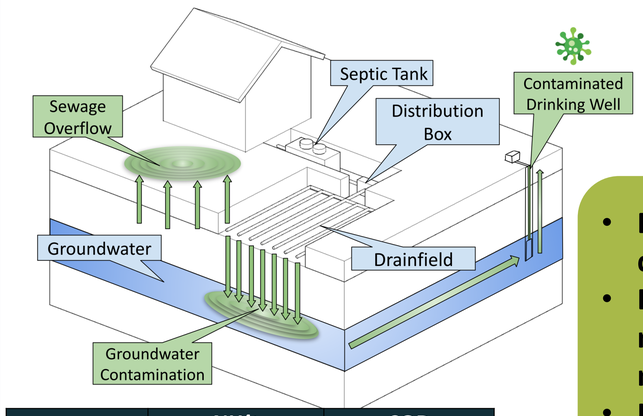
Investigating Septic Alternatives: Effects of Aeration on Nitrogen and Carbon Removal in an Electrified Anaerobic Baffled Reactor

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Introduction

How does intermittent aeration affect carbon and nitrogen removal in an electrified anaerobic baffled reactor?

Motivation



- **Buildup in drainfield**
- **Doesn't remove nutrients**
- **Low organics removal**

	NH^{4+}	COD
Septic Tank Removal Efficiency	**Negative removal to ~0%**	**~53-65%**
Study	Nasr & Mikhaeil, 2013	Nasr & Mikhaeil, 2013

Aerobic Septic Alternatives

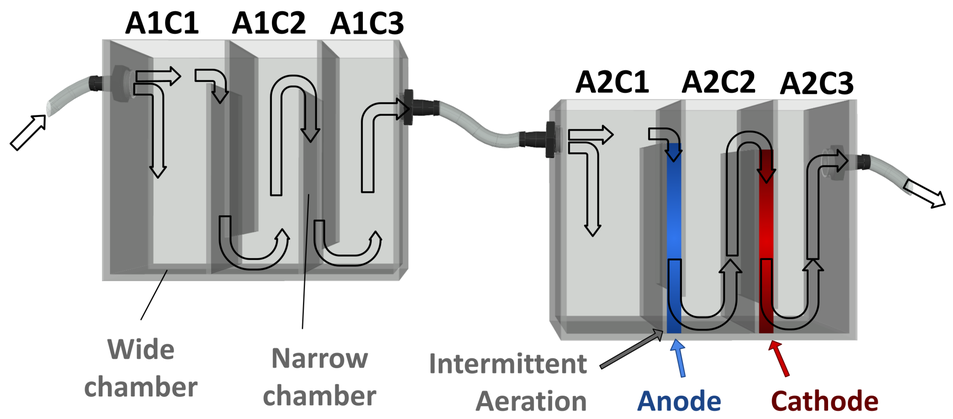
- High **cost**
- Continuous **electricity**
- Frequent **maintenance**

Methods

Research conducted through ENV E 499 – Special Study course

ABR 1 inoculated with wastewater treatment plant sludge → **Protein-rich feed solution[2] is pumped in for 4 hours, twice a day** → **Flow rate mimics a realistic septic usage schedule in a home**

Weekly tests: ammonium, Chemical Oxygen Demand (COD), Soluble COD (SCOD), and other water quality parameters



Patent Pending: 63/765,312

Chemical Processes Underway

$NH_4^+ + 2O_2 \rightarrow NO_3^- + 2H^+ + H_2O$ — Nitrification

Denitrification: $NO_3^- \rightarrow NO_2^- \rightarrow NO \rightarrow N_2O \rightarrow N_2$

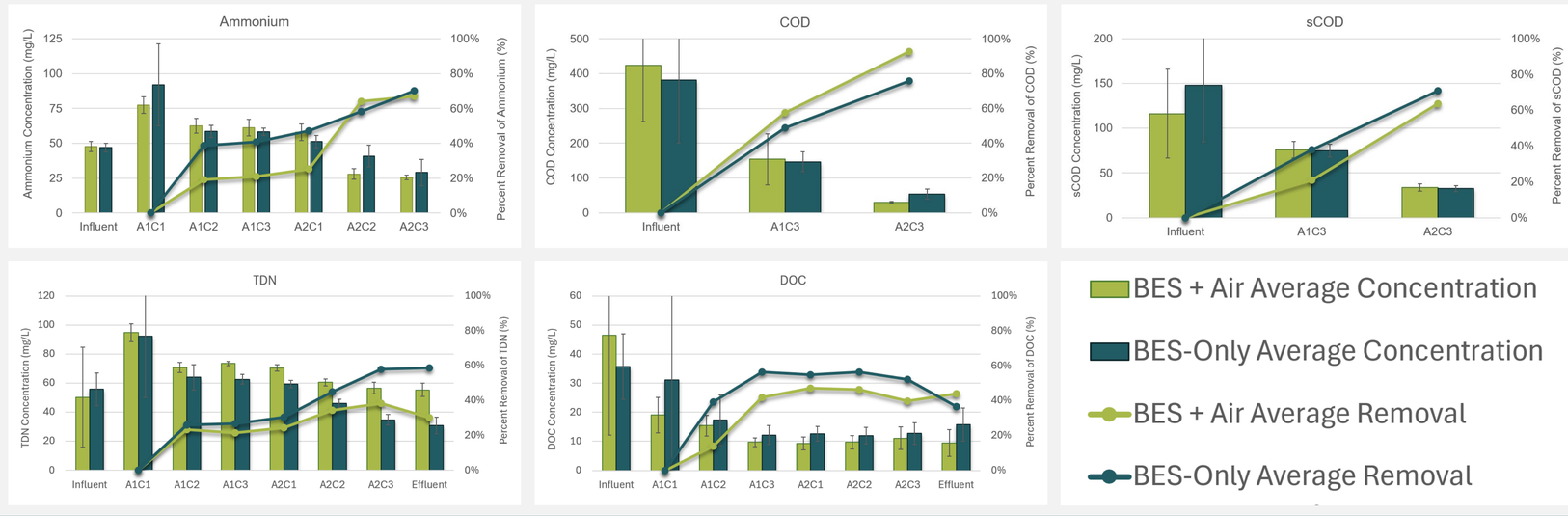
$NH_4^+ + 1.32NO_2^- + 0.066HCO_3^- + 0.13H^+$

Anammox ⇩

$1.02N_2 + 0.26NO_3^- + 0.066CH_2O_{0.5}N_{0.15} + 2.03H_2O$

	A1C1	A1C2	A1C3	A2C1	A2C2	A2C3
BES + Air	0.19	0.16	0.12	0.12	1.22	1.20
BES-Only	0.10	0.07	0.07	0.06	0.09	0.53

Results



Conclusions

- BES-Only still has more nitrogen removal than septic
- BES + Air increases nitrification and denitrification which increases nitrogen removal
- Denitrification increases carbon removal because of the oxidation of organic carbon which we can measure with COD (organics)

Next Steps

- DNA Sequencing will help indicate diversity and abundance of bacteria
- Energy usage is estimated to be low, but scaled energy evaluation is needed
- Scaling up model to near full size using real wastewater

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References