22 June 2021 (Tuesday)

4.00pm-5.30pm (SGT) (GMT +8)
Session 3.1 – Resource Efficient Treatment I

Session Chair(s): Ng How Yong, NUS (Singapore)

Implementation of Side-Stream Nitrogen Removal at Changi Water Reclamation Plant

D. Lye, J. Tan. PUB, Singapore's National Water Agency (Singapore)

Side-stream nitrogen removal using anaerobic ammonium oxidation (ANAMMOX) or deammonification has been widely recognised to be a viable alternative process for nitrogen removal. Deammonification is an energy efficient process alternative to the conventional nitrification and denitrification processes, which allows used water treatment plants to reduce the amount of aeration energy consumed for nitrogen removal. Deammonification involves two process steps -- the partial nitritation of ammonium and the subsequent anaerobic oxidation of the residual ammonium by nitrite to nitrogen gas. Changi Water Reclamation Plant (CWRP), PUB's largest used water treatment plant in Singapore, receives and treats 920,000 cubic metres per day (CMD) of used water in Singapore. In 2013, PUB conducted a pilot investigation at CWRP to assess the feasibility of implementing a full-scale side stream facility using the deammonification process to treat its nitrogen rich dewatering centrate (DC).

Simultaneously Anaerobic Digestion and Low-Carbon Denitrogenation in Sewage Mainstream by Integrating Anaerobic Membrane Bioreactors With Nitritation-Anammox

Z. Lei, S. Yang, R. Chen. Xi'an University of Architecture and Technology (China)

A new sewage treatment process aims to achieve efficient energy recovery with simultaneously low-carbon denitrogenation was constructed by coupling AnMBR with nitritation-Anammox, and the feasibility was investigated based on pollutants removal efficiency and dynamics analysis. The results indicate COD and N removal efficiency were averaged at 97% and 75%, respectively, accompanying a COD converted to methane ratio of over 83%. AnMBR and nitritation reactors contributed to almost all COD removal, while the denitrogenation was mainly achieved in the anammox reactor (>90%). In AnMBR, Anaerolineales, Bacteroidales and Clostridiales contributed to the producing of acetate and hydrogen; Methanothrix (58.43%) and Methanolinea (29.98%) were the main generator for methane production. Nitrosomonas and Candidatus Brocadia were the main functional microbes in the nitritation and anammox reactors, respectively. Results of this study demonstrate the feasibility of AnMBR coupling nitritation-Anammox for sewage treatment and will expected to put forward it's future development.

Ultralow Energy - No Bubble Deammonification

G. Kicsi, N. Hu. SUEZ (Singapore)

Deammonification is commercially applied to treat ammonia rich digestate from the side stream of water resource recovery facilities (WRRFs) however its broader adoption is challenged by process complexity, inefficient oxygen transfer, and greenhouse gas (GHG) emissions. A new solution called ZeeNAMMOX overcomes these challenges by leveraging the counter-diffusion benefits of membrane aerated biofilm reactor (MABR) technology to enable a resilient and energy efficient deammonification process. The diffusion of N2O into the lumen captures any N2O produced and provides the ability to reduce GHG emissions of this efficient process. Two pilots employing this solution were operated to treat digestate and demonstrated the performance of ZeeNAMMOX.

Optimisation of Wastewater Treatment Process Improvement Through The Use of "Live" Dashboards, Process Engineering, Artificial Intelligence and Machine Learning

R. Brice, C. Borges, V. Tang, J. Bishop, J. Scheri. Mott Macdonald (United Kingdom)

Water industry operations are energy intensive and wastewater processes are known to use approximately half of the total operational energy of a water company. However, typically an annual energy saving potential of 15 to 30% can be achieved by optimisation of operations. The Standard Aeration Efficiency (SAE) Calculator and the Clarifier Efficiency tool are part of a set of stand-alone, real-time applications Mott MacDonald is investing in to provide dynamic diagnostics targeting typical pain-points in wastewater treatment plant (WWTP) operations. This paper will present two case studies of this approach. At Rotorua WWTP (New Zealand) the SAE provided an evidence-based approach to reduce diffuser cleaning frequency and deferral of diffusers replacement. At Two Bridges WWTP (USA), the Clarifier tool helps operators managing the risk of biomass wash-out and maximize treatment during storm conditions, by understanding in real time the used vs residual solids capacity in the system.