WASTES: Solutions, Treatments and Opportunities
1St International Conference
September 12th – 14th 2011
Universidade do Minho, Guimarães, Portugal

LANDFILL LEACHATE TREATMENT – WHERE LIES THE SOLUTION?

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ABSTRACT

As society and technology has developed, an increasing amount of municipal solid waste (MSW) along with industrial and agricultural waste has been generated and the management of waste became a very organized, specialized and complex activity. The huge amounts of waste produced every day have several detrimental impacts of great concern, where the depletion of natural resources is one of the most important. Although several countries have been introducing more stringent laws to reduce the amount of waste to be landfilled, in an attempt to maximize recycling and materials recovery, landfilling is still the most generalized practice for MSW treatment.

Thus, the treatment of the high polluted waters leaching from landfills constitutes an important burden in landfill management. The selection and design of the management and treatment of a landfill leachate has to take into consideration factors such as leachate characteristics, effluent discharge alternatives, technological options, final discharge requirements and economical aspects.

The alteration in leachate characteristics with the increasing age of the landfill enhances the difficulty in the design of the treatment system. Generally, a young leachate presents weak to strongly acidic pH, high COD and TOC concentrations and high biodegradability (BOD_5/COD ratio in the range 0.4-0.7). A mature leachate (<10 years) is characterized by a high strength of ammonium nitrogen, a moderate strength in COD, low concentrations of heavy metals and a low BOD_5/COD ratio (most often close to 0.1) [1]. Typically, most of the organic materials present in the mature leachate have a high molecular weight and are recalcitrant compounds such as humic- and fulvic-like acids.

The leachate treatment system must be flexible enough to produce the same effluent quality despite the aging of the leachate and sudden and large variations in the leachate strength and volume. Accordingly, several solutions have been implemented. Constructed wetlands were an attractive alternative but the increase in land cost and unavailability has directed the attention to other biological treatments, which have been shown to be very effective for the treatment of easily biodegradable young leachates becoming less effective with time. Therefore, several physico-chemical processes have been developed and, currently, the treatment systems used for leachate treatment include biological, physico-chemical and combinations of these processes. The difficulty in removing recalcitrant organic matter has determined the search for effective chemical oxidation processes having the potential of converting harmful organics into innocuous substances without the production of concentrated residues. Consequently, advanced oxidation processes (AOPs) have increasingly been studied and applied in the treatment of mature leachate. Nevertheless, those processes also oxidize the ammonium and organic nitrogen to

nitrate greatly increasing its concentration above the legal limits for discharging, which creates the need for nitrate reduction.

After an overview of the most common processes used in landfill leachate treatment, their drawbacks and advantages, it will be presented the results obtained in our lab with a lab-scale rotating anoxic biological contactor to remove the excess nitrate, from an already treated landfill leachate. The results obtained so far point out this process as a promising alternative polishing treatment.

[1] Kurniawan, T.A., Lo, W.H., Chan, G.Y., 2006. Radicals-catalyzed oxidation reactions for degradation of recalcitrant compounds from landfill leachate. Chem. Eng. J. 125, 35-57.

Keywords: leachate, treatment systems, COD removal, nitrate removal
Suggestion for the theme concerned: Landfill: design, construction, leachate and biogas management
Presentation format: Plenary Lecture