

World Congress and Expo on

Applied Microbiology

August 18-20, 2015 Frankfurt, Germany

Targeted microbial diversity in cyclic low energy ammonium removal system determined by 454 pyrosequencing and quantitative PCR

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Cyclic Low Energy Ammonium Removal (Cleargreen) System is one type of the energy-saving de-ammonification system. A pilot scale Cleargreen system, with a feeding rate of 6.9 m³/day effluent water from a secondary wastewater treatment, has been tested in South Australia for 2 years. During a 450-day operation, the system gave a high ammonia removal of 80-85% with nitrite up to 150 mg N/L in the effluent. During the operation, 30 samples were taken for analysis of 454 pyrosequencing and quantitative PCR (qPCR). Analysis of 454 pyrosequencing showed that four nitrogen-related groups, family *Nitrosomonadaceae*, *Nitrospiraceae*, *Brocadiaceae* and *Rhodobacteraceae*, were detected, although all of them were below 4% of total bacterial population. Furthermore, the decrease of *Comamonadaceae* population was observed with the increasing of NH₄⁺-N removal; while *Brocadiaceae* population was found to increase as NH₄⁺-N removal was higher than 50%. qPCR results indicated that *Nitrospira* and other denitrifying groups containing *nirS* gene dominated in the system with the abundance of 5×10¹⁰ cell/mg VSS. Two ammonia-oxidizing bacteria and archaea groups, *Nitrobacter* and anammox were detected at 10³ - 10⁶ cell/mg VSS. Ammonia-oxidizing archaea increased with increasing NH₄⁺-N removal when NH₄⁺-N oxidation ratio was below 50%, while anammox bacteria group positively related with the removal of ammonia and total nitrogen removal. For microbial diversity of targeted nitrogen-related microbes, results from both 454 pyrosequencing and qPCR methods indicated that anammox bacteria could be enriched in the Cleargreen system, accompanying with the vicissitudes of other nitrogen-related microbes.

Biography

Hui-Ping Chuang has completed her PhD from Nagaoka University of Technology, Japan, and Postdoctoral studies from Hiroshima University, Japan and National Cheng Kung University, Taiwan. She is a Postdoctoral fellow in the Global Water Quality Research Center, NCKU, Taiwan. She has published 8 papers in reputed journals, and is specialized in the fields of biological treatment systems and improvement & application of molecular tools.

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