



## PhD Position

### Lactic Acid Production Using Industrial Lignocellulosic Waste

**Job Description:** Lactic acid has recently been identified as one of the “top-ten” Biorefinery production platform chemicals with multiple product applicability. In the food industry, lactic acid serves as pH regulator, acidulant, flavoring agent or inhibitor of bacterial spoilage. In the chemical industry, lactic acid is used as feedstock for biodegradable polymers (polylactic acid, PLA), oxygenated chemicals, environmentally friendly "green" solvents (ethyl lactate), etc. The world production of lactic acid is projected to grow nearly 20% per year. In a typical lactic acid fermentation process, the raw material cost constitutes between 40 and 70% of the total production cost. As polymer producers and other industrial users usually require large quantities of lactic acid at a relatively low cost, the use of starch and refined sugars as feedstock for lactic acid production will not be feasible in longer term. However, lignocellulosic biomass is attractive due to its lower price than corn, the feedstock for the current industrial production of lactic acid. Therefore, in order to develop a sustainable process for cost-effective production of lactic acid, research and innovation advances are needed to: 1) allow the use of low-cost lignocellulosic materials; 2) develop robust and high-performance lactic acid-producing microorganisms; 3) optimize fermentation media and process configurations; 4) minimize waste and downstream processing cost of lactic acid and PLA. This project aims to create new value from negative-cost biomass waste such as primary and secondary sludge that is available in bulk at Canadian pulp and paper mills. The sludge landfilling and incineration are not economically and environmentally attractive due to the prohibitively high treatment costs and potential environmental harmfulness. The project has the following objectives:

*Obj. 1.* Characterize the pulp and paper mill sludge waste, paper sludge and secondary sludge, as a potential feedstock for the production of fermentable sugars and lactic acid;

*Obj. 2.* Develop enzymatic treatment methods for hydrolysis of primary sludge to fermentable sugars, and secondary sludge to amino acid-rich hydrolysate;

*Obj. 3.* Assess the fermentability of enzymatic hydrolysates and design detoxification strategies for removal of inhibitory compounds, if needed;

*Obj. 4.* Evaluate fermentation methods such as separate hydrolysis and fermentation (SHF) and simultaneous saccharification and fermentation (SSF) in batch, fed-batch, repeated and semi-continuous cultures for production of lactic acid;

*Obj. 5.* Optimize process conditions and fermentation media for increased lactic acid yield, productivity and titer using experimental design and response surface methodology (RSM).

**Qualifications:** The ideal candidate will be a self-starter with a completed M.Sc. degree and background in Microbiology, Biology, Biotechnology, Biological Engineering or a related discipline. This position will involve working both independently and collaboratively with a multidisciplinary team, preparing papers, reports, and contributing to grants. Candidates should have a productive research history, high creativity, self-motivation, strong problem solving abilities, and good written and communication skills in English. Prior knowledge, experience and publications in the field of microbial lactic acid production will be an added advantage.

**Application:** The successful candidate will join a vibrant and multidisciplinary research team at Lakehead's renowned Biorefining Research Institute, BRI ([lubri.lakeheadu.ca](http://lubri.lakeheadu.ca)). The PhD position is available immediately or beginning of the fall semester of 2016. Please email applications including: 1) *cover letter* highlighting education background, research interests and experience; 2) copies of *transcripts* for M.Sc. degree; 3) *detailed CV* with contact information for at least three (3) references to:

Lew P. Christopher, PhD, PE  
Director, Biorefining Research Institute  
Senior Ontario Research Chair  
Professor, Lakehead University  
955 Oliver Rd, Thunder Bay, Ontario P7B 5E1  
Email: [lew.christopher@lakeheadu.ca](mailto:lew.christopher@lakeheadu.ca)  
Phone: +1-807-343-8844

Lakehead University is committed to creating a diverse and inclusive environment and welcomes applications from all qualified individuals including women, members of racialized groups/visible minorities, Aboriginal persons and persons with disabilities, and persons of any sexual orientation, gender identify or gender expression. Lakehead University is committed to an environment of open access to employment opportunities. Accommodations are available for all applicants with disabilities throughout the recruitment process. If you require accommodations for interviews or other meetings, please contact Human Resources. We appreciate your interest, however, only those selected for an interview will be notified.