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Application of membrane processes to remove arsenic from contaminated groundwaters

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The presence Arsenic (As) in groundwaters represents one of the main environmental issues of present times. Its abundance in water systems mainly depends on As availability into bedrocks and on geochemical conditions during water-rock interaction processes. In water systems, As can occur mainly as As(III) and As(V) inorganic species, reaching high concentrations extremely dangerous for human health. To limit the proved negative effects, the World Health Organization has set the drinking water guideline values of As to 10 µg/L. Considering the increasing need of safe drinking water, the development of efficient remediation systems becomes essential. In the last decades, membrane processes started to be considered as an interesting alternative to the conventional water treatment methods considering their many benefits, like the improvement of product quality without using chemicals and employing renewable energies in order to lower capital and operating costs (Figoli and Criscuoli, 2017). In this study, the geochemical approach was used as strong-scientific tool for pre-selection of suitable remediation systems. This approach allows to improve the performances and extend the treatment technology also in remote areas. Two type of commercial nanofiltration membranes were selected and their efficiency was evaluated in terms of arsenic rejection, water production and feed composition starting from three different groundwaters. The other main ions that contribute to water chemistry were also taken into account to evaluate the possible intended use of the considered waters after the treatments. Both used membranes were able to produce permeates with As contents lower than limit value or close to the limit of 10 µg/L. The performed experiments led to permeate samples still containing monovalent and some divalent ions, resulting in a water that does not need to be completely re-mineralized before use. Moreover, an innovative membrane with absorbent capacities against As(III) and As (V) species was developed and the preliminary results are quite promising.

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References: Figoli, A., & Criscuoli, A. (Eds.)., 2017. Sustainable membrane technology for water and wastewater treatment. Springer.