exchange and nanofiltration was carried out in this study based on lifecycle methodology. The life of the technologies was divided into two stages: cradle to gate (C-G) and gate to gate (G-G), in order to find out the impacts in different categories of environmental burdens, human health and resource consumption. Life cycle inventory was estimated by use of models and design equations concerning with the different technologies. Regeneration was considered for each technology and over the course of its full lifetime. The impact values of adsorption technology for the C-G stage are greater by thousand times (103) and million times (106) compared to ion exchange and nanofiltration technologies, respectively. The impact of G-G stage of the lifecycle is the major contributor of the impact for all the 3 technologies due to electricity consumption during the operation. Overall, the ion Exchange technology fares well in this study of removal of As (V) only.

Keywords : arsenic, nanofiltration, lifecycle assessment, membrane technology

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