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Low-sludge age EBPR process for resource recovery – microbial and biochemical process characterization

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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 nitrification, thus producing ammonium rich medium for phototrophic organisms [2]
- Water reuse for “fertigation” [2,4]

2. OBJECTIVES

- To start-up a short-SRT EBPR system and describe process performance
- To define the microbial community, affecting the performance of the short-SRT EBPR system
- To quantify energy recovery

3. RESULTS

1. Process Performance:

- Nitrogen removal in EBPR effluent: from phase A to phase D
- Phosphate removal in EBPR effluent: from phase A to phase D

2. Microbial community:

- Order-level taxonomic classification of 16S rRNA amplicons at selected days of the reactor operation. Taxa abundance is expressed in percentage (left axis). Alpha-diversity at the order level measured as Shannon index (white dots, right axis).

3. Biomethane potential:

- Recalcitrant, assimilated into biomass

4. Highlights:

- EBPR effectively removed phosphorus at SRT=3 d and *Accumulibacter phosphatis* was the main PAO (based on qFISH)
- Bulking correlates with poor phosphate removal (highlighted in red, in Fig. 1)
  - High abundance of *Thiothrix* filamentous bacteria
  - Sulfate reduction during the anaerobic phase (about 30% of influent sulfate)
- Sulfate reducers outcompeted PAO by
  1. Competing for influent COD
  2. Inhibiting phosphorus release
- Phosphate removal restored by reducing the anaerobic phase length (highlighted in green in Fig. 1)
- Up to 40% of influent carbon is recovered as methane at SRT=3 d

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References: