Young Scientist Special Session

Novel integration of partial denitrification and anammox in biofilm systems for nitrogen removal: Proof of concept from high-strength to low-strength wastewater treatment

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Excess nitrogen discharging from wastewater treatment plants (WWTP) is the main cause for eutrophication of water bodies. Anammox is an economic and efficient method for nitrogen removal from wastewater. It allows the NH4+ oxidization with NO_2^- as an electron acceptor to produce nitrogen gas and a low amount of NO_3^- under strictly anoxic conditions, with less aeration and organic carbon demand as well as low sludge production. However, the anammox has not been ready for full-scale mainstream treatment due to the major challenge of stable nitrite generation by the conventional nitritation approach. Additionally, its application is still limited to ammonia-contained wastewater due to the reaction mechanism.

The novel integration of partial denitrification (PD) and anaerobic ammonium oxidation (anammox) (PD/A) in biofilm system holds great advantages including the stable nitrite (NO_2^-) production, high loading rate, and efficient retention of anammox bacteria, offering a viable approach for extending application of anammox technology. Here we comprehensively presented the proof-of-concept investigation on the treatment of high-strength pharmaceutical wastewater (ammonia (NH_4^+-N) and nitrate (NO_3^--N) of 6300±50mg/L and 15300±50 mg/L), with the desirable efficiency of NH_4^+ and NO_3^- removal of 83.5% and 92.2% during the stable operation. Moreover, the novel PD/A biofilm process was demonstrated to play a cricial role in the enhanced nitrogen removal performance in a full-scale municipal wastewater treatment plant, in which the anammox bacteria was enriched in the anoxic bofilms.