Treatment of landfill gas with low methane content by biocover systems

Landfills are significant sources of anthropogenic atmospheric methane (CH4), which contributes to climate change. Large amounts of CH4 are emitted from landfills in dilute form due to mixing with air in leachate collection systems, or during lateral migration away from landfills. The objective of this study was to investigate the CH4 oxidation efficiency of a compost material subject to LFG diluted with atmospheric air resulting in CH4 concentrations of 5–10% v/v. CH4 oxidation rates and carbon dioxide (CO2) production were measured through batch and dynamic column experiments where two laboratory scale biofilters were constructed. The columns were run at increasing flow rates. Column gas concentration profiles for each of five flow campaigns were compared to each other. This showed that oxygen (O2) was present through the entire column and elevated CO2 concentrations throughout the biofilters were found. Moreover, the oxidation process tended to be centred in the lower parts of both columns. It was observed that the biofilters performed better once they had adapted to the increasing loads of CH4. In both columns, the maximum removal rate of CH4 was found to be 98–100%. Using CH4 mass balances the maximum oxidation rate was 238 g CH4 m−2 d−1 in Column 1 and 483 g CH4 m−2 d−1 in Column 2 (equal to the load). None of the biofilters reached their maximum CH4 oxidation capacity, hence they could have been exposed to a larger CH4 load. It was found that the retention time in the columns was not a factor limiting the oxidation process. High O2 consumption and carbon mass balances underlined the strong microbial activity in the biofilters and it was not suspected that the methane oxidising bacteria were O2 limited. The results of this study suggest that biofilters have great potential for reducing CH4 in diluted LFG.

General information
Publication status: Published
Organisations: Department of Environmental Engineering, Air, Land & Water Resources, Residual Resource Engineering, Technical University of Denmark
Contributors: Thomasen, T. B., Scheutz, C., Kjeldsen, P.
Pages: 29-37
Publication date: 2019
Peer-reviewed: Yes

Publication information
Journal: Waste Management
Volume: 84
ISSN (Print): 0956-053X
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
Original language: English
Keywords: Atmospheric Properties, Gas Fuels, Energy Resources, Chemical Reactions, Chemical Products Generally, Air supply, Carbon mass balance, Compost, Compost respiration, Methane oxidation, Open biofilter, Oxygen consumption, Atmospheric chemistry, Biofilters, Carbon dioxide, Climate change, Composting, Leachate treatment, Methane, Oxidation, Oxygen supply, Renewable energy resources, Biogas
DOIs:
10.1016/j.wasman.2018.11.011
Source: FindIt
Source-ID: 2441662853
Research output: Contribution to journal › Journal article – Annual report year: 2019 › Research › peer-review