PRODUCTION OF HIGH VALUE FERTILIZER PRODUCTS FROM ANAEROBIC DIGESTATE

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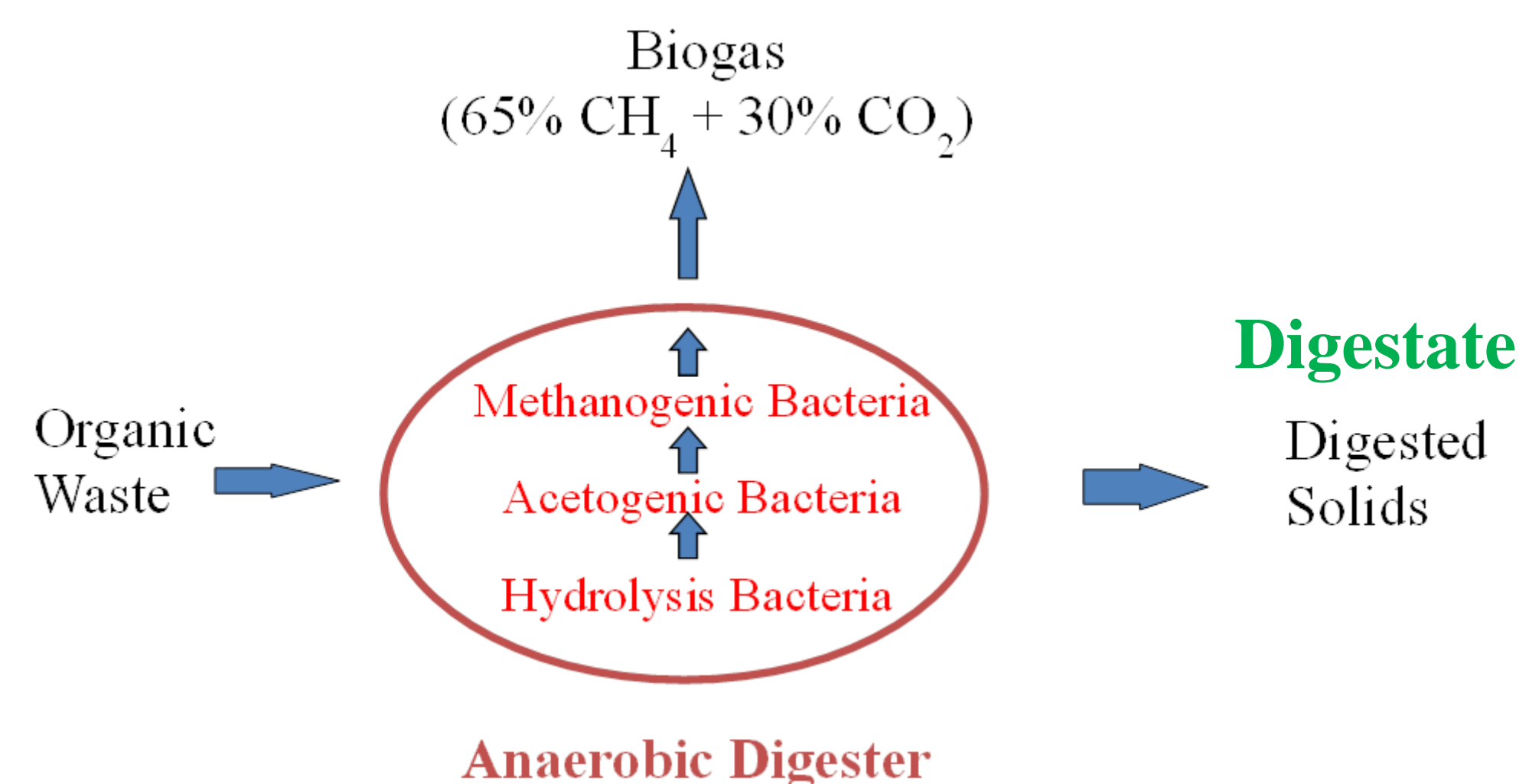[2]Agricultural Sustainability Institute
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Project Description

Dairy manure and food waste are energy and nutrient-rich materials when used as feedstock in Anaerobic Digestion (AD). This process produces biogas, high in methane as well as an effluent stream (digestate) consisting of partially digested residuals and high in mineralized nutrients. Although the digestate can be directly applied to land as a source of nutrients, there is a need to produce concentrated fertilizers that are cost effective and easy to handle, transport and apply to crops.

The goal of this project is to tackle that challenge.. We obtained 960 gallons of digestate from a mesophilic dairy digester, New Hope Dairy (Galt, CA) and a thermophilic mixed waste food digester, the UC Davis Renewable Anaerobic Digester Facility (UC READ, Davis, CA). Using advanced solid-liquid separation technologies we produced solid and liquid fertilizer products for application in a 1 acre tomato study at the Russell Ranch Sustainable Agriculture Facility (RRSAF) this summer.

Biogas
($65\% CH_4 + 30\% CO_2$)

Organic Waste

Methanogenic Bacteria
Acetogenic Bacteria
Hydrolysis Bacteria
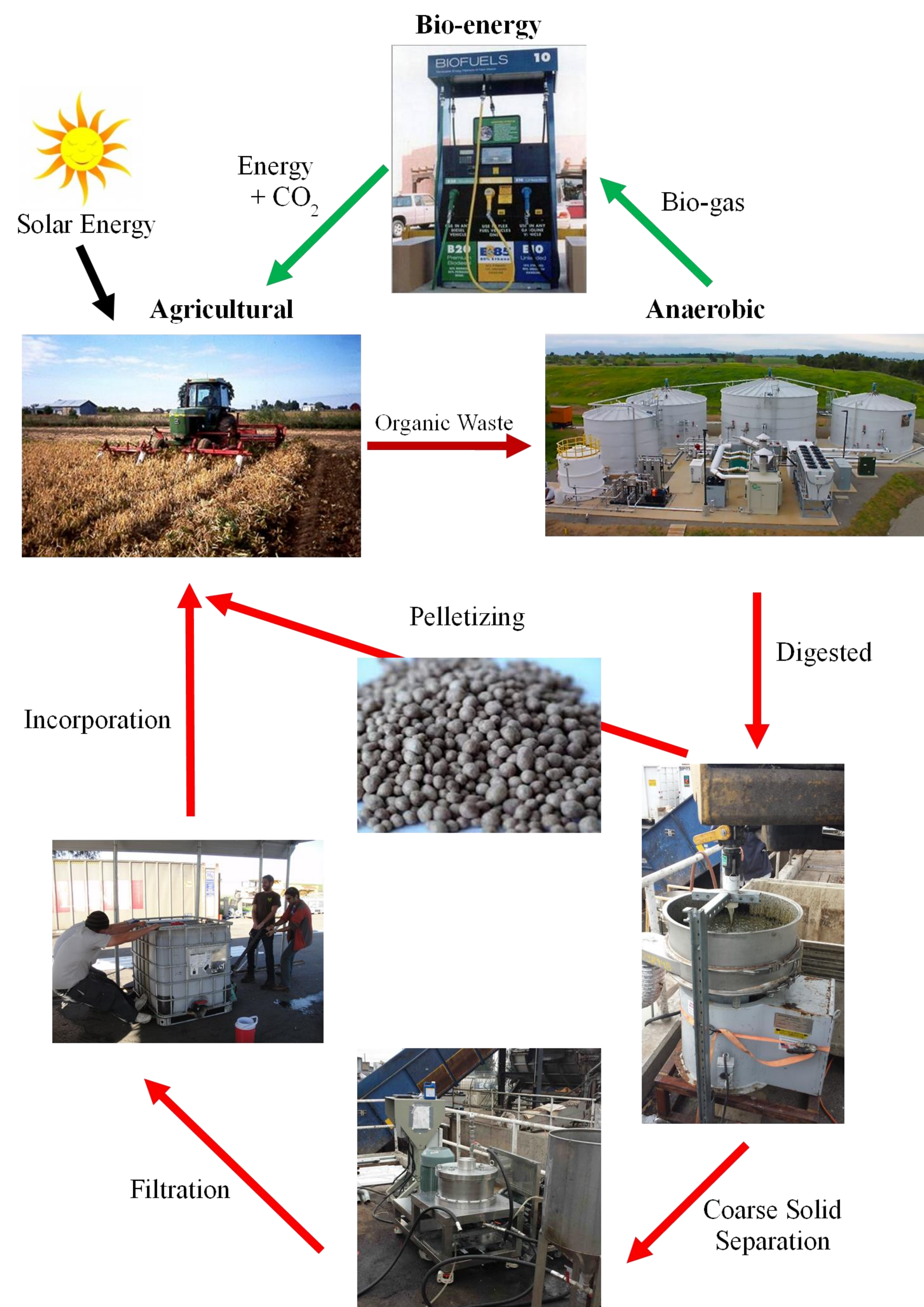
Digestate

Digested Solids

Anaerobic Digester

Project Objectives:

- Research and demonstrate effective separation technologies for the production of nutrients and water streams from anaerobically digested manure and food waste

- Design and produce new nutrient-rich, cost-effective, and safe fertilizer products and evaluate the nitrogen and other nutrient use efficiencies, crop nutrient uptake, and soil nitrogen mineralization in crops grown with different inputs, and

- Conduct an economic analysis and environmental assessment for the integrated technologies and new products and disseminate the project results to dairy producers and crop production consultants.

Fertilizer Production Process

Advanced technologies are used to process the digestate into solid and liquid products as shown in the process flow diagrams below.. Screening and dewatering techniques are used to separate coarse particles from the digestate. Membrane separation is used to separate fine particles and concentrate the nutrients into small volumes for further fertilizer product development and application.

Bio-energy

Energy + CO_2

Solar Energy

Agricultural

Bio-gas

Anaerobic

Organic Waste

Pelletizing

Digested

Incorporation

Filtration

Coarse Solid Separation

Project Outcomes, Impacts, and Progress

- Improve the economics of anaerobic digesters by creating valuable co-products from digestate
- Achieve better nutrient management in food and agricultural systems
- Reduce the environmental impact of animal manure and other organic wastes

Progress

Solids and nutrient contents of digestate from different digesters have been characterized. Particle sizes and nutrient distribution in solid and liquid fractions have been determined. A pilot integrated solid-liquid separation system has been developed and used to produce concentrated nutrient products, which will be tested in tomato growth studies in the spring and summer of 2015.

Food Leftovers

Winery Waste

CleanWorld

In 2011, Americans generated 250 million tons of waste. 164 million of that was landfilled. The largest percentage of that, food waste, amounted to over 34 million tons alone.

Discarded Food

Food Processing Residues

Yard Waste

Acknowledgements