24 June 2021 (Thursday)

7.00pm-8.30pm (SGT) (GMT +8)
Session 3.6 – Nutrient Removal

Session Chair(s): Sudhir Murthy, NEWhub Corp (USA)

Denitrifying PAOs For Low-Carbon And Low-Energy Nutrient Removal At The Ejby MøLle WRRF

N. Uri Carreno, T. Constantine, P. Nielsen, F. Szép, K. Chandran, C. Hoar, C. DeBarbadillo. VCS Denmark (Denmark)

The Ejby Mølle WRRF in Odense, Denmark, is an example of utility challenging itself in trying to utilize the latest technologies to enhance its overall efficiency. Some of the efforts towards achieving low-energy and low-carbon nutrient removal include: low dissolved oxygen and alternating aeration, anammox seeding from a sidestream anammox reactor, mainstream hydrocylones and chemically enhanced primary treatment, among others. This paper presents results from a WERF study on low-carbon and low-energy nutrient removal technologies for nitrogen and phosphorus removal. During this study, different experiments were made at Ejby Mølle during the transition winter-summer-winter operation in 2018 to investigate the seasonal differences in nitrogen and phosphorus removal. It was found that during the summer months, nitrite accumulates in the reactors and simultaneous nitrification-denitrification can be observed. Ex-situ activity tests confirmed the presence denitrifying PAOs capable of using both nitrite and nitrate and 16S amplicon sequencing results from that period show relatively high abundance of both putative DPAOs and anammox.

A Systematic Approach To Select BNR Technologies To Retrofit Manila Water's 36 Sewage Treatment Facilities

SH. Koh, E. Polloso, L. Hayag, J. Teodoro, A. Shaw, J. Barnard, YS. Tse. Binnies (Singapore)

In response to the Supreme Court's order to clean up Manila Bay and to restore its waters to be fit for swimming and other forms of contact recreation, water concessionaires in Metro Manila are faced with the urgency of converting their existing sewage treatment plants (STPs) into Biological Nutrient Removal (BNR) facilities to meet the latest discharge standards. Manila Water Company Incorporated (MWCI), water concessionaire of the East zone, currently owns and operates approximately forty STPs. To balance the need for a comprehensive consideration of all relevant processes and the constraint of needing to make good decisions in a timely manner, a systematic process options screening approach has been adopted. The result is an efficient process that categorises the STPs into suitable groups considering their unique sewage characteristics, footprint/location constraints, and treatment capacities/technologies, and then selects suitable long-list and short-list options to that category for further evaluation into a final concept.

Maximising AOB Activity The Key To Optimised Performance In Short-cut Nitrogen Demonstration Trial

A. Vellacott. Jacobs (Australia)

A 160kL/d capacity shortcut nitrogen removal demonstration plant, operated in anoxic/oxic mode with secondary clarification has operated since June 2017 at Melbourne Water's Western Treatment Plant (WTP). There have been four key periods (I - IV) exhibiting a high level of NOB out-selection. An extended six-month period out-selection was seen in Period IV. Initially reduced efficiency in Period IV(a), with an average 77% TN removal, 'COD efficiency' of 10.2 kgCOD/kgTN removed, despite a high level of NOB out-selection (NOB:AOB activity ratio of 0.35) due to reduced maximum AOB activity (average 108mgN/L/d) limiting ammonia oxidation. Maximum AOB activity increased to average of 229mgN/L/d in Period IV(b) and an increased average TN removal of 86% occurred with an average 'COD efficiency' of 6.1kgCOD/kgTN removed. When NOB out-selection results in low maximum AOB activity, plant capacity to remove TN is reduced, resulting in poorer effluent quality despite a high level of NOB out-selection.

Going For Mainstream Anammox For Municipal Wastewater Treatment Via Partial Denitrification Providing Nitrite

R. Du, Y. Peng. Beijing University of Technology (China)

Partial-denitrification (PD) has been proposed as a promising alternative for stably efficient production of NO2--N from nitrate (NO3--N) reduction for anammox process. In this study, an innovative PD coupling with anammox (PD-AMX) process was developed for mainstream municipal wastewater treatment. With the influent NH4+-N of 53.68 mg/L, total nitrogen (TN) removal achieved a relatively high level of 94.8% with a significantly low effluent TN concentration below 5 mg/L. Moreover, the aeration energy and N2O production would be efficiently reduced compared to the traditional biological nitrogen removal process. Genus Thauera possibly responsible for PD coexisted stably with the anammox bacteria (Candidatus Brocadia). The novel integration of PD and anammox provides a promising approach towards an energy-efficient mainstream treatment.

Innovative Process For Granulation Of Conventional Continuous Flow Activated Sludge – A Novel Cost Effective Infra-Stretching Concept To Treat More Flow And Remove/ Recover More Nutrients Without Expanding Your Plant

B. Stinson. AECOM (United States)

In a collaborative effort between AECOM and the City of Penticton, British Columbia, the formation of granular sludge was examined in the full-scale continuous flow activated sludge wastewater treatment plant in Penticton (began in 2018 and is ongoing). The Westbank process was the baseline configuration, but minor modifications were made to induce and enhance granule formation and provide retention within the process. This paper will share the details on the various process flow configurations tested, successes and failures, lessons learned and future work. Aerobic granulation was demonstrated feasible under continuous flow providing adequate treatment effluent TP < 0.3 mg/L and TN< 6 mg/L.