

Food for the Twenty-First Century Bioprocessing and Biosensing Center

Fall 2009 Seminar Series

UNIVERSITY OF MISSOURI
DIVISION OF FOOD SYSTEMS AND BIOENGINEERING

PRESENTER: Dr. David E. Brune, Professor

University of Missouri, Extension Bioprocessing, Agri. Systems Management

TITLE: Algal Biomass Production for Greenhouse Gas Reduction

ABSTRACT:

Microalgal biomass production offers a number of advantages over conventional biomass production, including higher productivity, use of otherwise nonproductive land, reuse and recovery of waste nutrients, use of saline or brackish water, and reuse of CO₂ from power-plant flue-gas or similar sources. Microalgal biomass production and utilization offers potential for greenhouse gas (GHG) avoidance by providing biofuel replacement of fossil fuels and carbon-neutral animal feeds. This presentation reviews the potential for GHG avoidance using a proposed algal biomass production system coupled to recovery of flue-gas CO₂ combined with waste sludge and/or animal manure utilization. A model is constructed around a 50-MW natural gas-fired electrical generation plant operating at 50% capacity as a semibase-load facility. This facility is projected to require 880 ha of high-rate algal ponds operating at a productivity of 20 g-dry-wt/m²-day. The algal biomass is assumed to be fractionated into oil, useful for biodiesel, protein providing animal feed replacement and, residual biomass digested to produce methane gas. Together these products are projected to provide a gross GHG avoidance of 36%, with net GHG avoidance of 26% after accounting for 10% parasitic energy costs to deliver CO₂ to the algal culture and to harvest and process algal biomass and algal products. The technology remains in early stages of development, with many important technical issues yet to be addressed. Successful integration of waste treatment processes with algal recovery of flue-gas CO₂ will require pilot-scale trials and field demonstrations to more precisely define the many detailed design requirements

BIOGRAPHICAL:

Dr. David Brune recently accepted appointment as Professor of Bioprocess and Bioenergy in the Division of Food Systems and Bioengineering at the University of Missouri-Columbia, having completed 22 yrs as Professor, and Newman Endowed Chair of Natural Resources Engineering in the Department of Agricultural and Biological Engineering at Clemson University in South Carolina. Dr. Brune received his M.S. degree in Agricultural Engineering and PhD in Sanitary Engineering from the University of Missouri-Columbia. He has conducted research in areas of aquaculture, microalgae for waste treatment, bioenergy from fermentation of biomass, and related topics. He served as lead investigator involved with the development of Clemson University's patented Partitioned Aquaculture System (PAS) and Controlled Eutrophication System (CEP). The Clemson program yielded 115 scientific articles, granted twenty-eight advanced degrees, and was successful in securing 46 grants generating \$4 million in external financial support. Prior to his appointment at Clemson University, Dr. Brune directed the Aquacultural Engineering program at the University of California-Davis.

DATE • TIME • LOCATION:

November 3, 2009, 4:00 PM, 105 Agricultural Engineering Building

The Food for the 21st Century (F21C) program at the University of Missouri (MU) was established in the mid-1980's through state funding. The overall goal of the program is to help Missouri food producers and processors maintain their competitive edge in the global marketplace by conducting cutting-edge research in a number of food-related areas. The program involves faculty researchers from multiple colleges including College of Agriculture, Food and Natural Resources; College of Arts and Sciences; College of Engineering; School of Medicine; College of Human Environmental Sciences; and College of Veterinary Medicine. Based on the research emphases, the researchers are grouped into four Clusters: Plant Biotechnology; Animal Reproduction; Bioprocessing and Biosensing Center; and Human Nutrition.

Bioprocessing and Biosensing Center was formed in 1986. The Center currently consists of 27 faculty members, plus collaborators, support staff, and graduate students from six departments in the College of Agriculture, Food and Natural Resources and College of Engineering. These departments include Biological Engineering; Food Science; Animal Sciences; Chemical Engineering; Electrical Engineering; and Mechanical and Aerospace Engineering. This seminar is one of the educational activities in the Bioprocessing and Biosensing Center.

Cluster Co-Leaders: Drs. Fu-hung Hsieh and Jinglu Tan

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