Cultivation of Algal Biofuel Feedstock in Desert Area of Southern Nevada using Municipal Wastewater (NVREC Project 1.3)
Dr. Jian Ma, Dr. Chulsung Bae, Peter Faught– UNLV (jian.ma@unlv.edu)

Why Grow Microalgae in Southern Nevada

- Impressive lipid productivity and fast growing characteristics offer great promise for microalgae to contribute a significant portion of the renewable fuels.
- Microrganae consume and process CO₂ and inorganic components in waste water as if they were nutrients, which is a concomitant benefit of reducing greenhouse gas emission and treating wastewater.
- One million gallon per day wastewater, which is treated by in Clark county region solved the water requirement for growing microalgae in desert.
- This new industry could bring much needed revenue to the lagging economies by educating a new workforce, creating jobs, generating payroll taxes, and providing opportunities to do business with other economies.

Scale-up Challenges and Research Needs

- Water conservation, management, and recycling.
- Nutrient source scaling, sustainability and management.
- Reliable material exposed to strong sunlight.
- Temperature maintenance without evaporative cooling.
- Periodic cleaning and cost analysis due to bio-film formation.
- Several prototype of Photobioreactors were designed and tested in laboratory.

Accomplishment and Ongoing Researches

- Closed Photobioreactor System with less water evaporation and more controllable parameters, makes cultivation of microalgae in Southern Nevada practical.
- Accomplished the investigation of ideal key parameters for microalgae cultivation, which are essential for economic analysis in algal biofuel industry.
- Development of New Solid Acid Catalyst and Its Application in Biodiesel Production
- On-going researches:
  1. The effect of CO₂ concentration to the growth rate of microalgae
  2. Temperature management for out-door Photobioreactor (PBR)
  3. The outdoor reliability test of PBR material—polyethylene
  4. Microalgae screening in outdoor PBR by natural selection using municipal wastewater and flue gas

1. Photobioreactor for macro-algae, collected in Flamingo Wash, Las Vegas.
2. Photobioreactor with new design for various control parameters, such as temperature, pH value, flow rate, light intensity for laboratory scale studies.
3. Prototype of hanging bag Photobioreactor for large scale production of microalgae etc.

3. Minimum reflection loss using photobioreactor is about 4% of total incident light if incident angle is kept smaller than 46°.

16 of total 21 Nevada Power Generation Facilities locate in Southern Nevada, which emits about 42 million tons of CO₂ every year.

1. Maximum productivity of algal biomass: The ideal maximum productivity of algal biomass is 0.104 kg/m²/day (or 379.6 ton/ha/yr).
2. Minimum Ideal Requirement of Water for Growing Algal Biomass is: 0.41 kilogram water is needed if one kilogram CO₂ is captured during cultivation process.