MODELA Computational fluid dynamics for the industry

The AS-MLE Module

(Modified Ludzack-Ettinger)

Audience and Processes

Designed for **Advanced Treatment Facilities** tasked with total nitrogen removal. This module models the classic BNR (Biological Nutrient Removal) **configuration consisting of an Anoxic reactor** followed by an **Aerobic reactor.**

Functionality

- **Denitrification Modeling:** Simulates the reduction of nitrates to nitrogen gas in the anoxic zone.
- **Internal Recycle Analysis:** Optimizes the Nitrate Internal Recycle (IR) flow from the aerobic to the anoxic stage.
- **Alkalinity Monitoring:** Tracks buffer capacity, as denitrification restores alkalinity consumed during nitrification.

Usage: The BNR Optimization

- **Zone Partitioning:** Define the volume ratio between the anoxic and aerobic tanks.
- **Recycle Tuning:** Adjust the Mixed Liquor Suspended Solids (MLSS) recycle rate to maximize nitrogen removal.
- **Carbon Sourcing:** Analyze if influent carbon is sufficient for denitrification or if external carbon (e.g., methanol) is required.

Concepts and Assumptions: ASM1 Denitrification

- **The Bridge:** Extends ASM1 to prioritize anoxic growth of heterotrophs using nitrate as the electron acceptor.
- **Zero-DO Anoxic Zone:** Assumes the first zone is strictly deprived of dissolved oxygen to facilitate nitrate reduction.

Benefits

- **Total Nitrogen (TN) Reduction:** Drastically reduces nitrate levels in the final effluent.
- **Cost Savings:** Leverages influent carbon for denitrification, reducing the need for expensive chemical additives.

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