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The Methanotrophic Activity in a Landfill Bio-Cover through a Subzero Winter

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Abstract : Landfills highly contribute to anthropological global warming through CH_4 emissions. Landfills are usually capped by a conventional soil cover to control the migration of gases. Methane is consumed by CH_4-oxidizing microorganisms known as methanotrophs that naturally exist in the landfill soil cover. The growth of methanotrophs can be optimized in a bio-cover that typically consists of a gas distribution layer (GDL) to homogenize landfill gas fluxes and an overlying oxidation layer composed of suitable materials that support methanotrophic populations. Materials such as mature yard waste composts can provide an inexpensive and favourable porous support for the growth and activity of methanotrophs. In areas with seasonal cold climates, it is valuable to know if methanotrophs in a bio-cover can survive in winter until the next spring, and how deep they are active in the bio-cover to mitigate CH_4. In this study, a pilot bio-cover was constructed in a closed landfill cell in Winnipeg that has a very cold climate in Canada. The bio-cover has a surface area of 2.5 m x 3.5 m and 1.5 m of depth, filled with 50 cm of gravel as a GDL and 70 cm of biosolids compost amended with yard and leaf waste compost. The observed in situ potential of methanotrophs for CH_4 oxidation was investigated at a specific period of time from December 2016 to April 2017 as well as November 2017 to April 2018, when the transition to surface frost and thawing happens in the bio-cover. Compost samples taken from different depths of the bio-cover were incubated in the laboratory under standardized conditions; an optimal air: methane atmosphere, at 22ºC, but at in situ moisture content. Results showed that the methanotrophs were alive oxidizing methane without a lag, indicating that there was the potential for methanotrophic activity at some depths of the bio-cover.

Keywords : bio-cover, global warming, landfill, methanotrophic activity
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