



Ammonia Fertilizer Production from Dairy Manure

Project Lead: Dr. Jongho Lee

Collaborating Partners:

Total Project Funding: \$91,500

Contribution from DIREC: \$15,000

Objectives:

- Fabrication of Ammonia-selective Membranes
- Building of Lab-scale Membrane System for Ammonia Recovery
- Ammonia Recovery from Synthetic Liquid Manure
- Feasibility Study for Real Liquid Manure

Activity Description:

- We fabricated hydrophobic membranes that are gas (ammonia)-permeable.
- We built a lab-scale membrane system called membrane contactor (MC), consisting of pumps, a membrane module, tubings, and temperature controllers.
- We used ammonia-concentrated liquid solutions as a synthetic liquid manure and demonstrated that ammonia can be effectively extracted from the solutions using the developed membrane system.
- We investigated the impact of various operating conditions of the membrane system on the ammonia extraction performance.
- We obtained real liquid manure samples from UBC Dairy Centre, and subjected the liquid to our system to recover ammonia.

Results:

- The developed membrane is highly hydrophobic, resisting wetting against water and allowing gaseous ammonia to pass through the membrane.
- The developed MC system that employs the developed membrane recovers the dissolved ammonia from ammonia-concentrated feed streams.
- The ammonia extraction performance is enhanced when the system temperature is higher, flow velocity in the membrane module is faster, and the concentration of acid stream as a draw solution increases.
- From the real liquid manure, we extracted approximately 80% of ammonia from the manure, and produced a stream of ammonium sulfate, a widely used fertilizer.

Benefits & Analysis:

- Dairy manure has high level of dissolved ammonia (>1500 ppm) and is an excellent source of ammonia-based fertilizer.
- Membrane contactor systems spontaneously extract ammonia from dairy manure and produce liquid streams of ammonia-sulfate, a widely-used fertilizer.
- By reducing the ammonia level in dairy manure, our approach can substantially reduce the dairy waste management cost to meet stricter regulations.
- The ammonia extraction using our technology can create values from dairy wastes through producing fertilizer, significantly reduce the toxicity of the wastes, and lower the risk of environmental pollution.

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DIREC Mission Statement:

The BC Dairy Association actively funds research and education projects. Our objective is to facilitate, encourage and financially support projects and programs that have been identified by the BCDA to benefit the BC dairy industry.

