

## Development of Spectroscopic Methods to Monitor and Enhance Production of Biodiesel from Algae

The unrivaled combination of speed, accuracy, and simplicity makes spectroscopic technologies in the visible through mid-infrared spectrum one of the most popular and widely used methods for determining many constituents in organic compounds. A great advantage of these techniques is that they require little sample preparation. Thus, both commercially available and specialized sensors for specific applications are commonly used in a variety of production lines for both quality and process control. These spectroscopic methods are based on the absorption of electromagnetic radiation by overtones and combinations of primarily C–H, O–H, or N–H chemical bonds. But the strength of the technique lies in recent advances in microprocessor speed and mathematical algorithms for developing calibrations to predict various constituents of interest from the spectra. Affordable fiber optic probes with excellent transmission properties allow long-range signal acquisition for continuous monitoring of chemical production or product quality control. Furthermore, dedicated sensors based on analyses of spectra can be designed and built to be inexpensive solutions for process control.

### The Process

- Obtain spectra from algae samples using laboratory-quality near-infrared monochromometer and Fourier transformation mid-infrared spectrometer.
- Using spectral and constituent data for lipid and other constituents of interest (such as concentration of different chain length fatty acids), develop calibrations to convert spectral data to constituent determinations.
- Based on the results above, select a field-capable spectrophotometer with the greatest potential for developing calibrations of algae *in situ* in prototype production ponds.
- Using all of the above results, develop specialized sensors for the determination of lipid content of algae *in situ*.

### Research Objectives

- Develop calibrations using commercially available spectrometers to make real-time determinations of the lipid content of algae *in situ* in prototype production ponds.
- Develop calibrations using commercially available spectrometers to make real-time determinations to provide process control that maximizes the efficiency of lipid production.
- Develop specialized sensors based on the results of full spectra instruments.

### Outcome

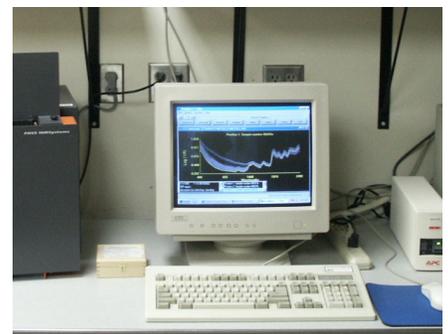
- Provide systems to increase production efficiency of algae grown for the production of biodiesel.

### For more information, contact

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Research assistant Sue Engdahl and professor Chris Lupton work on algae research at the San Angelo R&G Center.



Absorbance spectra