Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2021.26808

216 (2021) 246–251
March

Electrochemical removal of arsenic and remediation of drinking water quality

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Received 4 June 2020; Accepted 17 November 2020

ABSTRACT

Arsenic is one of the most abundant elements on the earth and possesses metallic as well as nonmetallic properties. Besides arsenic is very toxic and carcinogenic, it is found in nature both naturally and anthropogenically. Inorganic arsenic species existing in water are arsenite (As^{3+}) and arsenate (As^{5+}). Arsenic toxicity is a global problem because arsenic contamination is naturally coming from water resources. The maximum admissible concentration of arsenic must not exceed 10 μg L^{-1}, so the determination of the total arsenic amount regardless of its species is very important. In this work, the presence of arsenic was electrochemically determined using cyclic, square wave and differential pulse voltammetry, and a spectroscopic determination method including inductively coupled plasma-mass spectrometry (ICP-MS) was applied. A combination of ICP-MS as a sensitive, multi-element capable and reliable method with electrochemistry as a simple, cost-efficient and powerful method was performed to determine and remove arsenic for the first time. Newly modified nano-dimensional surfaces were developed to obtain specific arsenic behavior and effective electrodeposition of arsenic in the removal process. With the water supply research, regional differences in drinking waters were discovered, and different kinds of drinking water samples were put into a common form in terms of drinkable, arsenic-free, high-grade standards.

Keywords: Arsenic; Drinking water; Spectroscopy; Electrochemistry; Remediation