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Study of Gaseous Emissions from Composting Sludge

Biological treatment of municipal waste water generates large amounts of slu
rich in organic matter and certain chemicals. This composition rends sludge
ideal waste to be valorised through composting. However, the compos
facilities generate social rejection, often due to odour pollution. This article
studied gaseous emissions during the composting process of two types of slu

produced in wastewater treatment plants. The results obtained can be applie various fields.

The biological treatment of municipal waste water generates large amounts of waste sludge. This also known as biosolids, is rich inorganic matter, nitrogen, phosphorus, calcium, magnesium, su other elements. Due to its composition sludge can be valorized through composting. The com process allows the stabilization of the biodegradable organic matter contained in the waste to ol end product, known as compost, which can be applied to the soil as organic amendment. For development of the composting process it is important to maintain adequate conditions (humidity, p oxygen concentration, pH, etc.) that ensure the growth and activity of the microbial population resp for the biological degradation of organic matter. However, it has to be noted that the sludge c contain toxic compounds such as heavy metals and pesticides that could hinder compost final appli

One of the mainproblems of an industrial-scale composting installation is social opposition often re odorous pollution. Odors emitted in composting plants are mainly associated to the release of organic compounds (VOC), such as terpenes, alcohols, ketones, amines and sulfur compounds as ammonia (NH_3). In addition, also methane (CH_4) and nitrous oxide (N_2O) are emittedduring the com process. These compounds are greenhouse gases that contribute to the global environmental in the facility.

The aimof this work was to study the emissions of VOC, NH_3, CH_4 and N_2O during the composting of raw and anaerobically digested sludge produced in municipal waste water treatment plants. emission factors for the studied compounds were determined. Emission factors represent the am compound emitted per unit of waste treated (eg. grams of VOC emissions per ton of treated allowing the comparison among different waste composting technologies or processes perfor different scales. Following, the main VOC families and compounds present in VOC emissio identified and quantified. These data can be also used in environmental impact studies, for example context of Life Cycle Analysis.

Two types ofsludge were composted at pilot scale in duplicate (50 liters reactors) mixed with sh pallets, that act as bulking agent. The bulking agent accomplishes two functions in the com process: the regulation of humidity (sludge has a high content of water not suitable for a good devel of the biological activity) and porosity that is essential for the correct supply of the oxygen necessary process. Additionally, an innovative process control strategy has been applied. This strate developed by the research group allowing maximizing the biological activity in the process, reducin same time, the energy required for aeration. Target compounds in gaseous emissions were determ gas chromatography and mass spectrometry.

Figure 1: Raw sludge and shredded pallet (bulking agent) before being mixed in an adequate ratio composting treatment.

The results show higher emission factors in the digested sludge composting process for metha nitrous oxide than in the case of raw sludge, while those for VOC and ammonia show inverse resu are summarized the table below). In all cases, terpenes were the dominant VOC family throughou processes. Moreover, the evolution of the emissions show that these occur mostly within the fir days of the treatment process.

Emission factors during sludge composting (kg of emitted compound per t of sludge composted

Type of sludge	**COV**	**CH_4**	**N_2O**	**NH_3**
Raw sludge	0.175	0.013	0.005	0.576
Anaerobically digested sludge	0.033	0.780	0.525	0.004

The results of this work can be useful in the design and operation of gaseous emissions tr equipment in composting plants. Moreover, they can also be worthy in LCA studies and contribu better understanding of the gaseous pollutants present in waste composting facilities.

Top left figure: Pilot scale composting reactor (50 liters) used in the experiments.

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References

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