

Increased Nitrogen Removal in Cold Deammonification Biofilm Reactor (9-15°C) by Smooth Temperature Decreasing

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Abstract : The anaerobic ammonium oxidation (anammox) and nitrification-anammox (deammonification) processes are widely used for N-rich wastewater treatment nowadays. A deammonification moving bed biofilm reactor (MBBR) with a high maximum total nitrogen removal rate (TNRR) of 1.5 g N m⁻² d⁻¹ was started up and similarly high TNRR was sustained at low temperature of 15°C. During biofilm cultivation, temperature in MBBR was lowered by 0.5° C week⁻¹ sustaining the high TNRR. To study the short-term effect of temperature on the TNRR, a series of batch-scale experiments performed showed sufficient TNRRs even at 9-15° C (4.3-5.4 mg N L⁻¹ h⁻¹, respectively). After biomass was adapted to lower temperature (15°C), the TNRR increase at lower temperature (15°C) was relatively higher (15-20%) than with biomass adapted to higher temperatures (17-18°C). Anammox qPCR showed increase of *Candidatus Brocadia* quantities from 5×10³ to 1×10⁷ anammox gene copies g⁻¹ TSS despite temperature lowered to 15°C. Modeling confirmed causes of stable and unstable periods in the reactor and in batch test high Arrhenius constant of 29.7 kJ mol⁻¹ of the process as high as at 100 mg NO₂-N L⁻¹ were determined.

Keywords : deammonification, reject water, intermittent aeration, nitrite inhibition

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