



Potential methane production and oxidation in soil reclamation covers of an oil sands mining site in Alberta, Canada

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Anthropogenic activities create a number of significant greenhouse gases and thus potentially contribute to global warming. Methane production is significant in some agricultural production systems and from wetlands. In soil, methane can be oxidised by methanotrophic bacteria. However, little is known about methane production and oxidation in oil sand reclamation covers. The purpose of this study was to investigate methane production and oxidation potential of tailing sands and six different reclamation layers of oil sands mining sites in Alberta, Canada.

Methane production and oxidation potential were investigated in laboratory scale microcosms through continuous headspace analysis using gas chromatography. Samples from a reclamation layer were collected at the Canadian Natural Resources Limited (CNRL) reclamation site at depths of 0-10 cm, 10-20 cm and 20-40 cm in October 2014. In addition, tailing sands provided by Suncor Energy Inc. and soil from a CNRL wetland were studied for methane production. Samples were dried, crushed and sieved to 4 mm, packed into serum bottle microcosms and monitored for eight weeks. Methane production potential was assessed by providing an anoxic environment and by adjusting the samples to a moisture holding capacity of 100 %. Methane oxidation potential was examined by an initial application of 2 vol % methane to the microcosms and by adjusting the samples to a moisture holding capacity of 50 %. Microcosm headspace gas was analysed for methane, carbon dioxide, nitrous oxide and oxygen. All experiments were carried out in triplicates, including controls. SF₆ and Helium were used as internal standards to detect potential leaks.

Our results show differences for methane production potential between the soil depths, tailing sands and wetlands. Moreover, there were differences in the methane oxidation potential of substrate from the three depths investigated and between the reclamation layers. In conclusion, the present study shows that reclamation layers for oil sands mining sites in Alberta, Canada have the potential to oxidize on-site produced methane emissions to the less harmful greenhouse gas carbon dioxide. Such oxidation might mitigate impacts of methane production from these sites.