Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2017.21242

85 (2017) 138–146
August

Improvement of bivalent metal dispersion in ternary layered double oxide (LDO) for efficient anion removal

Yuan Gao[a], Weikang Shu[a], Mao Lin[a], Jia Zhang[a], Jizhi Zhou[a,*], Zhi Ping Xu[b], Guangren Qian[a]

[a]*School of Environmental and Chemical Engineering, Shanghai University, Shanghai 200444, China, Tel. +86-21-66137746; emails: jizhi.zhou@shu.edu.cn (J. Zhou), gaoyuanhong@i.shu.edu.cn (Y. Gao), shuwk@i.shu.edu.cn (W. Shu), lm0813@yeah.net (M. Lin), irujam@t.shu.edu.cn (J. Zhang), jizhi.zhou@shu.edu.cn (J. Zhou), grqian@shu.edu.cn (G. Qian)*
[b]*Australian Institution for Biotechnology and Nanomaterial, University of Queensland, Brisbane, Queensland 4072 Australia, Tel. 61-7-33463809; email: gordonxu@uq.edu.au (Z.P. Xu)*

Received 1 March 2017; Accepted 17 July 2017

ABSTRACT

In this study, the removal of tripolyphosphate (TPP) was performed over $Mg_{2-x}Ca_xFe$ layered double oxide (Fe-LDO, x = 0.0–2.0) and $Mg_{2-x}Ca_xAl$ layered double oxide (Al-LDO, x = 0.0–2.0). For the preparation of LDO, the thermal process of the pristine LDHs was carried out by thermal gravity analysis (TGA). It is indicated that the binary metal in $Mg_{2-x}Ca_xAl$ layered double hydroxide (Al-LDH, x = 0.5–1.5) was well dispersed while $Mg_{2-x}Ca_xFe$-LDH showed two separated Ca-Fe-LDH and Mg-Fe-LDH phases in the sample. In TPP removal, the removal amount of TPP over Mg_2Fe-LDO and Mg_2Al-LDO was 11.8 and 21.4 mg P/g, respectively. In contrast, Ca_2Fe-LDO and Ca_2Al-LDO provided 121.0 and 185.0 mg P/g of TPP removal capacity, respectively. Moreover, on ternary $Mg_{2-x}Ca_xFe$-LDO and $Mg_{2-x}Ca_xAl$-LDO (x = 0.5–1.5), the sorption amount of TPP in Al-LDO was higher than that in Fe-LDO. Especially, 117 mg P/g of TPP removal amount was recorded in the case of $Mg_{0.5}Ca_{1.5}Al$-LDO. This was attributed to the fact that Al-LDO could be reverted to Mg-Al-LDH framework, which provided OH-metal on the solid surface to improve the TPP adsorption on the adsorbent. The other reason for TPP removal was Ca doping into the Mg-Al-LDH framework in the reformed LDH from LDO, which improved the affinity of TPP to the adsorbent by TPP precipitation. Therefore, our result proposed that it was advisable and feasible to use LDO for the removal of TPP.

Keywords: Layered double oxide (LDO); Tripolyphosphate; Precipitation; Adsorption; Ternary metals

* Corresponding author.