



Enhanced stabilisation of municipal solid waste in bioreactor landfills: UNESCO-IHE PhD Thesis

Roberto Valencia Vazquez

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Municipal solid waste entombed in landfills will produce pollution in the form of landfill gas and leachate when the barriers fail in the long term. Bioreactor landfills are an alternative solution to avoid such negative impacts and to achieve a more stable residue, the so-called Final Storage Quality (FSQ) of residues. However, until now the main technical problem faced by landfill operators in bioreactor landfill operation is homogenous liquid distribution within the waste mass.

The main objective of this thesis was to achieve a FSQ status of waste, through laboratory and pilot-scale experiments, that complies with the Waste Acceptance Criteria (WAC) of the European Landfill Directive for inert waste. This thesis focused on the interaction and modification of the factors controlling the waste stabilisation process in a bioreactor landfill. The results revealed that within a year of operation biological stabilisation can be achieved, but not FSQ status. However, residues were close to comply with such stringent criteria. Buffer and septage addition had a positive effect on the waste stabilisation process by reducing biogas production lag-phase and risks associated with pathogen contamination. Also the use of coarse materials had a positive impact on the waste stabilisation process, especially as homogenous mixtures. The presence of Anammox bacteria - shown for the first time to be active in a bioreactor landfill - suggested that it could have contributed substantially to the removal of nitrogen, which has been identified as the main parameter to jeopardise the achievement of FSQ status.

In conclusion, this research reduced our current gaps-in-knowledge and offered feasible technical alternatives to control and steer the processes occurring in a bioreactor landfill aiming to achieve FSQ status of residues.

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