Industry Standard Biological Wastewater Treatment in WaterTAP

Marcus Holly[a,b], Chenyu Wang[a,b], Alejandro Garciadiego[a,b], Adam A. Atia[a,b]
[a] National Energy Technology Laboratory (NETL), [b] NETL Support Contractor

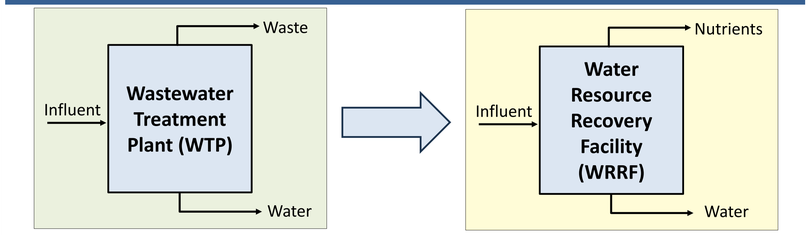
Background

Biological wastewater treatment is essential in municipal and industrial wastewater facilities to decompose organic components and other contaminants. By utilizing microorganisms to treat bodies of water instead of chemicals, biological treatment:

- reduces the accumulation of nutrients in treated water and the resultant algal blooms
- recovers nutrients for use in novel technologies

The International Water Association (IWA) has developed standardized biochemical models for these processes.

Motivation

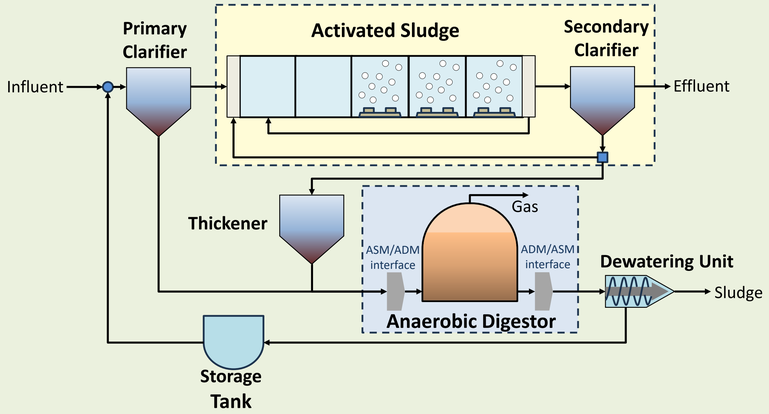


Apply advanced technologies to:

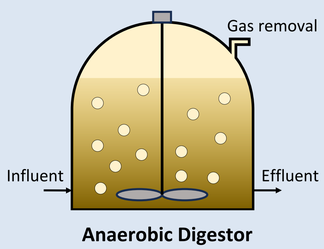
- Increase energy efficiency
- Recover valuable products
- Reduce waste disposal costs

Approach

Benchmark Simulation Model 2 (BSM2)



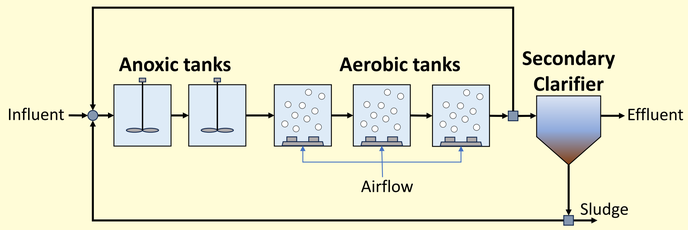
Anaerobic Digester Model No. 1 (ADM1)



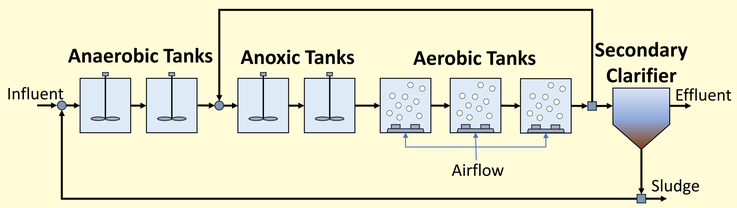
ADM1

- Biochemical:
  - Extracellular process
  - Intracellular process
- Physico-chemical:
  - Ion association/dissociation
  - Gas-liquid transfer
  - Precipitation – to be added

Activated Sludge Model 1 (ASM1)



Activated Sludge Model 2d (ASM2d)



ASM1

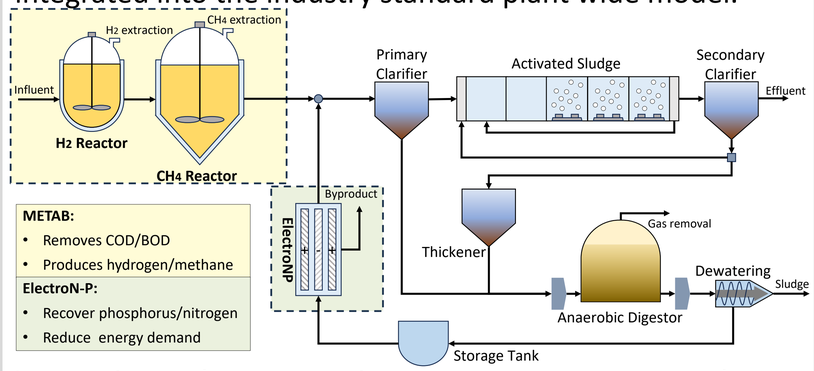
- Carbon oxidation
- Nitrification
- Denitrification

ASM2d

- Additional biological processes
- Phosphorus removal
- Cell internal structure

Analysis and Results

Explore design and operation of novel technologies being integrated into the industry standard plant wide model.



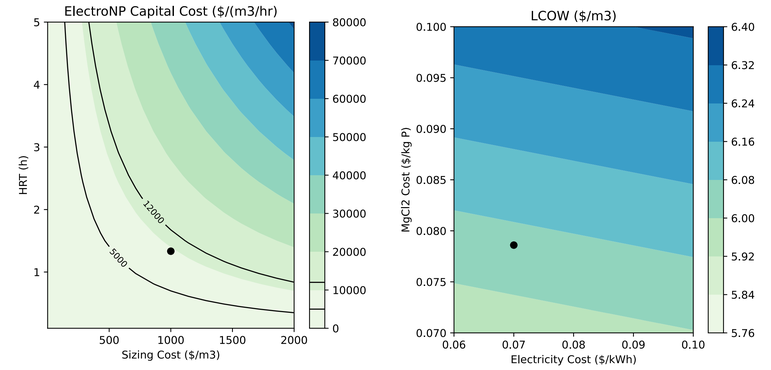
METAB:

- Removes COD/BOD
- Produces hydrogen/methane

ElectroN-P:

- Recover phosphorus/nitrogen
- Reduce energy demand

Leveraging technoeconomic assessment to set research targets for novel technologies



Remarks and Future Work

Future efforts on plant-wide treatment development will improve model stability and account for various forms of physicochemical phenomena, such as precipitation and ion speciation. This material is based upon work funded by the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy (EERE), Industrial Efficiency and Decarbonization Office (IEDO), under Funding Opportunity Announcement Number DE-FOA-0002336.

Contact: Adam A. Atia, adam.atia@netl.doe.gov
Contact: Marcus Holly, marcus.holly@netl.doe.gov
Contact: Chenyu Wang, chenyu.wang@netl.doe.gov

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