The effect of ZnO on aerobic biodegradation of a novel polyacrylate tannage in activated sludge system

Xiang fei Lü, Hong rui Ma*, Kai Du, Ran Zhao, Xia Zhao, Jian zhong Ma

Department of Environmental Engineering, College of Resource and Environment, Shaanxi University of Science and Technology, Xi'an 710021, P.R. China, Tel. +86 13572405108; email: Sophie_Lv@126.com (X.f. Lü), Tel./Fax: +86 29 86168825; email: mahr@sust.edu.com (H.r. Ma), Tel. +86 13759939676; email: 406627868@qq.com (K. Du), Tel. +86 15110354855; email: 445374885@qq.com (R. Zhao), Tel. +86 15902995075; email: zhaoxia@sust.edu.com (X. Zhao), Tel. +86 29 86168010; email: majz@sust.edu.com (J.z. Ma)

Received 24 March 2014; Accepted 12 December 2014

ABSTRACT

Some analysis including differential chemical oxygen demand, total organic carbon, bacterial community composition, CO₂ production, particle size distribution, scanning electron microscopy, gel-permeation chromatography, Fourier transform infrared spectroscopy, and mass spectrum in addition to the properties of degradable products and polyacrylate/ZnO was studied in order to evaluate the effect of ZnO nanoparticles on biodegradation of polyacrylate in aerobic activated sludge system. Biodegradation mechanisms of polymer degradation with and without ZnO particles were obtained by chemical structure analysis, indicating that biodegradation was mainly considered as depolymerization and assimilation, and the depolymerization of polyacrylate was occurred more easily than polymethacrylate. Furthermore, the addition of ZnO enhanced the solubility of polyacrylate in the aqueous phase, changed the structure of polyacrylate, altered the proportion of different microbial strain, reduced the toxicity of polyacrylate on micro-organisms, and dispersed soil particles with a multiaperture surface, which are beneficial to the increased biodegradation of polyacrylate under aerobic activated sludge system.

Keywords: Activated sludge; Aerobic system; Biodegradation; Polyacrylate/ZnO; Tannage

*Corresponding author.

1944-3994/1944-3986 © 2015 Balaban Desalination Publications. All rights reserved.