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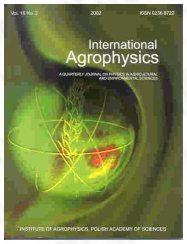

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Methane oxidation in homogenous soil covers of landfills: a finite - element analysis of the influence of gas diffusion coefficient

(get PDF)

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abstract Methane produced in municipal landfills covered with a soil layer diffuses to the atmosphere. Counterdiffusion of oxygen down the soil creates an oxic zone where biochemical oxidation of methane by methanotrophic microorganisms can take place. Oxidation is possible only in that part of the oxic zone where both the substrates, i.e., methane ond oxygen are present simultanously. Biochemical oxidation of methane is governed by Michaelis-Menten kinetics. The solution of the equation system comprising the Michaelis-Menten equation generalized for the two substrates, i.e., methane and oxygen and the Fick' s diffusion equation was found numerically with the use of the finite element method. Results of the calculations were presented for the steady state conditions in a homogenous soil layer with constant (in space and time) gas diffusion coefficient and kinetic parameters, i.e., the Michaelis constant (KM) and the maximum oxidation rate. The effect of the gas diffusion coefficient on the distribution profiles of methane, oxygen and actual methanotrophic activity, as well as on the depth of oxygenation zone and on the methane oxidation capacity in the soil layer is discussed.

keywords landfills, methanotrophic capacity, methane oxidation, modelling, gas diffussivity