Start up of a gravity flow CANON-like MBR treating surface water under low temperature

Zhaozhi Wang, Heng Liang, Fangshu Qu, Jun Ma, Jie Chen, Guibai Li

State Key Laboratory of Urban Water Resource and Environment (SKLUWRE), Harbin Institute of Technology, 73 Huanghe Road, Nangang District, Harbin 150090, PR China
Suzhou Litree Membrane Separation Technology Ltd. Co., Suzhou 215152, PR China

Highlights
- Reflux can give the MBR system a better mixture.
- SRT did not have effect on washout of NOB but related to membrane fouling.
- DO is the key factor to control ANAMMOX process treating surface water even under low temperature.
- Increasing ammonium loads can really make the ANAMMOX process dominant in the MBR system.
- Sustainable flux is the key to make this MBR system more sustainable.

Abstract
Operation conditions such as reflux, sludge retention time (SRT), aeration intermediate, hydrogen retention time (HRT) and powder active carbon (PAC) dosing were optimized to start up a CANON-like MBR. Reflux can give the MBR system a good mixture. SRT did not have much effect on washout of nitrite oxidized bacteria (NOB) but related to membrane fouling. Decreasing aeration intermediate reduced ammonium removal rate to 50% due to the limited oxygen, but nitrification was dominant. HRT did not have much influence on ammonium removal rate, whereas reduce the NO3/NH4 totalremoval value to 0.8. PAC played a great role in ammonium removal and reduced the NO3/NH4 totalremoval value to 0.55. Under the optimized operation conditions such as reflux of 1 m3/L, SRT of 20 days, aeration intermediate of 11 h 50 min off and 10 min on, 20 mg/L of PAC, one column (8#) and a membrane reactor (9#), ammonium removal rate was increased to 99% while the NO3/NH4 totalremoval value was around 0.55. Increasing the ammonium concentration to 6 mg/L can reduce the NO3/NH4 totalremoval value to 0.13. On a whole, Dissolved oxygen (DO) is the key to start up the CANON-like MBR treating surface water even under low temperature and sustainable flux increased the sustainability of the system.

Introduction
The need to conserve energy and resources is well documented, and therefore more attention is being paid to the selection of processes that conserve energy and resources. Operation and maintenance costs plus reliable process control are extremely important to operating agencies. Thus, the operability of treatment plants is receiving more attention.

Operational simplicity is preferable for decentral wastewater treatment, and therefore a MBR was applied, a configuration in