Personal Information

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Education

2015/09 – Present
University of Washington
PhD, in Environmental Engineering

2008/09 – 2012/06
University of Washington
BS, Chemical Engineering

Research interests

Nitrogen remains one of the greatest pollutants from human activity plaguing waterways and estuaries in the U.S. Excess nitrogen in surface waters accelerates eutrophication, the stimulation of the explosive algal growth that devastates an ecosystem by depleting oxygen and releasing toxins. Unfortunately, nitrogen removal in wastewater treatment systems is very costly. However, combining new advancements in microbiology and wastewater treatment (WWT) could make nitrogen removal in WWT more sustainable and less expensive.

A revolutionary innovation in WWT is the nitrogen removal by anaerobic ammonium oxidizing bacteria (anammox), which convert ammonium and nitrite to nitrogen gas (N2) in the absence of oxygen and provide new possibilities for biological nitrogen removal. Anammox are an improvement over the traditional autotrophic nitrification/heterotrophic denitrification process because they produce 75% less sludge, emit 90% less CO2, reduce the energy required for aeration by 60%, and do not require an organic carbon source. Also, they can form large, dense granules that easily separate from other solids, allowing for smaller footprint reactors. Anammox need nitrite, produced by ammonium-oxidizing bacteria (AOB), to anaerobically oxidize the ammonium in the effluent. The granule construction allows for AOB to grow on the high O2 exterior of the granule, while the anammox grow on the anoxic interior. To establish good nitrogen removal anammox and AOB must be enriched in the reactor system while nitrite-oxidizing bacteria (NOB), which use oxygen to oxidize the nitrite to nitrate, need to be outcompeted. The competition between anammox and NOB for nitrite and between AOB and NOB for oxygen is a significant challenge as lowering activity of NOB will lower AOB activity, and nitrogen effluent concentrations will rise.

I hope to overcome the challenges keeping anammox from mainstream wastewater treatment by leveraging metabolisms of organisms novel to the Anammox process. If successful, my research will eventually lead to new wastewater treatment technologies that will keep our waterways cleaner at a lower cost to consumers.

Awards & Scholarships

1. EPA STAR Fellowship, 2016 - Present
2. Valle Graduate Scholarship, 2015 - 2016
3. National Science Foundation Graduate Research Fellowship, Honorable Mention, 2015
4. UW Science and Technology Showcase, 1st Place, $1,000, “OmniOff”, 2012
5. Environmental Innovation Challenge, Honorable Mention, $2,500, “OmniOff” 2012
6. Campus Sustainability Fund Grant, $1,600, 2012
7. Social Innovation Fast Pitch Competition, 2nd Place, University Division, $2,000, “Biodiesel Cooperative: Fostering Tomorrow’s Energy Innovators”, 2011

Professional experience

1. 2012/07-2014/08, E3 Energy Partners, (Bioproducts process design firm), Process Engineer
2. 2011/03-2012/09, E3 Energy Partners, Engineering Intern
3. 2010/06-2010/09, EdeniQ, (Cellulosic ethanol plant), Engineering Intern