Impact of operational conditions and reactor configuration on process performance and microbial community in short solid retention time EBPR systems

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1. INTRODUCTION

Current research promotes resource recovery using different strategies:
- Energy recovery using A-stage systems [1]
- Phosphorus recovery using low SRT EBPR systems [2,3]
- To minimize ammonia oxidation, so it can be assimilated by phototrophic organisms [2]
- Water reuse for “fertigation” [2-4]

Common element: short SRT EBPR systems

2. OBJECTIVES

- To assess the start-up operation of a short SRT EBPR system
- To define the microbial community affecting the performance of the short SRT EBPR system
- To test the process performance stability in two different configurations:
  - Sequencing batch reactor (SBR)
  - Continuous flow system

3. RESULTS

Sequencing Batch Reactor:
- Stable operation at SRT 8 days (day 50).
- Incomplete nitrification when the SRT was shifted to 5 days (data not shown)
- Filamentous bulking after nitrifiers were washed out at SRT=4 days
- qFISH revealed high abundance of M. parvicella (7%) and Thiothrix (17%) at relatively low DO levels in aerobic phase

Continuous flow system:
- Filamentous bulking occurred at SRT 8 days
- Bulking corresponded with poor phosphorus removal and high Thiothrix abundance (Sulfate reduction correlated with SVI and P-removal)
- Action taken: The anaerobic HRT was reduced to phase out the SBRs:
  - Significant reduction in SVI
  - Significant reduction in sulfate reduction
  - P-removal, however, was not recovered

4. CONCLUSIONS

- Low SRT EBPR systems are sensitive to bulking due to Thiothrix and M. parvicella
- SBR is more robust due to imposed substrate gradients
- Sulfate reducers compete with PAOs for volatile fatty acids (via completed or uncompleted oxidation)
- Sulfate reducers can be controlled by manipulating the anaerobic HRT

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