

PROJECT PROPOSAL

The role of Algae, sunlight and humic substances in disinfection in an Arctic Wastewater Stabilization Pond

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Project Description

This research aims to measure, and better understand and provide guidance on disinfection of domestic wastewater in Arctic wastewater stabilization ponds (WSPs). WSPs are sustainable, low cost and maintenance, passive wastewater treatment systems that are commonly used in Northern communities across Canada. Their performance is susceptible to environmental conditions and therefore can exhibit variable treatment efficiencies. Disinfection in WSPs relies on naturally occurring water quality variables, such as sunlight, pH, dissolved oxygen and humic substances. Disinfection in Pond Inlet's WSP over recent years has been variable and pathogen removal, measured by the indicator organism E.Coli, has not been in compliance with federal effluent standards outlined in the Wastewater Systems Effluent Regulations. Measuring disinfection performance of WSPs and providing evidence to guide potential improvements is the overarching goal of the project. This will be accomplished by studying the effect and presence of algae and humic substances in WSPs, as well as measuring sunlight intensity, influent and effluent E. Coli concentrations and standard water quality parameters. This will require extensive sampling over the course of two sampling periods, each a week long, and collection of samples to isolate humic substances and determining their concentration in the wastewater. This will be used to produce a model for Pond Inlet's WSP to help understand reasons why disinfection is inconsistent, and to test different scenarios for improvement.

Methodology

Samples will be collected according to the Standard Methods for the examination of water and wastewater (1). Several wastewater quality parameters, including pH, dissolved oxygen, temperature, and depth will be measured using a Hydrolab DS5X by OTT Hydromet. . Solar radiation penetration throughout the water column will be measured using and Ocean Optics Jaz Spectrometer. A DR 1900 Portable spectrophotometer by Hach will be used to measure nitrogen species and phosphorous concentrations. All monitoring will take place on site. Monitoring will take place daily, or multiple times per day. Transportation between the hotel in Pond Inlet and the site will be by car.

Data

Data will be analyzed to discern the disinfection efficiency within the sampling period and how the parameters measured are correlated with pathogen removal. This will be accomplished by correlating the wastewater parameters listed above to E.Coli removal. The data will be used to validate and update a model from Beran and Kargi (2009) and modified by Rami Massarani from Queen's research team for application to Pond Inlet's WSP. This model predicts aspects of treatment performance, such as algae growth, organic matter, nitrogen and phosphorus removal. The update will include the addition of a disinfection model. Data will also be compared with past measurements made by researchers from Queen's and Dalhousie Universities.

Reporting

The culmination of our efforts will result in several journal publications. In addition, the Pond Inlet community will have access to any data we collect and our findings.