ASSOCIATION OF 1890 RESEARCH DIRECTORS

Research at West Virginia State University is focused on understanding how microorganisms control environmental processes and how they can be used in biotechnology, particularly bioenergy generation. This project is increasing bioenergy production from anaerobic digestion and continuing to develop and improve AD biotechnology, from developing new applications to improving its economic impact. Overall, this could prove to be an attractive alternative for farmers burdened with maintenance and operational costs of farm equipment.

Bioenergy, Anaerobic Digestion and Renewable Resources

Who cares and why?

Anaerobic Digestion (AD) has been used worldwide for many years to reduce the environmental impact of high-strength organic wastes while simultaneously recovering bioenergy (methane) from these wastes. Benefits of this process include natural gas production that can be used to run vehicles or generate electricity, and the reduction of greenhouse gas emissions generated from these wastes.

Organic wastes produced from agricultural and industrial activity threaten human health, as well as contribute to excess nutrient problems in streams, rivers, lakes and estuaries. Unlike many cattle and hog farms that have successfully incorporated AD technology into their operations, most poultry farms have not adopted anaerobic digestion to handle wastes. Poultry farms alone produce 10 million tons of waste per year in the United States. This waste has value, not only as a fertilizer but also as a potential alternative energy source.

What has the project done so far?

Research at West Virginia State University is focused on understanding how microorganisms control environmental processes and how they can be used in biotechnology, particularly bioenergy generation. Techniques in microbiology and genomics, as well as biochemical and modeling methods, are being used to study how the microbial consortia function. Activities involve practical and theoretical aspects of the anaerobic digestion process focusing on: treatment and use of organic wastes from animal farms, agriculture and industrial processes; feasibility of co-

digestion — combining the health-threatening organic wastes with wastewater or other digesters — to improve energy production and economics of high-temperature digestion; understanding the system of anaerobic microorganisms involved in converting biomass to energy; exploring factors that control the efficiency, stability and energy output of microbial communities involved in the digestion process; determining how plant biomass breakdown occurs in natural environments, such as insect guts and soil; and researching the use of digestion byproducts in mine-land reclamation.

Impact Statement

Research has led to increased bioenergy production from anaerobic digestion, continued development and improvement of anaerobic digestion biotechnology, development of applications of digestion for new wastes, improved economics of anaerobic digestion, reduction of environmental pollution from agricultural/industrial processes and reduction of farm pollution draining into the Potomac River.

Results have already shown that a thermophilic, continuous-stirred tank (CST) digester can be used to treat poultry litter. Co-digestion of poultry litter with other organic wastes, such as thin stillage from ethanol production, results in increased bioenergy output. This process may be useful for improving the economics of thermophilic AD. Testing of a simpler, cost-effective plug-flow design is underway. This could prove to be an attractive alternative for farmers burdened with maintenance and operational costs of farm equipment.

What research is needed?

Researchers are examining soil microbial diversity and genomic technologies to develop better knowledge of microbes and plants needed to revitalize soil degraded from extractive industries. Integrating practices are being used to encourage reestablishment of native plant communities in disturbed areas.

Want to know more?

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Additional links: http://www.umes.edu/ard/Default.aspx?id=46285

This project was supported by USDA-NIFA Evans-Allen Formula Funds and USDA-NIFA Capacity Building Grant Funds.