

ROLE OF SEMI-AEROBIC PHASE IN HYBRID LANDFILLING: THE S.AN.A METHOD

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Hybrid Bioreactor Landfills are designed to enhance and speed up biological processes, aiming at reducing the duration of post operational phase until landfill completion. S.An.A. (Semi-aerobic, Anaerobic, Aerated) concept consists in a Hybrid Bioreactor featuring a first semi-aerobic phase to enhance the methane production occurring in the following anaerobic step and a forced aeration for the abatement of the residual emissions. At the end of the last step, aerobic conditions are restored and flushing applied for leaching residual non-biodegradable compounds.

The aim of the present study was to apply the S.An.A. concept to four lab-scale landfill simulation reactors, analyzing different management options and comparing final results with two traditional anaerobic reactors. Phase 1 was designed to combine the demonstrated advantages of leachate recirculation and landfill pre-aeration under semi-aerobic conditions, with a greater methane production expected during Phase 2. This presentation reports the results of the full experiment in which the anaerobic Phase 2 was followed by forced aeration in Phase 3, with the aim of completing biological stabilization processes and a final optional Phase 4 involving flushing of inorganics.

Results of the application of S.An.A. concept to a lab scale bioreactor system showed that pre-aeration under semi-aerobic conditions was effective in controlling the concentration of VFA, increasing pH and stimulating methane production during the following anaerobic phase; in particular, with intermittent airflow during the semi-aerobic phase, methane potential in the following anaerobic Phase 2 was 50% higher in comparison to control reactors. Forced aeration in Phase 3 reduced organic compounds and nitrogen concentration in leachate of an order of magnitude; a better performance was obtained in low airflow reactors.

S.An.A. hybrid bioreactors proved to be an efficient system both for increasing methane production and reaching landfill completion in shorter time, suggesting that with proper landfill management, the duration of post-closure care might be reduced by 25–35%.

In this presentation, main focus will be on the role of the initial semi-aerobic phase in the success of the S.An.A concept.

A full paper related to this presentation has been published in *Waste Management* journal:

Morello L., Raga, R., Lavagnolo M.C., Pivato A., Ali M., Yue D., Cossu R., 2017. The S.An.A. concept: Semi-aerobic, Anaerobic, Aerated bioreactor landfill. *Waste Management* 67, 193-202