



São Paulo - Brazil - May - 20th to 22nd - 2015

Academicth

INTERNATIONAL WORKSHOP ADVANCES IN CLEANER PRODUCTION

“CLEANER PRODUCTION TOWARDS A SUSTAINABLE TRANSITION”

Landfill Leachate Treatment by Constructed Wetland: Operation Strategies

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Abstract

Landfill leachate is an important issue related to waste management, due to its high contaminants concentration and toxicity, making treatment by conventional technologies and operational parameters more difficult. Thus, this study aimed the evaluation of leachate treatment, focused on organic matter and ammonia nitrogen, by constructed wetlands, an alternative and low cost technology, using different operational strategies. The leachate taken from a landfill located in the city of Guarulhos, Metropolitan Region of São Paulo, has been treated in a laboratory scale horizontal flow constructed wetland (HF-CW) system (total volume of 30.8 L). The units were filled with calcareous gravel and planted with *Cyperus papyrus*, *Heliconia psittacorum* and *Gynerium sagittatum*, and a control was maintained without vegetation. The system was fed with leachate diluted in water with different proportions (between 10% and 30%) with mean Chemical Oxygen Demand (COD) concentration between 336 and 750 mg.L⁻¹ and ammonia nitrogen (NH₄-N) between 47 and 199 mg L⁻¹. The operation was divided in three stages: (1st) continuous feeding with mean Hydraulic Retention Time (HRT) between 2.7 and 5.3 d; (2nd) regime of effluent recirculation to evaluate the effect of increasing the HRT to 21 days; (3rd) continuous feeding with two wetlands units in series, aiming HRT increasing (between 8.1 and 9.9 d) without recirculation. The COD removal was low, with averages below 40%, resulting in effluent concentration between 270 and 750 mg.L⁻¹. However, there was removal of NH₄-N, especially in the 2nd and 3rd stages, with average removal between 43% and 81%, resulting in concentration between 20 and 223 mg.L⁻¹, showing HRT influence. The low efficiency for COD is probably related to the recalcitrance of the leachate, or due to inhibition of microorganisms by toxicity. For NH₄-N, it is inferred that the increase of the HRT provided greater time for oxygen diffusion to the wetland system, meeting the demand of heterotrophic bacteria, which allowed the use of excess oxygen by nitrifiers, culminating in the oxidation of NH₄-N. Thus the HRT is an important parameter that must be taken into account during dimensioning of HF-CW, since it influences the treatment efficiency and is related to the area demand.

Keywords: landfill leachate; constructed wetlands; recalcitrance; nitrification; Hydraulic Retention Time.

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