THE GEORGE WASHINGTON UNIVERSITY
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Primary Sludge Fermentation: Sustainable and Economical Process of Supplementing Carbon for Short-Cut Nitrogen Removal

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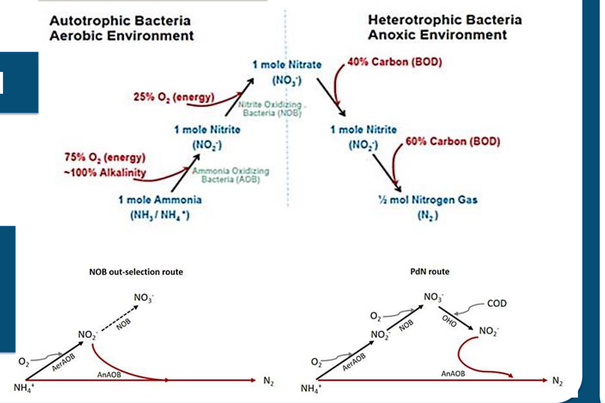
Introduction

Conventional

VS

Short-Cut Nitrogen Removal



Objectives

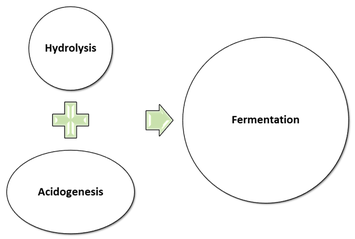
1. Find the SRT needed to reach required soluble COD yields as well as to limit the concurrent nutrient release during fermentation
2. Explore the viability of primary sludge fermentate as the recycled carbon source for selecting PdN in order to reduce chemical costs
3. Analyze the operational cost savings when incorporating primary sludge fermentation in Blue Plains Advanced wastewater treatment plant

Blue Plains Advanced Wastewater Treatment Plant

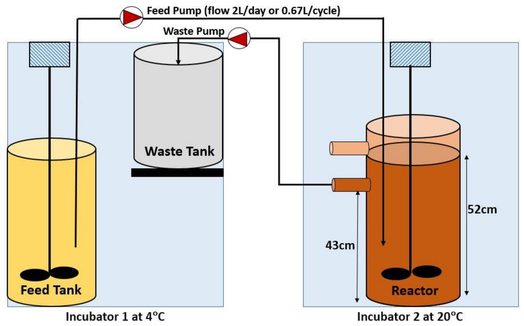
- 1400 MLD plant
- Stringent limits:
  - TN < 3.8 mg TN/L
  - TP < 0.18 mg P/L
- Conventional BNR system
- Costs per year:
  - **$8M** for methanol dosing
  - $0.6M on alkalinity
  - $1.5M for aeration

Fermentation

Primary Sludge → Particulate COD → Soluble COD → Volatile Fatty Acid



Materials and Methods

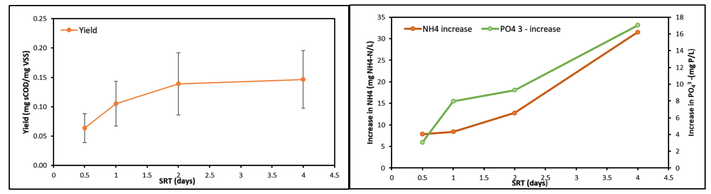


Lab scale CSTR → Temperature controlled at 20° C

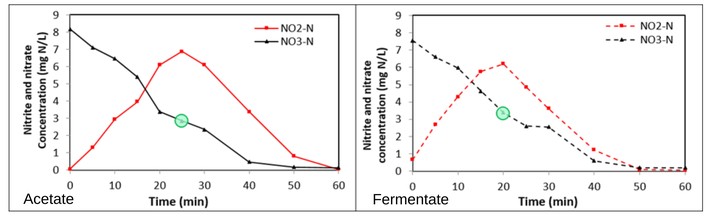
SRT management → Feeding and wasting primary sludge

Results

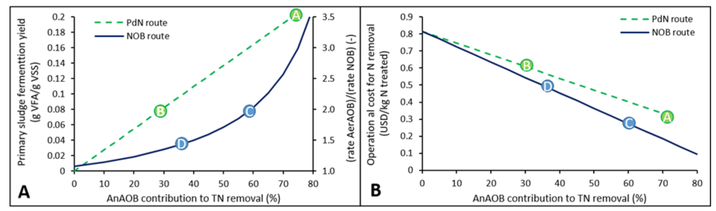
Comparison of yield and nutrient release with SRT



Kinetic test results show feasibility of fermentate to perform PdN with similar PdN set points (2-3mg N/L) like Acetate



Cost comparison coupled with AnAOB contribution for 4 different scenarios



(A) PdN+IFAS (B) PdN+Screen (C) NOB outselection+IFAS (D) NOB outselection+Screen

Conclusions

- 2 day SRT is preferable in terms of yield and nutrient added to the system
- **$6.2M** out of $10M (62% of total operational cost) can be saved with PdN-AnAOB route and using fermentate as a carbon source

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