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Isolation, Preliminary Characterization and Preliminary Assessment of Scale-Up Potential of Photosynthetic Microalgae for the Production of Both Biofuels and Bio-Active Molecules in the U.S. and Canada

Cooperative Research and Development Final Report

CRADA Number: CRD-10-372

NREL Technical Contact: Philip Pienkos

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Cooperative Research and Development Final Report

In accordance with Requirements set forth in Article XI.A(3) of the CRADA document, this document is the final CRADA report, including a list of Subject Inventions, to be forwarded to the Office of Science and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

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CRADA Title: Isolation, Preliminary Characterization and Preliminary Assessment of Scale-Up Potential of Photosynthetic Microalgae for the Production of Both Biofuels and Bio-Active Molecules in the U.S. and Canada

Parties to the Agreement: National Research Council Canada

Joint Work Statement Funding Table showing DOE commitment:

Estimated Costs	NREL Shared Resources
Year 1	$150,000.00
Year 2	$ 00.00
Year 3	$ 00.00
TOTALS	$150,000.00

Abstract of CRADA work:

Combustion flue gases are a major contributor to carbon dioxide emissions into the Earth's atmosphere, a factor that has been linked to the possible global climate change. It is, therefore, critical to begin thinking seriously about ways to reduce this influx into the atmosphere. Using carbon dioxide from fossil fuel combustion as a feedstock for the growth, photosynthetic microorganisms can provide a large sink for carbon assimilation as well as a feedstock for the production of significant levels of biofuels. Combining microalgal farming with fossil fuel energy production has great potential to diminish carbon dioxide releases into the atmosphere, as well as contribute to the production of biofuels (e.g., biodiesel, renewable diesel and gasoline and jet fuel) as well as valuable co-products such as animal feeds and green chemicals. CO_2 capture may be a regulatory requirement in future new coal or natural gas power plants and will almost certainly become an opportunity for commerce, the results of such studies may provide industries in the US and Canada with both regulatory relief and business opportunities as well as the ability to meet environmental and regulatory requirements, and to produce large volumes of fuels and co-products.

In addition, algae represent an underutilized microbial group in the search for valuable bioactive molecules such as antibiotics and anti-cancer drugs. It is well known that microalgae are capable of producing food supplements and nutraceuticals such as omega-3 fatty acids and antioxidants, but the

ability of this diverse group to make other products of medicinal value has largely gone untapped. The strains that are isolated and characterized for biofuel production potential will also be tested for the production of selected bioactivities.

Summary of Research Results:

Water samples were transferred to NREL from various locations in Canada. These were used for enrichment cultures to provide strains for cultivation in northern latitudes. A method was developed to deliver simulated flue gas to enrichment cultures and isolated strains to help ensure that isolates would be robust to large scale cultivation using flue gas as a carbon source. We learned that flue gas itself is not toxic, but can lead to significant drops in pH, inhibiting algal growth. With sufficient buffering in the growth medium, simulated flue gas does not inhibit growth, but actually stimulates growth and its use facilitated strain isolation. In May 2011, the NREL project came to a halt due to lack of funding. We used enrichment cultures along with fluorescence activated cell sorting (FACS) to build a culture collection of 65 clonal strains. These strains have been maintained in cryopreservation at NREL and have been transferred to NRC in Halifax for evaluation.

Subject Inventions Listing: None

Report Date: 06/15/2012 **Responsible Technical Contact at Alliance/NREL**: Philip Pienkos

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