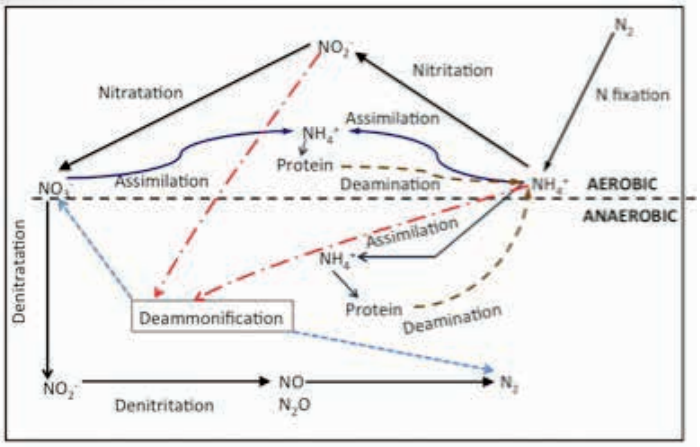
Executive Summary

WERF

Sidestream process options for both removal and recovery of nutrients

Technologies for Sidestream Nitrogen Removal (NUTR1R06w)



Nitrogen Transformations in Aerobic and Anaerobic Environments. Dashed red line indicates reactants for deammonification, and dashed blue line shows products of deammonification.

The Central Issue

Liquid streams, known as sidestreams, generated by the dewatering of digested sludge contain elevated nutrient concentrations. Discharge of these streams to a main treatment process causes increased nutrient loading to the primary and secondary treatment processes. With increasing demands for lower nutrient effluents and increasing desire to reduce operating costs (energy, chemicals, maintenance), reducing ammonium and phosphate in sidestreams is gaining interest.

Context and Background

The project team performed a state of the knowledge review of sidestream treatment with a specific emphasis on the removal and recovery of inorganic nitrogen. Types of recycle streams commonly found in conventional wastewater treatment plants, their characteristics, and the potential impact on the plant were reviewed, along with a comprehensive review of biological and physiochemical treatment technologies that have been developed and implemented to separately treat the nutrient-rich streams. Details on the following were examined:

- Nitrification and denitrification processes.
- Nitritation and denitritation processes.
- Deammonification processes.
- Reduction of sidestream ammonia in solids digestion processes.
- Physiochemical processes for ammonia recovery and destruction.

Findings and Conclusions

The research team determined that the cost effectiveness of implementing sidestream nitrogen removal in a facility is site specific and dependent on several conditions. Those conditions include space at the facility for construction of a new sidestream treatment process, costs including energy, chemical use, and construction, and non-economic considerations such as sustainability goals or metrics and public perception.

The team also found that biological treatments of sidestreams are practiced more widely than physiochemical processes, largely due to the familiarity of plant operators with biological treatment experience and the limited number of economically viable physiochemical processes with extensive operating and performance history. However, as ammonia-N and phosphate-P continue to be viewed as a recovered resource as opposed to pollutants that must be treated, interest in physiochemical processes has been increasing.

While there is a great interest in physiochemical processes for N and P recovery, the researchers found that a present worth analysis of deammonification technologies creates a challenge for physiochemical ammonia recovery processes. Although capital costs and footprint requirements may be higher for a deammonification process, the absence of chemical requirement makes deammonification a low-cost option for separate sidestream nitrogen removal. However, physiochemical and biological treatment of sidestreams should not be viewed as mutually exclusive options. Resource recovery processes may impact effluent and ultimately enhance nutrient removal.

Management and Policy Implications

This report explains the various sidestream process options for both removal and recovery of nutrients. It documents current sidestream management options. It also describes treatment technologies available for sidestream nitrogen removal and recovery as well as their performance. Current practices for sidestream nitrogen removal and recovery processes are also documented.

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Related WERF Research

Project Title	Research Focus
Mainstream Deammonification (INFR6R11)	Investigates novel low-energy technologies with the most potential for the wastewater sector to achieve net zero energy.
Towards a Renewable Future: Assessing Resource Recovery as a Viable Treatment Alternative (NTRY1R12a)	Reviews the technical and economic benefits, as well as challenges associated with extractive nutrient recovery to help water resource recovery facilities (WRRFs) considering nutrient recovery to produce additional value-added products from wastewater.
Shortcut Nitrogen Removal – Nitrite Shunt and Deammonification (WERF/WEF Special Publication)	Provides utility owners, managers, engineers, operators, and researchers with a solid explanation of shortcut nitrogen removal and the most current research and cutting-edge industry practices on how to implement these emerging resource-saving technologies in a sustainable manner.

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