

## Cover Story:

### Algae to Fuels Research at the University of Minnesota, USA

The University of Minnesota (UMN) is undertaking a comprehensive “algae to fuels” research program. The program led by Prof Roger Ruan includes mass cultivation, harvesting, and downstream processing of oil producing microalgae. Growing microalgae on wastewater streams such as municipal wastewater and animal manures, algal oil extraction and conversion, and direct conversion of wet algae to hydrocarbon fuels are their unique strength.

The UMN researchers have screened hundreds of algae species and strains collected from local waters and commercial algae banks. They have discovered several strains able to grow well in the wastewater environment and accumulate high levels of lipids. They have also developed acclimation strategy to improve the performance of high potential strains. The photobioreactors developed by the UMN researchers are among the most efficient production facilities with low capital cost and no cleaning and minimum maintenance requirement. The research group also has the full capacity to develop downstream processing techniques. They have developed a harvest technique utilizing existing wastewater treatment plant equipment and agents. They are currently developing and testing a range of conversion processes including oil extraction, in situ trans-esterification, microwave assisted pyrolysis, and hydrothermal liquefaction. They are particularly interested in direct conversion of wet algae into hydrocarbon fuels, thus reducing the costs associated with energy intensive drying and oil extraction operations. They plan to develop a large pilot algae cultivation facility for long term operation tests and demonstration within 3 years.

The program is led by Prof. Roger Ruan at the Center for Biorefining and Department of Bioproducts and Biosystems Engineering. About fifteen researchers with diverse academic backgrounds are currently working on the program. They have received more than over five million US dollars supports from the US DOD, DOE, USDA, Minnesota Legislative-Citizen Commission on Minnesota Resources (LCCMR), University of Minnesota IREE, Metropolitan Council Environment Services, Minnesota State Legislature, Xcel Energy, and some other private companies.

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