ALBERTA INNOVATES

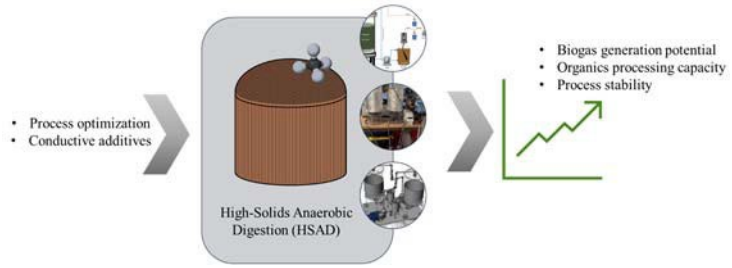
AGRICULTURE AND ENVIRONMENT

BIOINDUSTRIAL AND CIRCULAR INNOVATION

BIOENERGY

Advancing High Solids Anaerobic Digestion of Organic Waste

Landfill gas is produced mainly through “anaerobic digestion” of organic materials by microorganisms in a low oxygen environment. Landfill gas is high in methane gas which contributes to greenhouse gas (GHG) emissions. This project focuses on enhancing the high-solids anaerobic digestion (HSAD) process, in order to divert high-solid organics from landfills and recover methane-rich biogas that can be used to produce heat, electricity or renewable natural gas. Dr. Bipro Dhar’s team will develop and test new engineering strategies using different materials (specifically, conductive additives) to optimize microbial populations for enhanced HSAD process efficiency and reliability. This research aligns with the Government of Alberta’s "Zero Waste” vision for diverting organics from landfills, as well as provincial and federal low-carbon energy objectives.



FUNDING DETAILS

RECIPIENT:
Dr. Bipro Dhar
University of Alberta

PARTNERS:
City of Edmonton
InnoTech Alberta

TOTAL BUDGET:
$359,000

AI FUNDING:
$96,000

PROJECT DATES:
NOV 2018 – JAN 2023

PROJECT TRL:
Start: 4
End: 7

APPLICATION

Municipalities and other waste service providers are expected to be the main users of this technology. Currently, only centralized waste management facilities use the HSAD process due to high capital cost, long payback period, and limited evidence on profitability. Project success will drive HSAD process costs down and demonstrate economic viability. Improved economics will, in turn, open up the biogas production market to small- and mid-size waste management facilities.

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PROJECT GOALS

The overall project goal is to advance the HSAD process to better meet industry needs. The specific goals are to:

- Optimize process parameters and operational approaches for the HSAD process, targeting enhanced process stability, organics processing capacity, and biogas generation potential.
- Develop an engineering strategy for shaping more efficient and robust microbial populations in a digester using retrofitting conductive additives.
- Refine the HSAD process and conduct pilot-scale demonstrations of developed techniques.
- Demonstrate a 15 per cent improvement in biogas production compared to existing HSAD process.
- Evaluate the techno-economic feasibility of applying conductive materials as additives for the HSAD process.

BENEFITS TO ALBERTA

- Enhance the opportunity to cut GHG emissions in Alberta and pave the way for successful diversion of organic waste from landfills as well as replace a portion of fossil fuels use with waste-derived bio-methane.
- Reduce HSAD process capital costs and show a payback of less than 5 years, thereby improving economics for small- and medium-scale HSAD facilities.
- Attract investment in HSAD process technologies in small- and medium-sized waste management operations.
- Stimulate the wide-scale adoption of the HSAD process across the province to create unique opportunities for new jobs and economic diversification while taking steps towards building a sustainable and healthy environment for Albertans.

6 Publications

7 Students Trained

1,900 kt/yr Future GHGs Reduced

>200 Future Jobs

CURRENT STATUS

January 2023 - Completed

This project was completed in January 2023. In this project, laboratory-scale testing and analysis, and pilot-scale demonstration are completed. Results to date have demonstrated the effects of selected conductive additives and key factors on microbial populations which, in turn, affect biogas production. Lab-scale results confirm the potential to improve HSAD process efficiency by at least 15 per cent. To date, the team has published three peer-reviewed journal articles and presented at three conferences.