Measurement of Wastewater Contaminants in Norway House Cree Nation

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WASTEWATER CONTAMINANTS

- Classic wastewater contaminants:
 - Nutrients (e.g., phosphorous, nitrogen)
 - Metals (e.g., lead, mercury, copper)
 - Pathogens (e.g., coliform bacteria)
 - Organic material
- Emerging wastewater contaminants:
 - Pharmaceuticals
 - Personal care products
 - Antibiotic resistance genes









WASTEWATER CONTAMINANTS

- Can have effects at the organism, population and ecosystem levels
- Excess phosphorous = algae blooms
 - Less light penetration, decreases dissolved oxygen (DO), changes in natural ecosystem dynamics
- High levels of organic material = ↓ DO
 - Microorganisms use up oxygen to "eat" the organic material
- Pharmaceuticals are designed to have effects on humans at low doses
 - What happens when they interact with aquatic organisms?





PASSIVE SAMPLERS



Diffusive gradients in thin films sampler (DGT)

Polar organic chemical integrative sampler (POCIS)





SAMPLING IN NORWAY HOUSE

- Tertiary lagoon-treatment plant system
- Summer 2014 we sampled for nutrients, pharmaceuticals, pesticides, antibiotic resistance genes and basic water quality parameters at six sites within and surrounding the wastewater treatment plant
 - Upstream of release (intake to drinking water treatment plant)
 - Fours sites within plant: 1°, 2°, 3° lagoons and final effluent
 - Downstream of effluent release (Church point)
- Passive samplers to sample pharmaceuticals
 - Deployed and left for 21 days in the system

Lake Winnipeg

Litlle Playgreen Lake

Playgreen Lake

Continuous release sewage treatment system



NUTRIENTS



 Nutrients showed improvement at final effluent site

TDN

TDP

- Minimal presence of nutrients in upstream and downstream sites
- Little improvement between primary and tertiary lagoons

PHARMACEUTICALS

- Seven human-use pharmaceuticals were detected: atenolol, carbamazepine, sulfamethoxazole, sulfapyridine, gemfibrozil, metoprolol, and trimethoprim
- Limited reduction of these analytes within the treatment facility
- No detection at upstream and downstream sites
- Concentrations typical of a community of this size e.g., Morden and Winkler, MB

PHARMACEUTICALS



PHARMACEUTICALS



SUMMARY

- Lagoon treatment system is effective at attenuating nutrients
- Pharmaceuticals detected throughout treatment plant, but mostly below detection limits at upstream and downstream sites
- Limited treatment of all contaminants from primary to tertiary lagoons, suggesting that lagoon operation could be optimized

FUTURE WORK

- Further sampling this summer/fall to assess temporal trends both annually and seasonally
- A secondary downstream site closer to effluent release



Current downstream site











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