Design parameters and operational modes for sustainable landfill operation in arid areas

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Solid waste management (SWM) strategies offer huge potentials to contribute to climate change mitigation (Aljaradin and Persson 2012). Effective mitigation through reducing Greenhouse gases (GHG) concentrations in the atmosphere is the significant technique for climate change problems (Sands and Schumacher 2009). To assess the potentials of SWM to contribute to GHG reduction and resource recovery, available technologies and strategies have to be analyzed. Climate change is caused by an increasing level of GHG in the atmosphere (Sands and Schumacher 2009). Methane gas is a GHG that is 23 times more harmful than the same volume of carbon dioxide (IPCC 2007). One of the main sources for methane is landfills and most of the methane gas produced from the landfills leaks into the atmosphere and contributes to global warming. Globally the solid waste volume is still increasing at high rates due to the rapid population increase as well as the change in living standards and consumption patterns. In Europe, solid waste management has undergone major changes since the landfilling directive came into force, due to the more stringent regulations, and an increasing interest in recycling and reuse. Organic matter degradation is among the most important processes determining GHG. This main objective of this work is to study the effect of climate change on the organic matter degradation inside municipal solid waste landfill, and to test the reliability of the prediction models, which is used to predict greenhouse gases generation rates and its effect on the global phenomena of climate change.

To address these issues, and considering the complexity of field studies in landfills, a pilot plant scale lysimeter needed to be constricted to study the effect of different scenarios of climate change on the organic matter degradation. The work will include changing the temperature of waste, the moisture content (by using water or leachate recirculation). The lysimeter will be in anaerobic conditions for some time so as to achieve a widely and homogenous degradation inside the landfill. Thereafter, solid waste samples will be taken to analyze and determine different physical and chemical parameters as well as investigations of the biological activity of the waste; this will include measurements of the respiration activity and gas formation potential. The results will suggest new optimized design parameters and operational scenarios for sustainable landfill based on the landfill location climatic conditions. Furthermore, the laboratory data will be used to test the reliability of the climate prediction models available.

References:

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