

Next Generation of Municipal and Industrial Wastewater Treatment Technologies using Particulate Biofilm Processes

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Billion of dollars are spent annually for operating and maintenance costs for waste and wastewater treatment plants in Canada, while current society demands for clean and safe water have been increasing. In parallel, energy security and climate change mainly caused by anthropogenic activities have become a national and international issue to be addressed. One of the most important factors affecting water quality is the enrichment of nutrients, i.e. organic matter, nitrogen, and phosphorus in water bodies leading to excessive eutrophication. Biological treatment is one of the most cost-effective means to reduce organic and nutrient content of liquid waste streams, prior to their final discharge to the environment. Although conventional biological treatment and reuse processes have been used successfully to control various nutrients, their applications are currently economically and practically challenged by increasingly stringent federal and provincial regulations for tertiary wastewater quality discharges, particularly in light of the significant impact of side streams i.e. digester supernatant and dewatering centrate, which account for 10%-30% increase of the total nitrogen load of the treatment plants.

Research on new Biofilm technologies for upgrading municipal and industrial wastewater treatment plants and the treatment of internal side streams without the need for expansion of the existing volumes is therefore essential. Furthermore, the emerging trend of reducing power consumption and carbon footprint for wastewater treatment plant is driving technology development. The new generation of such treatment processes will include the application of sustainable novel biological shortcut nutrient removal reactors coupled with the recovery of the value-added products and energy that are generated in such a process, as well as the use of energy-efficient processes to transform “energy-consuming treatment processes” into “energy-saving and energy-positive systems”. The primary focus of this talk is to provide a high-level overview of the next generation of wastewater treatment plants using biofilm processes and their integration to maximize energy and value-added products recovery, including *biomethane*, *biohydrogen*, and *biopower*, in accordance with the emerging paradigm shift towards mining resources from wastewater.