

Accepted Manuscript

Short communication

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PII: S1385-8947(17)31310-4

DOI: <http://dx.doi.org/10.1016/j.cej.2017.07.163>

Reference: CEJ 17429

To appear in: *Chemical Engineering Journal*

Received Date: 30 March 2017

Revised Date: 16 July 2017

Accepted Date: 28 July 2017

Please cite this article as: Neelam, Y. Albo, A. Burg, D. Shamir, D. Meyerstein, Bromate reduction by an electron exchange column, *Chemical Engineering Journal* (2017), doi: <http://dx.doi.org/10.1016/j.cej.2017.07.163>

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Bromate reduction by an electron exchange column

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Abstract: Polyoxometalates (POMs), $\text{Na}_3\text{PW}_{12}\text{O}_{40}$ and $\text{H}_5\text{AlW}_{12}\text{O}_{40}$ were entrapped in silica matrices using the sol-gel process and utilized as reducing electron exchange columns for the reduction of bromate. Bromate is a toxic disinfection by-product, generated during the ozonation process of water. The results distinctly show that this hazardous compound can be efficiently removed from aqueous media at different pH values without the addition of any chemicals to the media. Furthermore, the reducing capacity of the matrices can be recharged without loss of activity. This is the first reported practicable application of reducing electron exchange columns.

Keywords: electron exchange column, polyoxometalate, sol-gel, bromate reduction

1. Introduction

Bromate is a toxic disinfection by-product of the water treatment process with potential carcinogenic effects that imposes serious health risks when present in drinking water [1]. The U.S. Environmental Protection Agency set the maximum contaminant level (MCL) of bromate at $< 10 \mu\text{g/L}$ [2]. Therefore, efforts to develop processes for the reduction of bromate concentrations in water are ongoing. Several approaches have been investigated in the past for the removal of bromate ions from aqueous solutions, including reduction processes that employ

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