Modeling and particular application of ASM2d model for describing organic matter and nutrient removal in a novel anaerobic-anoxic/oxic eight-phased system

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Received 28 July 2012; Accepted 24 March 2013

ABSTRACT

An eight-phased AA/O process has advantages of saving energy power, cost, and enhancing nitrogen and phosphorus removal; it does not need equipment for sludge and mixed liquor recycle and also it required small land for construction. A computer program was built based on activated sludge model No. 2d (ASM2d) for simulating the performance of multi-tank AA/O activated sludge process in Wuxi campus, southeast university. The difficulty of simulation is the system operation with unsteadily state condition. The results indicated that the growth rate constant of ammonia oxidizing bacteria was 1.4 day\textsuperscript{-1} and yield coefficient was 0.14. According to simulation, heterotrophic organism X\textsubscript{H}, phosphate accumulating organism X\textsubscript{PAO}, and ammonia oxidizing bacteria X\textsubscript{AOB} decreased in the anaerobic tanks because of the lysis reaction. Then the X\textsubscript{H}, X\textsubscript{PAO}, and X\textsubscript{A} increased in the aerobic tanks due to aerobic growth. The heterotrophic microorganism; phosphorus accumulating organism; and autotrophic bacteria concentrations increased in quantities by about 56, 36, and 74\% in tank one due to changes in the environmental state condition from anaerobic to aerobic and decreased in quantities by about 20, 44, and 0.14\% in the tank three due to changes in the environmental state condition from aerobic to anoxic. The ratio of total nitrifying species to total active biomass varied between 1 and 12\% in multi-tank AA/O process. The multi-tank AA/O system achieved 89±1.3\%, 87.7±1.1\%, 73.6±2.1\%, and 83.7±0.9\% of chemical oxygen demand, NH\textsubscript{4}\textsuperscript{+} -N, TN, and total phosphorus (TP) removal efficiencies, respectively, during a six-month operation with the effluent meeting Chinese sewage discharge standard GB18918-Grade A.

Keywords: Wastewater; Multi-tank; AA/O; ASM2d; Modeling; Biomass

1. Introduction

Over the last 10 years, a number of biological nitrogen and phosphorus removal processes have been used to remove phosphorus with simultaneous nitrification and denitrification process. Most of the developed biological nitrogen and phosphorus removal processes consist of a sequential anaerobic and aerobic stage for biological phosphorus removal*Corresponding author. 1944-3994/1944-3986 © 2013 Balaban Desalination Publications. All rights reserved.