



Mechanisms of ethidium bromide removal by Ca-montmorillonite

Po-Hsiang Chang^a, Zhaohui Li^{b,*}, Wei-Teh Jiang^{c,*}

^aSchool of Human Settlements and Civil Engineering, Xi'an Jiaotong University, 28 Xianning West Road, Xi'an, Shaanxi, 710049, P.R. China, email: tectonicion@xjtu.edu.cn

^bDepartment of Geosciences, University of Wisconsin – Parkside, Kenosha, WI 53144, USA, email: li@uwp.edu

^cDepartment of Earth Sciences, National Cheng Kung University, Tainan 70101, Taiwan, email: atwtj@mail.ncku.edu.tw

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ABSTRACT

Ethidium bromide is extensively used in many biochemical laboratories. Due to its high toxicity, its removal from the wastewater before being disposed becoming an emerging issue. Swelling clay minerals, due to their inexpensive material cost, high efficiency, and vast reserves, have been evaluated for the removal of different types of contaminants. In this study, the removal of ethidium bromide, particularly its mechanism of removal was assessed, using Ca-montmorillonite (SAz-1) as a representative swelling clay minerals. The ethidium bromide removal could reach equilibrium within 1 h and a capacity of 1,276 mmol kg⁻¹, same magnitude as the cation exchange capacity of SAz-1. The total amount of metal cations desorbed from SAz-1 to the amount of ethidium removed was linearly correlated with a slope of 0.7, suggesting cation exchange as the dominant mechanism. In addition, the less-than-unity desorption/adsorption ratio could be attributed to the removal of ethidium dimers bridged with bromide counterions. An increase of the basal spacing to 18.3 Å for SAz-1 after adsorption implied that intercalation of flat-lying ethidium dimers into the clay interlayer, which increased its thermal stability, and active participation of the amine groups of ethidium molecules in the adsorptive interaction was evidenced from Fourier transform infrared band shifts. The results suggested that Ca-montmorillonite is an excellent candidate for fast and effective removal of ethidium bromide from aqueous solution. As such, it could serve as an ideal packing material for kits to be manufactured and used for ethidium bromide removal in case of spill.

Keywords: Ethidium bromide; Montmorillonite; Adsorptive removal; Desorption

*Corresponding authors.