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Biochemical Analysis of Microalgae for Enhanced Oil Synthesis and Biomass in a Waste Water System

Abstract.

Through this Nebraska Center for Energy Sciences Research project, a collaborative team of University of Nebraska-Lincoln researchers, private industry partners, and municipalities will seek comprehensive and viable algal-based solutions to monetize wastewater remediation in the production of oil for next generation biofuels and high value lipid co-products. Central to this effort is developing and scaling up novel bioreactors that retain eukaryotic microalgae while wastewater flows through and growing highly dense biomass while iteratively reducing nutrient contaminants. Connected in series, these bioreactors will constitute an attachable bioremediation system to an existing wastewater treatment facility with the goal of output water meeting or exceeding EPA standards for clean water that reenters waterways. Our team will research the use of EPA regulated municipal waste streams from Hastings Nebraska as the source of water and nutrients from which algaic products would be produced. The algal strains *Chlorella sorokiniana*, a green microalga, and *Tribonema aequale*, a green filamentous alga, have been chosen for these studies. The proposed research is organized into several concurrent and interrelated projects: The in-depth analyses of *C. sorokiniana* and *T. aequale* lipid-related metabolism using metabolomic techniques both in laboratory and scaled up settings using municipal waste streams; monitoring the levels of triglyceride (oil, TAG) synthesis under these conditions; evaluating the effectiveness of using algae to remediate specific waste streams including reductions of ammonia and nitrate coincident with oil synthesis; and a techno-economic analysis of oil produced to establish associated costs and economic feasibility.