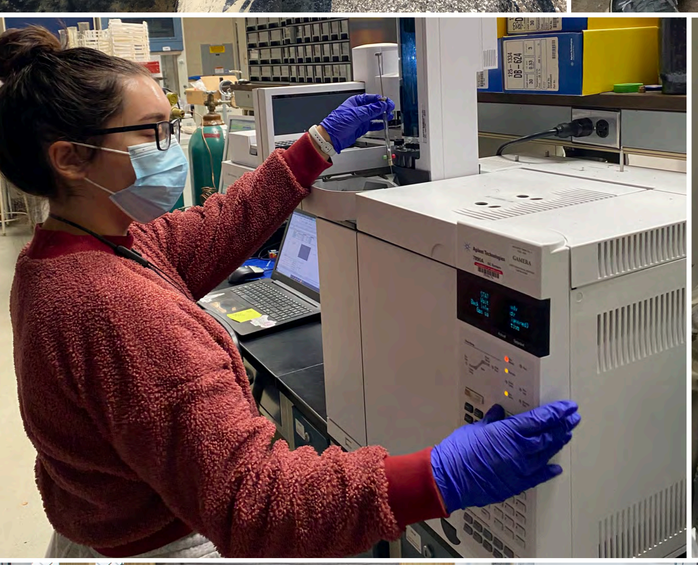
DEPARTMENT OF
ENVIRONMENTAL SCIENCE & TECHNOLOGY

Undergraduate Program	Graduate Program
Ecological Technology Design	Soil and Watershed Sciences
Ecosystem Health	Ecological Technology Design
Soil and Watershed Science	Wetland Science
Natural Resources Management	Ecosystem Health & Natural Resource Management



Waste to Energy: Bioenergy & Bioprocessing Technology

Dr. Stephanie Lansing and Dr. Amro Hassanein convert waste to energy through researching:

- Innovations in Anaerobic Digestion and Fermentation, including nanotechnology, electrochemistry (microbial electrolysis cells, microbial fuel cells, and electrolysis), biochar, and bioplastic production from fermentation products.
- Reducing Antimicrobial Resistance through integration of Engineering, Public Health, and Social Science. Studies include manure treatment, social science, video-based communication outreach, and multi-institute graduate teaching.
- Food, Energy, and Water (FEW) Nexus interdisciplinary approach. Project includes food waste, municipal solid waste (MSW) digestion, algal turf scrubber-based bioenergy at the Port of Baltimore, and a patented ammonia scrubber for nutrient recovery post-digestion. Life Cycle Assessments (LCA) of bioenergy are used to understand climate change, eutrophication, and other impacts of waste to energy products.
- Ecological Engineering practices to create circular economies and allow humans and nature to work together for the benefit of both.
- Extension support to food waste, dairy, and poultry manure digester operators in Maryland, as well as sanitary waste digestion projects in Haiti.
- Food system resiliency, as the Co-Vice Chair of the Maryland Food Systems Resiliency Council and Chair of the Environment and Production Subcommittee.

What is an Anaerobic Digester?

When wastewater flows through an enclosed digestion container without oxygen, known as an anaerobic digester, microorganisms use the wastewater as a nutrient source to produce methane-enriched biogas that can be used to replace natural gas for heating, as a vehicle fuel, or to power an electric generator. During the digestion process, solids, organic matter, and pathogens are drastically reduced while nutrients are retained, resulting in a high-value liquid fertilizer.

What are Anaerobic Digestion Substrates?

Professor Lansing is researching various substrates, reactor conditions, and additives to increase the value and efficiency of digestion technology. For example, food waste has a high biogas potential, with more than 34 million tons of food waste entering landfills each year, diverting food waste to digesters could increase biogas production and drastically reduce greenhouse gases associated with landfilling food waste. Algae turf scrubbers (ATS) can be used for cleaning polluted water, with the algae extracted for bioenergy using digestion technology. In addition to agricultural digesters, human wastewater digesters using latrine wastes have been designed and built in Haiti to reduce pollution from untreated waste and deforestation by providing biogas for cooking, replacing charcoal and firewood as the main energy source.

Anaerobic Digester Benefits Include:

- Non-intermittent renewable energy production in the form of biogas
- Large decreases in greenhouse gas production from manure management, food waste disposal, and use of fossil fuels for electricity, heating, and vehicle fuel - specifically, the capture of methane, a greenhouse gas 25 times more powerful than CO2, that would be emitted into the atmosphere without digestion installation
- Wastewater treatment with a large decrease in organic pollutants
- Creation of a fertilizer that is high in dissolved nutrients and great for plant growth
- Large reductions in noxious odors

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