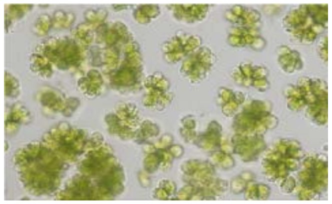
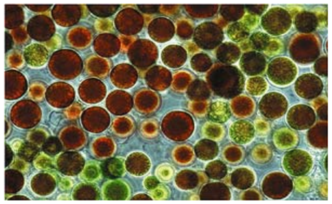
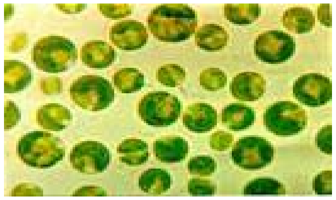
Microalgae Bioenergy Technology
An Integrated Approach to Biofuel Production



Biorefining and Carbon Cycling Program
Dept. of Biological and Agricultural Engineering
University of Georgia, Athens, GA 30605
www.biorefinery.uga.edu





…The Background

- US consumes 60 billion gallons of petroleum diesel and 120 billion gallons of gasoline per annum
- US needs about 140.8 billion gallons of biodiesel per annum to replace all the transportation fuels used
- Total area of algae ponds required to produce biodiesel to replace all petroleum transportation fuels: **9.5 million acres** (3.5 million ha)
- Equivalent acreage required if using soybean to produce biodiesel: **2,970 million acres** (1,094.2 mill ha)
- Crude oil import bill of US per annum:$100-150 billion

…The Need

- Investigation on novel and alternative feedstocks for biofuel production is in dire need.
- Microalgae is regarded as an emerging renewable energy source that offers the promise of enhanced biomass yield, carbon sequestration and concomitant waste-stream bioremediation

…The Research Objectives

- Propose a combined biotechnological scheme for processing/treatment of agricultural and industrial wastewater for the production of microalgae biomass
- Examine the algal growth and lipid content under various levels of carbon dioxide concentration, nutrients, temperature, light and salinity to determine the optimal growth conditions for enhanced growth
- Develop cost-effective large-scale microalgae cultivation systems
- Develop technologies for harvesting algal cells and extraction and conversion of lipids into biodiesel or bio-oil
- Examine the algal biomass for production of value added products
- Conduct Life Cycle Analysis of biofuel production from microalgae

Why Algae Biodiesel?

Oil Yield per acre per year of algae compared to various oilseed crops:

Algae	***5000 - 15000 gallons/acre***
Oil Palm	*635 gallons/acre*
Coconut	*287 gallons/acre*
Jatropha	*207 gallons/acre*
Rapeseed/Canola	*127 gallons./acre*
Peanut	*113 gallons/acre*
Sunflower	*102 gallons/acre*
Safflower	83 gallons/acre
Soybean	48 gallons/acre
Hemp	39 gallons/acre
Corn	18 gallons/acre

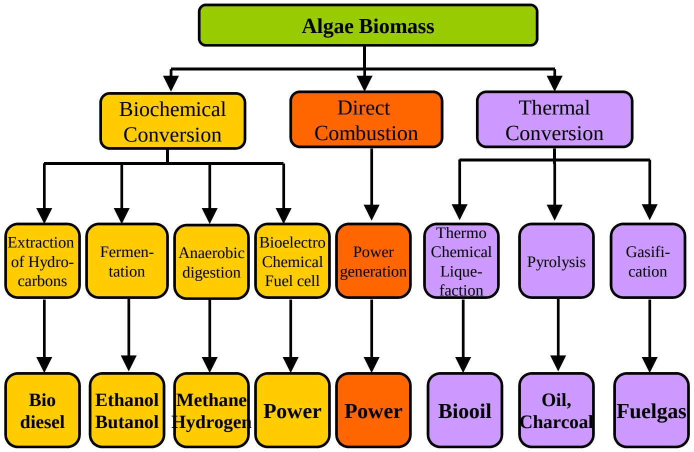
*Sources: *http://www.unh.edu/p2/biodiesel/article_alge.html, http://oakhavenpc.org/cultivating_algae.htm*

…The Impacts

- Development of cost effective large-scale microalgae cultivation system
- Significant increase in renewable biomass feedstock productivity on a per land basis
- Utilization of land and water (saline / brackish / wastewater) which otherwise can not be used for conventional agriculture; thereby freeing land and water for other beneficial uses
- Algae biomass / biofuel feedstock production process coupled with waste stream treatment will cleanup and recycle waste nutrients, thereby improving water conservation and the environment
- Algae acts as carbon dioxide sinks for carbon recycling

…The Constraints/Challenges

- Maximum sustainable photosynthetic efficiency, biomass productivity and oil productivity will be determined
- Capital costs of microalgae cultivation systems need to be reduced substantially



For details contact: Dr.K.C.Das, *Associate Professor, Faculty of Engineering and Coordinator of UGA Biorefining and Carbon Cycling Program*. E-mail: *kdas@engr.uga.edu*