Microbial and biochemical process characterization of a low-sludge age EBPR process for resource recovery

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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 phototropic organisms [2] 
- Water reuse for “fertigation” [2,4]

**Common element:** short-SRT EBPR systems

### 1. INTRODUCTION

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Current research promotes resource recovery using different strategies:
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### 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

**System:** sequencing batch reactor fed with municipal wastewater

### 3. RESULTS

**1. Process Performance:**

- Ammonia, nitrite and nitrate at the end of the anaerobic and aerobic phases and influent; c) soluble COD at the end of the anaerobic and aerobic phases and total COD in the influent; d) phosphate removal; e) sludge volumetric index; f) total suspended solids.

**Phase A:** from day 50 to day 78 – anaerobic SRT=1.2 d and aerobic SRT=3 d; phase B: from day 78 to 83 – anaerobic SRT=1.2 d and aerobic SRT=1.75 d; phase C: from day 83 to 109 – anaerobic SRT=1.2 d and aerobic SRT=1.75 d; phase D: from day 109 to day 132 – anaerobic SRT=0.88 d and aerobic SRT=1.75 d; phase E: from day 132 to day 156 – anaerobic SRT=0.68 d and aerobic SRT=1.75 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 (right axis).

**3. 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 *Thiobrix* 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

**References:**