Treatment of municipal wastewater by a magnetic activated sludge device

Zhimei Liu\textsuperscript{a}, Zhen Liang\textsuperscript{b,*}, Shengjun Wu\textsuperscript{a}, Feng Liu\textsuperscript{a}

\textsuperscript{a}Key Laboratory of Reservoir Aquatic Environment, Institute of Green and Intelligent Technology, Chinese Academy of Sciences, Chongqing 401122, P.R. China
\textsuperscript{b}Department of Aquatic, Southwest University, Chongqing 402460, P.R. China

Tel./Fax: +086 23 63063015; email: liangzh2004@163.com

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ABSTRACT

Activated sludge process is one of the biological treatment methods for wastewater. The conventional activated sludge exposes a variety of disadvantages, such as sludge expansion, little biomass and loose flocs structure. Therefore, the conventional activated sludge needs to be improved. Compared with conventional activated sludge, the magnetic separation technology could overcome the disadvantages and improve the performances of conventional activated sludge. In this paper, a magnetic activated sludge device was built to conduct a pilot-scale study for 124 days from municipal wastewater. The effects of conventional activated sludge and magnetic activated sludge on removing the organic matters and nitrogen were compared. In addition, the sedimentation performance of the magnetic activated sludge and the variations of the biomass concentration were also investigated. The measuring cylinder experiment showed that sludge velocity reduced from 90 to 56\% after 2 min of settling (SV\textsubscript{2}) with the variations of magnetic powder (Fe\textsubscript{3}O\textsubscript{4}) dosage from 0 to 120 g/L. When the magnetic powder was added to aeration tank, the concentrations of mixed liquor volatile suspended solids (MLVSS) increased gradually and reached the maximum value of 7.35 g/L. The leakage of biomass was not observed during the magnetic activated sludge process, indicating that magnetic powder could maintain a high concentration of activated sludge. Also, the magnetic powder had no negative influence on the growth of the activated sludge. Both processes did not have significant difference in removing chemical oxygen demand (COD) (above average: 75.13\% removal) and biochemical oxygen demand for five days (above average: 92.79\% removal). In contrary to the conventional activated sludge process, magnetic activated sludge process had higher removal efficiency in removing ammonium nitrogen (NH\textsubscript{4}-N) (88.68\pm 7.98\% removal). The average total nitrogen (TN) removal efficiencies of both processes were 37.56\pm 14.35\% and 42.35\pm 22.65\%, respectively. The lower COD/TN might affect denitrification efficiency.

Keywords: Conventional activated sludge; Magnetic powder (Fe\textsubscript{3}O\textsubscript{4}); Magnetic activated sludge; Municipal wastewater

*Corresponding author.