Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2018.22589

116 (2018) 258–266
June

Ammonia and phosphorous precipitation through struvite crystallization from swine wastewater with high suspended solid

Ling Ma[a], Shoujun Yuan[a,*], Feng Ji[b], Wei Wang[a,c], Zhen-Hu Hu[a,c,*]

[a]*School of Civil Engineering, Hefei University of Technology, Hefei 230009, China, email: 2522474088@qq.com (L. Ma), Tel. +86 551 62904148, Fax +86 551 6290266, email: sjyuan@hfut.edu.cn (S.-J. Yuan), dwhit@126.com (W. Wang), Tel. +86 551 62904144, Fax +86 551 6290266, email: zhhu@hfut.edu.cn (Z.-H. Hu)*
[b]*Institute of Animal Husbandry and Veterinary Medicine, Beijing Academy of Agriculture and Forestry Sciences, Beijing 100081, China, Tel. +86 010 51503301, email: fengjp3@hotmail.com (F. Ji)*
[c]*Institute of Water Treatment and Wastes Reutilization, School of Civil Engineering, Hefei University of Technology, Hefei 230009, China*

Received 22 December 2017; Accepted 3 June 2018

ABSTRACT

Anaerobic effluent of swine wastewater contains high concentration of suspended solid (SS), phosphate (PO_4-P), ammonia nitrogen (NH_4^+-N), and heavy metals such as copper (Cu) and zinc (Zn), posing eutrophication and environmental risk if it was discharged into water body. Struvite crystallization is a promising way to simultaneously recover NH_4^+-N and PO_4-P from wastewater. However, the information is very limited for recovering NH_4^+-N and PO_4-P through struvite from wastewater containing high SS and heavy metals. In this study, the precipitation of NH_4^+-N and PO_4-P through struvite process from real swine wastewater was investigated. The results showed that the amount of formed struvite precipitate of NH_4^+-N and PO_4-P from swine wastewater increased as pH increased from 7.5 to 10.0. The recovery of NH_4^+-N and PO_4-P reached the maximum of 71% and 85%, respectively, at pH 9.5. The contents of Cu and Zn in the struvite precipitates were up to 130 mg kg^{-1} and 400 mg kg^{-1}, respectively. When polymeric aluminum (PAC) and polyferric sulfate (PFS) were separately added as coagulants, 23.9%–40.0% and 17.3%–32.4% of SS were correspondingly removed. In the following struvite crystallization process, 79% of NH_4^+-N and 100% of PO_4-P were precipitated. The contents of Cu and Zn in struvite precipitates declined to 53 mg kg^{-1} and 152 mg kg^{-1}, correspondingly. Combined flocculation and struvite crystallization process can effectively remove SS from the liquid, increase the recovery of NH_4^+-N, and decrease content of Cu and Zn in struvite precipitate, reducing the environmental risk of struvite as fertilizer.

Keywords: Swine wastewater; Flocculation; Struvite; Heavy metals; Nutrient recovery

*Corresponding author.