Low nitrous oxide production through nitrifier-denitrification in intermittent-feed high-rate nitritation reactors - DTU Orbit (17/12/2018)

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Nitrous oxide (N₂O) production from autotrophic nitrogen conversion processes, especially nitritation systems, can be significant, requires understanding and calls for mitigation. In this study, the rates and pathways of N₂O production were quantified in two lab-scale sequencing batch reactors operated with intermittent feeding and demonstrating long-term and high-rate nitritation. The resulting reactor biomass was highly enriched in ammonia-oxidizing bacteria, and converted ∼93 ± 14% of the oxidized ammonium to nitrite. The low DO set-point combined with intermittent feeding was sufficient to maintain high nitritation efficiency and high nitritation rates at 20-26 °C over a period of ∼300 days. Even at the high nitritation efficiencies, net N₂O production was low (∼2% of the oxidized ammonium). Net N₂O production rates transiently increased with a rise in pH after each feeding, suggesting a potential effect of pH on N₂O production. In situ application of 15N labeled substrates revealed nitrifier denitrification as the dominant pathway of N₂O production. Our study highlights operational conditions that minimize N₂O emission from two-stage autotrophic nitrogen removal systems.

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