Model-based optimization of biofilm based systems performing autotrophic nitrogen removal using the comprehensive NDHA model

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1. INTRODUCTION
PN/A based treatment has many benefits:
• Lower aeration costs [63% [1]]
• Lower sludge production (90% [2])
→ Certain operational conditions cause N₂O emissions which could offset the carbon footprint of PN/A!

Objectives:
1) Develop a model to predict N₂O emissions from biofilm Anamox reactors
2) Define optimal operational conditions for maximum nitrogen removal and minimum N₂O emissions

2. MODEL DEVELOPMENT
1D model combining NDHA [3], Advection-Diffusion approximation and pH solver

3. SCENARIO ANALYSIS

4. RESULTS

• pH 7.5 promotes a good balance between AOB and AnAOB enzymatic activity
• 500 µm radius promotes AnAOB and gives enough oxygen exposure for AOB
• N₂O production is low at low ammonia oxidation rates
• Process performance is stable with high N-removal and low N₂O emissions under the optimal L∞/L∞(pH) and ammonia loading

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