

4th International Conference on **Pollution Control & Sustainable Environment**
 &
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Simultaneous treatment of leachates and landfill gas (CH₄) by a passive biofiltration process well adapted for Nordic regions

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Leachate treatment and the elimination of landfill gas (LFG) are the main environmental challenges faced by operators in the province of Quebec, Canada. CRIQ, in collaboration with its partners (Université Laval and Université de Sherbrooke), has been working for more than ten years on the development of biofiltration processes for the treatment of leachate and methane (CH₄). The leachates treatment is intended to comply with the limit values as prescribed in the regulation (in particular BOD: 65 mg/l, ammonium: 10 mgN-NH₄/l, zinc: 0.07 mg Zn/l and phosphorus: 0.3 mg Ptot/l). The process makes it possible to envisage, using methanotrophic bacteria that are unique in their ability to use CH₄ as a source of carbon and energy, the treatment of landfill gas. The results obtained in laboratory tests over a period of 16 months for simultaneous treatment (leachate-methane) will be shown for parameters such as BOD₅, MES, NH₄, NO₃⁻, pH, CH₄. The behaviors observed for nitrogen are presented in figures 1 and 2. For the period when the conditions were optimal (250th to 450th day) the nitrification process made it possible to reach N-NH₄ transformation rates higher than 95% (output concentration of less than 10 mgN NH₄/l). Considering the average concentration of N-NH₄ contained in the leachates (680 mg N-NH₄/l) as well as the observed transformation rates (nitrification), the elimination of N-NO₃ in the biofiltration process would be attributable to the activity methanotrophic bacteria (methanotrophic denitrification). Overall, the results obtained make it possible for landfill operators to make significant gains in terms of sustainable development (passive technology, increased treatment of nitrogen (NH₄ and NO₃), autothermal biological process), reduction of GHG emissions, etc.). Those work led to a patent in 2017. Future work planned is on-site testing using a prototype.

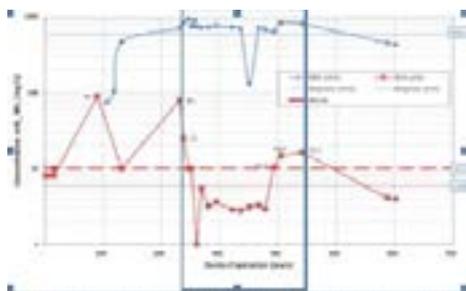


Figure 1: Transformation of ammonium

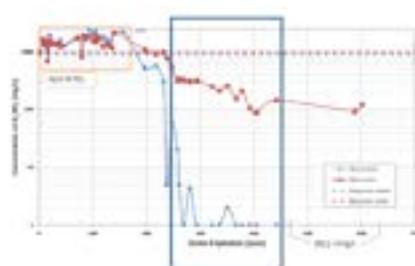


Figure 2: Elimination of nitrates

Recent Publications

1. Dia O, P Drogui, G Buelna and R Dubé (2017) Strategical approach to prevent ammonia formation during electrocoagulation of landfill leachate obtained from a biofiltration process. *Separation and Purification Technology* 189:253-259.
2. Dia O, Drogui P, Buelna G, Dubé R and Ben Salah Ihsen (2017) Electrocoagulation of bio-filtrated landfill leachate: Fractionation of organic matter and influence of anode materials. *Chemosphere* 168:1136-1141.
3. M Zolfaghari, P Drogui, S K Brar, G Buelna and R Dubé (2016) Unwanted metals and hydrophobic contaminants in bioreactor effluents are associated with the presence of humic substances. *Environmental Chemistry Letters* DOI: 10.1007/s10311-016-0598-7.

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Biography

Rino Dubé has held a position as a Research and Development Officer at the Centre de recherche industrielle du Québec (CRIQ) since 1995. He is a civil engineer by training, specializing in environment and bioprocesses with a Master's degree from Université Laval. Mr. Dubé carries out laboratory-scale and large-scale technological innovation projects in the agricultural, industrial and municipal wastewater sectors, more recently including treatment of leachates from composting sites and landfills. He has conducted several projects on removal/ transformation of nutrients (nitrogen, phosphorus). In particular, he has participated actively in the development of biofiltration on organic media for the simultaneously treatment of highly-charged liquids and gases. This work was concretized in twenty pilot systems installed in the field in an industrial context, and has been the subject of several articles and lectures, as well as four invention patents.

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