Executive Summary

WERF

Which low-energy alternatives to activated sludge treatment have the greatest potential for implementation?

Pilot membrane aerated biofilm reactor at the University of Notre Dame.

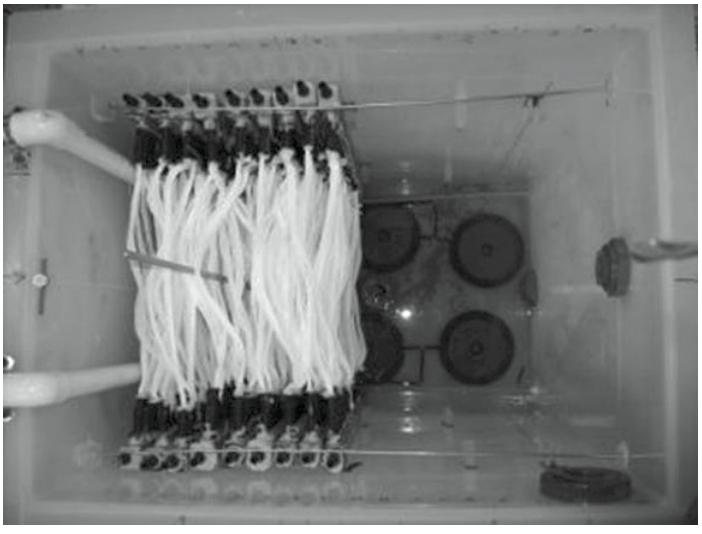
Challenge Projects on Low Energy Treatment Schemes for Water Reuse: Phase 1 (ENER2C12)

The Central Issue

In recent years, a number of low-energy alternatives to activated sludge treatment for wastewater have emerged. Water resource recovery facilities exploring alternatives to activated sludge may want to know which of these emerging processes may be a "game changer" for the industry. Based on an initial look at 30 emerging technologies, mainstream deammonification and anaerobic MBR appear to have great potential as low-energy alternatives to conventional activated sludge.

Context and Background

Working together, the WateReuse Research Foundation and WERF collaborated to fund a series of reports summarizing the potential from cutting edge research on low-energy alternatives to conventional activated sludge. Given the potential for numerous alternatives to the activated sludge process, this research was greatly needed. In fact, the sector may be on the verge of becoming post-activated sludge process reliant, thus furthering the water resource recovery facility concept in the very near future.



Top down view of membranes in pilot reactor.

The research is presented in four reports. The first is an overview and evaluation of approximately 30 emerging technologies with promise to reduce process energy demand. The second report provides a discussion of a process approach using forward osmosis and membrane distillation, among other technologies, to provide high-quality reclaimed water. The third report provides a discussion of membrane aerated biofilm reactors based on pilot studies. The fourth is a discussion and life cycle assessment of anaerobic membrane bioreactors.

Findings and Conclusions

As previously stated, the research found that mainstream deammonification and anaerobic MBR have great potential as low-energy alternatives to conventional activated sludge, but other emerging technologies or combinations of process technologies may provide possibilities as well. Significant potential exists for advancing low-energy alternatives to activated sludge processes, the current energy-intensive mainstay of the sector. Additional research will further accelerate implementability of these alternatives.

Management and Policy Implications

Progressive water resource recovery facilities and their consultants will benefit from closely following the advancement of these alternatives to activated sludge. Given the amount of research on these topics that is currently underway, furthering of the water resource recovery facility concept is likely in the very near future.

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Related WERF Research

Project Title	Research Focus
Low Energy Alternatives for Activated Sludge – Advancing Anaerobic Membrane Bioreactor Research (ENER4R12)	Will demonstrate AnMBR treatment of dilute (municipal) wastewater at the pilot scale under seasonal temperatures and show that low-energy, post-treatment of AnMBR effluent can achieve excellent nitrogen removal, thus advancing the state of knowledge about using AnMBRs for secondary treatment at moderate to cold temperatures. The research will determine if the life cycle cost and environmental impacts of the AnMBR with post-treatment system are favorable compared with more conventional strategies for carbon and nitrogen treatment.
Full-Plant Deammonification for Energy-Positive Nitrogen Removal (INFR6R11) and the LIFT Compendium currently under development.	Phase 1 of this research is currently underway and includes the operation of pilot studies by DC Water in the District of Columbia, AIZ Waterboard in Austria, and the Hampton Roads Sanitation District (HRSD) in Virginia to demonstrate the feasibility of the proposed full-plant deammonification processes. Pilot data supports expanded research in Phase II to develop more general design guidelines. Phase II will develop tools to aid engineers and operators in applying full-plant deammonification at full-scale for various process configurations at North American facilities.

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