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Bioflocculation of green microalgal biomass using activated sludge and potential for biogas production

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1. INTRODUCTION
New technologies are developed to recover wastewater resources and increase energy yields in form of biogas [1].
- Potential energy recovery using microalgae. Available harvesting methods are costly and energy intensive [2].
- Assess the potential of energy recovery via biogas production from the harvested activated sludge-algal biomass.

Objectives:
- Developing cost-efficient way of harvesting microalgae via bioflocculation using activated sludge from a short-SRT EBPR system.
- Assess the potential of energy recovery via biogas production from the harvested activated sludge-algal biomass.

2. METHODS
1. Flocculation experiments
Microalgal biomass:
- Mixed green microalgal culture cultivated on effluent wastewater:
  - Chlorocella sorokiniana and Scenedesmus sp.

Activated sludge:
- Taken from a short SRT (3.5 d) EBPR system [3]:
  - Solid-liquid separation after the aerobic phase (AS_A)
  - Solid-liquid separation after the anaerobic phase (AS_AE)

Flocculation strategies:
- Strategy I: Flocculation of microalgae and activated sludge
- Strategy II: Step 1: Coagulation of microalgae with a cationic polymer (PDADMAC)
- Step 2: Flocculation with activated sludge

2. Biomethane potential tests
Mesophilic conditions (37 °C)
Digestion scenarios:
- I. Algae
- II. Algae + polymer (20 mg/g algae)
- III. AS_AE, alone (activated sludge removed after the aerobic and after the anaerobic phase)
- IV. AS_AE, algae (10% ratio of algae/AS)
- V. AS_AE, AS_AE, algae + polymer (10% ratio of algae/AS, 20 mg polymer/g algae)

3. Flocculation
1. Polymer dosing
   - 100% algae + polymer
   - 10% algae + 90% activated sludge + polymer

2. Mixing ratio
   - Algae + activated sludge + polymer (16 mg/g algae)

3. Activated sludge settleability
   - Algal biomass recovery (%)

4. Biogas potential and energy recovery
1. Biogas potential of biomass
2. Energy recovery

5. CONCLUSIONS
- An effective solution is proposed to harvest microalgal biomass and to significantly decrease the amount of polymer coagulant required;
- 97% microalgal biomass recovery was reached with 16 mg polymer/g algae;
- Poor settling sludge did not affect microalgal biomass recovery, however, due to bulking the biomass volume was increased;
- Optimum polymer dosing depends on the mixing ratio of algae and activated sludge;
- Co-digestion with biomass taken after the anaerobic phase enhanced biogas potential;
- Up to 40% of the influent COD of the EBPR was recovered as methane;

REFERENCES: