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ACCEPTED MANUSCRIPT

Sulfate-reduction, Sulfide-oxidation and Elemental Sulfur Bioreduction Process: Modeling and Experimental Validation

Xijun Xu[1], Chuan Chen[1], Duu-Jong Lee[1,2,3*], Aijie Wang[1], Wanqian Guo[1], Xu Zhou[1], Hongliang Guo[1], Ye Yuan[1], Nanqi Ren[1*], Jo-Shu Chang[4]

[1]State Key Laboratory of Urban Water Resource and Environment, Harbin Institute of Technology, Harbin 150090, China

[2]Department of Chemical Engineering, National Taiwan University, Taipei 106, Taiwan

[3]Department of Chemical Engineering, National Taiwan University of Science and Technology, Taipei 106, Taiwan

[4]Research Center for Energy Technology and Strategy, National Cheng Kung University, Tainan, Taiwan

[*]Corresponding authors: djlee@ntu.edu.tw (DJL); rnq@hit.edu.cn (RNQ)

ABSTRACT

This study describes the sulfate-reducing (SR) and sulfide-oxidizing (SO) process using Monod-type model with best-fit model parameters both being reported and estimated. The molar ratio of oxygen to sulfide (R_{OS}) significantly affects the kinetics of the SR+SO process. The S^0 is produced by SO step but is later consumed by sulfur-reducing bacteria to lead to "rebound" in sulfide concentration. The model correlated well all experimental data in the present SR+SO tests and the validity of this approach was confirmed by independent sulfur bioreduction tests in four denitrifying sulfide removal (DSR) systems. Modeling results confirm that the ratio of oxygen to sulfide is a key factor for controlling S^0 formation and its bioreduction. Overlooking S^0 bioreduction step would overestimate the yield of S^0.

Keywords: Kinetic model; sulfur bioreduction; microaeration; data fitting

1. INTRODUCTION

Sulfate-bearing wastewaters are produced by pulp and paper manufacturers, petrochemical plants, mineral processes and acid mine drainage from mining activities (Knobel and Lewis, 2002). Under anaerobic environment with the presence of chemical oxygen demand (COD), the sulfate-reducing bacteria (SRB) can convert

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