Effects of pH adjustment on the hydrolysis of Al-enhanced primary sedimentation sludge for volatile fatty acid production

Lin Lin, Xiao-yan Li

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Effects of pH adjustment on the hydrolysis of Al-enhanced primary sedimentation sludge for volatile fatty acid production

Lin Lin, Xiao-yan Li*

Environmental Engineering Research Centre, Department of Civil Engineering,

The University of Hong Kong, Pokfulam, Hong Kong, China

(*Corresponding author: phone: 852-28592659; fax: 852-28595337; e-mail: xlia@hku.hk)

Abstract

Aluminum-based chemically enhanced primary sedimentation has seen increasing use in wastewater treatment plants. However, the derived sludge (Al-sludge) has low biodegradability due to the inhibition of Al-coagulants on organic hydrolysis, which increases the difficulty of sludge treatment and limits the potential for resource recovery. In this study, the effects of pH adjustment on the pretreatment and fermentation of Al-sludge was investigated, with a focus on sludge hydrolysis and production of volatile fatty acids (VFAs). The effects of abiotic and biotic hydrolysis on sludge disintegration, organics solubilization, and hydrolytic enzyme activity were also evaluated. The results show that adjustment of the pH to between 8.0 and 10.0 was more effective than adjustment to between 2.0 and 6.0 for sludge hydrolysis and subsequent VFA production. The enzymatic activities of protease and α-glucosidase showed a positive correlation with the pH values, leading to the highest VFA yield (275 mg-COD/g-VS) for the initial pH 10.0 condition, with 46% improvement over the control reactor (without pH adjustment). Semi-continuous fermentation was found to be more effective than batch fermentation for the biotic hydrolysis rate, k_H. Little phosphorus (<0.1 mg/L) was released from the Al-sludge into the fermented sludge liquor, so P removal was not necessary before the VFAs were used. The wastewater treatment process with Al-based