Treatment of landfill gas with low methane content by biocover systems - DTU Orbit
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Landfills are significant sources of anthropogenic atmospheric methane (CH$_4$), which contributes to climate change. Large amounts of CH$_4$ 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 CH$_4$ oxidation efficiency of a compost material subject to LFG diluted with atmospheric air resulting in CH$_4$ concentrations of 5–10% v/v. CH$_4$ oxidation rates and carbon dioxide (CO$_2$) 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 (O$_2$) was present through the entire column and elevated CO$_2$ 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 CH$_4$. In both columns, the maximum removal rate of CH$_4$ was found to be 98–100%. Using CH$_4$ mass balances the maximum oxidation rate was 238 g CH$_4$ m$^{-2}$ d$^{-1}$ in Column 1 and 483 g CH$_4$ m$^{-2}$ d$^{-1}$ in Column 2 (equal to the load). None of the biofilters reached their maximum CH$_4$ oxidation capacity, hence they could have been exposed to a larger CH$_4$ load. It was found that the retention time in the columns was not a factor limiting the oxidation process. High O$_2$ consumption and carbon mass balances underlined the strong microbial activity in the biofilters and it was not suspected that the methane oxidising bacteria were O$_2$ limited. The results of this study suggest that biofilters have great potential for reducing CH$_4$ in diluted LFG.

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