



## **A laboratory study of greenhouse gas emissions from organic substrates**

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The GHG emission from soil depends from organic matter chemical composition, chemical nature of organic compounds presented in as well as as soil properties where it is added. Also, organic matter importance is related to the long-term binding of carbon in the soil in relation to effects of soil improvement and to what the compost substitutes. The purpose of current study was to determine possible amounts of greenhouse gas emissions from different organic substrates. The main greenhouse gases which were analysed were CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub>. The study objects were: uncomposed fresh sludge from cattle farm, fresh and composted municipal sewage sludge. The organic substrates were mixed either with peat or sawdust from Alder trees. The experiment was carried out in 2009-2010 autumn and winter period in Department of Plant Production and Grasslands, and in laboratory of Department of Soil Science and Agrochemistry, at Estonian University of Life Sciences. To perform the study specific plastic chambers were used with volume of 24.4 litres (PLAS LABS Inc. USA). The chambers were provided with hermetically closed opening for gas sampling. For every experiment was weighted 250 g of study substrate and added 250 g of peat or sawdust for each chamber. The studied mixtures were: 1) control, chamber without substrate, 2) fresh cattle sludge, 3) fresh cattle sludge + peat, 4) fresh cattle sludge + saw dust, 5) fresh municipal sewage sludge, 6) compost of municipal sewage sludge, 7) fresh municipal sewage sludge + peat, 7) compost of municipal sewage sludge+ peat. The materials were mixed shortly before experimental setup and their moisture content was determined. The total content of N, Corg, and main nutrients (P,K,Ca ,Mg) was analyzed from all organic substrates. The whole experiment was carried out in three repetitions. The results were calculated accordingly to sewage sludge or municipal sludge dry matter content. The C:N ratio for organic substrates used in experiment was: 1) peat 71, 2) fresh sewage sludge 6, 3) compost of municipal sewage sludge 13, 4) fresh sludge 16, 5) sawdust 196. The collected mixture of greenhouse gases was analysed by Agilent GC system 7890A which was equipped with Entech gas sampling and injection system. Results showed that in case of fresh sludge mixing with sawdust and peat the CO<sub>2</sub> emission was intensified a from 5-20 mmol CO<sub>2</sub> kg<sup>-1</sup> h<sup>-1</sup> from cattle manure to 15-33 mmol CO<sub>2</sub> kg<sup>-1</sup> h<sup>-1</sup> from mixture of manure with peat and to 23-34 mmol CO<sub>2</sub> kg<sup>-1</sup> h<sup>-1</sup> from mixture of manure with sawdust. The peat addition resulted with emission maximum during the first ten days, if the sawdust was added to fresh cattle manure then the active emission occurred from day 15th and continued during the ten days. Our experiment showed that if the composted municipal sewage sludge was mixed with peat the N<sub>2</sub>O and CO<sub>2</sub> emission rate were increased if compared to fresh sludge mixtures with peat or sawdust. The most intensive emission of all greenhouse gases from substrates occurred during first 15 days.