Desalination and Water Treatment
www.deswater.com
doi: 10.1080/19443994.2013.781103

51 (2013) 4072–4080
May

Taylor & Francis
Taylor & Francis Group

Advanced total phosphorus removal approach: system design and combined sewer overflows (CSOs) sludge application

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Received 1 July 2012; Accepted 31 December 2012

ABSTRACT

Advanced total phosphorus (TP) removal is required to regulate the TP concentrations to less than 0.2 mg/L, as specified by the South Korean policies for the prevention of aquatic eutrophication. In order to meet the standards from 2012, the treatment efficiency of conventional treatment plants should be improved. This study addresses this need by developing a novel TP removal methodology that uses a static mixer for coagulation and a redesigned sedimentation tank incorporated with a guiding baffle. Experiments were carried out during summer, autumn, and winter. Results show that: (1) the phosphorus removal efficiency was relatively higher in summer than in autumn and winter, (2) the inline static mixer increased the efficiency of soluble phosphorus removal to above 95%, and (3) optimal angle determination for the guiding baffle was essential to achieve a stable hydraulic behavior and a low shear rate at the bottom of the sedimentation tank and thus to improve the sedimentation rate. In addition, the application of combined sewer overflows sludge led to stable and high phosphorus removal efficiency (> 90%). These results indicate that the newly designed TP removal plant could serve as a prototype for an advanced treatment of phosphorus in wastewaters.

Keywords: Phosphorus removal; Inline static mixer; Guiding baffle; CSOs' sludge

1. Introduction

Nutrients, including phosphorus, are extensively used for agricultural production and industrial development for the last several decades. However, previous studies revealed that the presence of high concentrations of phosphorus in an aquatic system causes eutrophication in the rivers or lakes [1,2]. Without any treatment, eutrophication would threaten the lives of fish and livestock that depend on waterbodies [2]. Thus, controlling the phosphorus concentration level

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Presented at the Nonpoint Source (NPS) Workshops at the Third International Conference on Rainwater Harvesting & Management, Goseong, Korea, 20–24 May 2012 and the Korea-China World Expo Exhibition Plan, Beijing Normal University, Beijing, China, 4–7 July 2012