

Research Unit Summary

USDA-ARS
Coastal Plains Soil, Water & Plant Research Center
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Patrick G. Hunt, Research Leader

Current research projects and objectives

1. Feasibility analysis of wastes-to-bioenergy options – The objective of this research thrust is to investigate various biochemical and thermochemical treatment/conversion options for safe disposal and bioenergy production of livestock wastes.
2. Feedstock characterization for synthesis gas production and biofuel synthesis – The objectives of this research thrust are: 1) to characterize synthesis gas from gasifying various waste feedstock materials via TGA/MS, and 2) to evaluate the effectiveness of commercial catalysts for catalytically synthesizing biofuels from wastes-derived synthesis gas.
 - Cooperative research - Catalytic conversion processes for mixed alcohols and hydrocarbons from animal wastes and biomass generated synthesis gas (6657-13630-003-05)
3. Anaerobic digestion for biogas and hydrogen production – The objectives of this research thrust are: 1) to maximize production of biogas from livestock wastes via anaerobic digestion, and 2) to produce CO-free hydrogen gas for direct fuel-cell application by anaerobically /microaerobically digesting animal manures with *Thermotogales* bacteria.
4. Bench-scale gasification – The objective of this research thrust is to optimize gasification conditions for optimal conversion of waste feedstocks and feedstock blends for desired synthesis gas composition.

Lead SYs and contact information

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Key accomplishments

Wet gasification of animal and municipal wastes for energy generation and waste treatment – This accomplishment is under the research thrust #1. We investigated the applicability of the new wet gasification technology to treat and harness energy from animal and municipal wastes. Based on theoretical considerations and limited experiments with dairy manure wet gasification, some of wet wastes such as swine manure and sewage sludge could be fed directly into a wet-gasifier, which would produce more energy than combusting the same amount of brown coal. The costs of a conceptual

first generation wet gasification manure management system for a model swine farm were significantly higher than that of traditional anaerobic lagoon systems. However, there are many significant environmental advantages of the wet gasification: 1) removing oxygen demanding wastes, estrogens, odorous compounds; 2) achieving total pathogen kills; 3) recovering most of nitrogen as ammonia which could be used as a fertilizer; and 4) producing relatively clean water which, after minimal treatment, could be used as a livestock drinking water.

Other scientific expertise or capabilities already available to the RU that could be applied to bioenergy research

- Thermogravimetric analyzer with mass spectrometer
- Precision irrigation system for energy crop production development
- Access to full-scale animal waste treatment facilities for waste feedstocks
- Bench-scale batch gasification system under construction
- Instrumentation which includes: Inductively coupled plasma spectroscopy, gas chromatograph, high performance liquid chromatograph, atomic absorption, spectrophotometer, and ion chromatograph