INTEGRATED SORPTION TECHNOLOGIES

FOR RECOVERY OF NITROGEN AND PHOSPHOROUS FROM ANAEROBIC MEMBRANE BIOREACTOR PERMEATES

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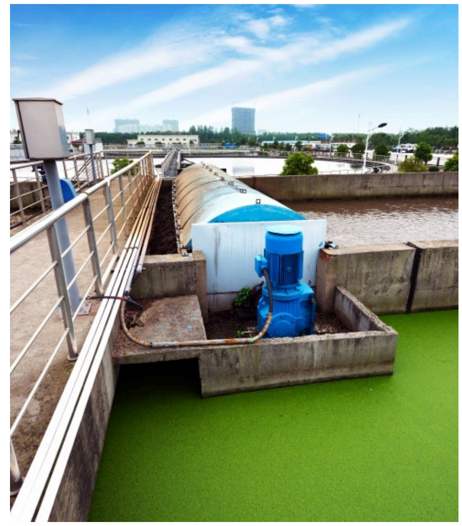
WHY DID WE DO THIS RESEARCH?

Municipal utilities spend considerable time, energy and chemicals to remove phosphorous and nitrogen compounds like ammonia and ammonium from municipal wastewaters. Removing these nutrients is expensive and often not commercially feasible; however, even in low concentrations phosphorous and nitrogen can degrade water quality.

This 2013-2015 project created an effluent of specific, elevated, concentrated feedstock amenable to methods such as the Ostara process (a struvite recovery technology) to generate fertilizer from wastewater, and developed a more economical treatment to collect ammonium nitrogen and regenerate exhausted zeolite for AnMBR permeates. The new processes developed through this project could eliminate the need for energy intensive nitrification processes and/or the need for the addition of chemicals for phosphorous removal, and will help municipalities to meet strict effluent regulations.



WHAT DID WE DO?

Commercially available adsorbents were batch tested for nitrogen (N) and phosphorous (P) sorption and then the most effective adsorbents were column (continuous) tested for N & P adsorption.

An innovative ammonium nitrogen recovery process was developed using a natural zeolite and an alkaline regeneration method. Five zeolites were tested using synthetic wastewater in batch experiments to determine the best natural zeolite.

WHAT DID WE FIND?

In column tests, a commercial ion exchange resin recovered the most phosphorus (62 %) after being treated with a salt solution (NaCl). All other sorbents recovered less than 20 % of the phosphorus from the synthetic wastewater, suggesting that a mechanism to facilitate increased phosphorus recovery may be necessary.

In column tests, 0.5 M NaCl was determined to be the most efficient desorption solution due to its high recovery and low cost; using the 0.5 M NaCl solution 100 % of the sorbed P was recovered from the commercial ion exchange resin.

Zeobrite Lm had the best combination of ammonium exchange capacity (AEC) and regeneration efficiency, but frequent regeneration of exhausted zeolite was required.

WHAT ARE THE IMPLICATIONS FOR DECISION MAKERS?

Commercial sorbents are able to remove and recover phosphorous from wastewater, but sorbent technologies will need to be improved to enhance economic viability for their use in nutrient recovery.

There is a gap between lab-scale use of sorbents for P recovery and full scale implementation in wastewater treatment plants.

Overall, the results of this study have shown that selectivity of sorbents will need to be improved to target nutrients in wastewater, eliminating competition effects during adsorption, and increasing the quantity of P recovered from the wastewater stream.