J. Non-Confidential Final Report

(In addition to the confidential Final Report discussed above, project proponents are required to provide a **Non-Confidential Final Report**, identified and marked accordingly, which is intended to be a public document detailing the project outcomes, total project costs, CCEMC contributions, and expected greenhouse gas benefits. The Non-Confidential Final Report is to be based on the Final Report with any confidential information removed. The Non-Confidential Final Report will be posted to the CCEMC's website upon completion of the project.)

This project funded by CCEMC (total CAD$500,000, 2015-2016) is aimed to develop the algal-based carbon sequestration technology. The main goal is to remove at least 50 tons per year of CO2 using four full-scale HY-TEK Bio photobioreactors (6,800 L each). In addition, a secondary goal is to establish the technology to produce 1,000 liters of biofuel intermediate and 10 kg of lutein per year by 2016. The proposed work is the joint effort between the University of Maryland Center for Environmental Science and a biotech company called HY-TEK Bio.

At the end of this project, HY-TEK Bio has constructed four full-scale (6,800L) and three mid size (500L) photobioreactors at their facility located in the Baltimore Waste Water Treatment Plant. Air compressor and pipelines connected to flue gas produced from the adjacent power plant have been constructed. An innovative sparger system has been installed to generate uniform air bubbles. LED lights with specific lights for algae have been mounted to the bioreactors. Probes for monitoring pH, water temperature, O2 and CO2 have been installed and connected to the computer system for real time analysis. Algal strain HTB1 and the mutant strain have been cultivated in the photobioreactors mentioned above. Algal cultures seemed to grow to some extent but crashed a few days later. The team went through numerous tests, and we recently found that protozoan grazing and algal settlement are the two main factors causing the crash of algae. Low concentration of bleach treatment and stronger airlift will be in placed in the near future.

Researchers at UMCES have developed mutant strains that grow faster and produce more lipid than the wildtype through chemical and physical mutagenesis. One mutant stain produces higher oil but less lutein compared to the wildtype. HTB1 can be aggregated with bacteria at higher pH range. The aggregation technology developed in this project allows removing the vast majority of water content from algal culture. The enzymatic conversion of algal oils to FAMEs proved to be efficient. Despite that HY-TEK could not provide sufficient algal biomass from their large cultivation systems, researchers at UMCES managed to obtain growth rate, biomass, CO2 uptake, lipid and lutein data based on the algae grown in smaller tanks (up to 40L) maintained in the laboratory. Both HTB1 and the mutant strains can reach biomass of 3 g/L (dry weight) in one week. Assuming that HTB1 can reach this level of biomass in the large photobioreactors, HY-TEK Bio expects to mitigate about 50 tons of CO2 in one year using four full size photoreactors.