Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2018.21621

103 (2018) 122–132
January

Preparation of NaX zeolite films for the sorption of Pb^{2+}, Cd^{2+} and Cu^{2+}

Chunxiu Zhang[a,b], Huasheng Xu[a,b], Jinpeng Yu[a,b], Pengfei Wang[a,b,*]

[a]*Shanghai Research Institute of Chemical Industry, Shanghai 200062, China, Tel. +86 13122369851, email: m18376654611@163.com (C. Zhang), Tel. +86 13917611405, email: xhs69@163.com (H. Xu), Tel. +86 13501826084, email: freeyujinpeng@126.com (J. Yu)*
[b]*Shanghai Luqiang New Materials Co. Ltd., Shanghai 201806, China, Tel. +86 021 52815377-0101, Fax +86 021 52802532, email: wpf@sricims.com (P. Wang)*

Received 2 May 2017; Accepted 8 November 2017

ABSTRACT

NaX zeolite films, used as an effective sorbent for Pb^{2+}, Cd^{2+} and Cu^{2+} from aqueous solution, were prepared on α-Al_2O_3 ceramic tube by pre-coating sol, drying in warm temperature and crystallizing in synthetic solution. The resulting films were characterized with X-ray diffractometer (XRD), scanning electron microscopy (SEM), energy dispersive spectrometer (EDS) and sorption test. Results showed that a thin NaX zeolite film with a thickness of 1–3 μm was obtained. The effects of initial pH, concentration, and sorption time on film sorption capacity for Pb^{2+}, Cd^{2+} and Cu^{2+} were investigated. It was observed that the sorption isotherms of NaX zeolite films were all well described by the Langmuir isotherm model. The saturation sorption capacities of Pb^{2+}, Cd^{2+}, Cu^{2+} on the films were increasing with temperature between 25–45°C, which were 3.075 mmol/L, 2.992 mmol/L and 2.274 mmol/L at 45°C, respectively. In addition, the sorption rates of NaX zeolite films were studied in comparison with pelletized NaX zeolite particles based on sorption kinetic models: Lagergren pseudo-first-order model, Lagergren pseudo-second-order model and Weber and Morris model. The models indicated that NaX zeolite film can effectively avoid the effect of diffusion resistance caused by particle morphology due to increasing external surface area.

Keywords: Sorption; NaX zeolite; Film; Heavy metal; Kinetic

*Corresponding author.

1944-3994 / 1944-3986 © 2018 Desalination Publications. All rights reserved.