World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:11, No:07, 2017

Low Energy Technology for Leachate Valorisation

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Abstract : Landfills present long-term threats to soil, air, groundwater and surface water due to the formation of greenhouse gases (methane gas and carbon dioxide) and leachate from decomposing garbage. The composition of leachate differs from site to site and also within the landfill. The leachates alter with time (from weeks to years) since the landfilled waste is biologically highly active and their composition varies. Mainly, the composition of the leachate depends on factors such as characteristics of the waste, the moisture content, climatic conditions, degree of compaction and the age of the landfill. Therefore, the leachate composition cannot be generalized and the traditional treatment models should be adapted in each case. Although leachate composition is highly variable, what different leachates have in common is hazardous constituents and their potential eco-toxicological effects on human health and on terrestrial ecosystems. Since leachate has distinct compositions, each landfill or dumping site would represent a different type of risk on its environment. Nevertheless, leachates consist always of high organic concentration, conductivity, heavy metals and ammonia nitrogen. Leachate could affect the current and future quality of water bodies due to uncontrolled infiltrations. Therefore, control and treatment of leachate is one of the biggest issues in urban solid waste treatment plants and landfills design and management. This work presents a treatment model that will be carried out "in-situ" using a cost-effective novel technology that combines solar evaporation/condensation plus forward osmosis. The plant is powered by renewable energies (solar energy, biomass and residual heat), which will minimize the carbon footprint of the process. The final effluent quality is very high, allowing reuse (preferred) or discharge into watercourses. In the particular case of this work, the final effluents will be reused for cleaning and gardening purposes. A minority semi-solid residual stream is also generated in the process. Due to its special composition (rich in metals and inorganic elements), this stream will be valorized in ceramic industries to improve the final products characteristics.

Keywords : forward osmosis, landfills, leachate valorization, solar evaporation
Conference Title : ICEPCP 2017 : International Conference on Environmental Pollution Control and Prevention
Conference Location : Rome, Italy
Conference Dates : July 17-18, 2017