Evolution of microbial communities and nutrient removal performances in aerobic granular sludge sequencing batch reactor during change of substrate

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Context

- Aerobic granular sludge (AGS) is a promising alternative wastewater treatment to the conventional activated sludge system.
- AGS present various advantages such as enhanced settlability and presence of different red-ox conditions simultaneously in the granules.
- AGS allows substantial space, energy and chemical savings.
- Phosphate accumulating organisms (PAO) often found in high proportions in AGS allow biological phosphorus removal

Methodology

- An AGS sequencing batch reactor was run for 7 months.
- The composition of the synthetic wastewater was progressively changed from volatiles fatty acids (VFA) only to a mix of VFA, glucose and amino acids.
- The COD, Phosphorus (P) and Nitrogen (N)-removal performances were monitored.
- The bacterial community composition was analyzed by amplicon sequencing of weekly biomass samples.

Objectives

- Maintain the reactor nutrient removal during the substrate change
- Identify the taxa involved in P-, N-removal.

Microbial communities

A clear shift was observed in the bacterial community composition through the experiment.

Functional groups

- The functional groups were identified using the MGAS Field Guide on website.

Principal component analysis

The samples are clustered according to the synthetic wastewater composition

Contribution of the different genera to the two main PCA axis.

Reactor performances

The nutrient-removal performances of the reactor were similar at the beginning and the end of the experiment.

Outlook

- Determine which organisms are responsible for P-removal with the mixed substrate.
- Identify the metabolisms and roles of uncharacterised taxa using metagenomic and metatranscriptomic analysis.

Phosphorus removal

Chemical oxygen demand

COD = Chemical oxygen demand

N-removal = Nitrogen removal

P-removal = Phosphorous removal

AGS = Aerobic Granular Sludge

PAO = Phosphate accumulating organism

P = Phosphorus removal

N = Nitrogen removal

COD = Chemical oxygen demand