The effects of powdered activated carbon or ferric chloride on sludge characteristics and microorganisms in a membrane bioreactor

Yue Zhang*, Xinhua Zhao

Department of Environmental Engineering, School of Environmental Science and Engineering, Tianjin University, Tianjin 300072, China
Tel. +86 13820774508; Fax: +86 22 87402072; email: tjdxhjzy@tju.edu.cn
Received 7 March 2013; Accepted 29 June 2013

ABSTRACT

In this study, the effects of two different additives, powdered activated carbon (PAC) and ferric chloride (FeCl₃) were evaluated on the characteristics of wastewater treatment sludge. The sludge activity was quantified by the measurement of the specific oxygen uptake rate (SOUR), dehydrogenase activity (DHA), microbial metabolic products including extracellular polymeric substances (EPS) and soluble microbial products (SMP), and by the quantification of the microbial diversity. In a 60-d period of PAC addition (PAC-MBR), average SOUR was 6.11 ± 1.02 mg O₂/g VSS h, and SOUR remained relatively stable. Average SOUR was 7.55 ± 2.40 mg O₂/g VSS h, but it presented greater variability during the FeCl₃ runs (Fe-MBR). During PAC-MBR, DHA was higher than during Fe-MBR and increased significantly with chemical oxygen demand; however, this correlation was low in Fe-MBR. Compared with PAC-MBR, EPS, and SMP in Fe-MBR showed a slowly decreasing trend. DGGE profiles of microbial diversity showed more total bands for PAC-MBR than for Fe-MBR; these bands may also have had greater intensity, suggesting that both the number of dominant microbial species and the overall microbial population was greater for PAC than for FeCl₃ additive. Overall, microbial metabolic processes changed in more complex ways in Fe-MBR than in PAC-MBR. The observed variations in microorganism diversity and activity suggested a progressive microbial adaptation process.

Keywords: Membrane bioreactor; Additives; Sludge activity; Microbial diversity; PCR-DGGE

*Corresponding author.

1944-3994/1944-3986 © 2013 Balaban Desalination Publications. All rights reserved.