The BRACE CENTRE FOR WATER RESOURCES MANAGEMENT

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WASTE STREAMS & RECYCLED CO_2 TO ENHANCE BIO-OIL EXTRACTION FROM MICROALGAE

Green microalgae can potentially produce 100-times more oil/ha than terrestrial plants such as palm oil, coconut, castor bean and sunflower seeds, while sequestering significant amounts of CO_2. Microbial oil contents (HHV: 30-45.9 MJ/kg) may be as high as 90% of dry cellular wt (DW) under specific culture conditions, with up to 70% achieved during heterotrophic growth. Neutral lipids constitute up to 80% of their total cellular lipid content, with 89% existing as oil (triacylglycerides TGA), even in algae growing optimally under nutrient-sufficient conditions. Biofuels are high-volume, low-value products and this places a number of critical constraints on the use of microalgae for practical biofuel production. The best strategies for effective algal biofuel production depend not only on their photosynthetic efficiency, but also on efficient biofuel refinement, where the higher photosynthetic C-requirement for bio-oil production is compensated for by much lower energy inputs for algal growth and oil extraction. The coupling of waste heat, gaseous emissions and wastewater with algal production represents significant and transformative breakthroughs that will positively impact the cost and efficiency of these systems. For algae to serve as a platform for renewable and sustainable biofuel production and CO_2 sequestration, it must be shown through LCA that biomass production and biofuel recovery technologies emit less CO_2, and consume less energy/unit of energy produced than other energy market competitors. Hence, the feasibility of using microalgae for bio-oil recovery hinges on designing cultivation strategies that enhance algal growth and oil productivity (algal oil content may need to be >25% to as high as 50% (DW) for economic viability) under Canadian climatic conditions, while minimizing environmental impacts, greening bio-oil extraction and developing integrated bio-oil recovery approaches.

Dr. Champagne is an Associate Professor in the Department of Civil Engineering at Queen's University. She has developed an expertise in bioresource management and environmental sustainability. Her research interests range from converting biomass and residual materials to biofuels, bioenergy and bioproducts, to low energy passive treatment alternatives for the mitigation of various waste and wastewater streams. She was recently awarded a Canada Research Chair in Bioresources Engineering (Oct '12) for her work in this area. Dr. Champagne holds undergraduate degrees in Biology (McGill '90) and Water Resources Engineering (Guelph '93), and a Master's (Carleton '96) and PhD (Carleton '01) in Environmental Engineering. She is also a past recipient of the Ontario Ministry of Research Innovation Early Researcher Award (2008) and Petro-Canada Young Innovator Award for her work using lignocellulosic and waste biomass for the recovery of higher value products.

Tuesday, April 15th, 2014

McGill Downtown Campus, Macdonald Engineering Building, Room 497
11:00 am - 12:00 pm

EVERYONE WELCOME