

Isotope analysis of N₂O from animal manure composting

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N₂O is one of the greenhouse gases. Animal manure composting is one of its sources. It is needed to understand the production processes of N₂O in order to reduce its emission. Since N₂O can be produced by nitrification, denitrification, and nitrifier denitrification reaction in composting process, it is difficult to deduce the major production pathway. Isotope analysis is effective for such a purpose because isotope ratios of N₂O is different between each production pathways. We studied the production process of N₂O in animal manure composting by isotope analysis.

Composting experiment was conducted at National Agricultural Center for Hokkaido Region (Sapporo city, Hokkaido). Cow dung was composted for about 2 months, with overturning at two-week interval. The experiment was conducted in a tent-like ventilated chamber in which ambient air entered from bottom part and flowed out from the topside. During the whole experiment period, temperatures at compost and ambient air and concentrations of NH₃ and N₂O were monitored at one-hour and a half-hour interval, respectively. Gas samples were collected 12 times and N₂O isotope ratios were measured in laboratory. At the time of overturning, solid samples were collected at 3 points in the surface layer and 2 points in the inside of the compost pile, and dry weight, volatile solids, total nitrogen, electrical conductance, pH and concentrations of inorganic nitrogen (NO₂⁻, NO₃⁻, NH₄⁺) were measured. We also conducted isotope analysis of inorganic nitrogen for subset of the samples.

Accumulation of NO₃⁻ which is final product of nitrification was observed at the surface layer of compost with the progress of composting. This suggested nitrification occurred at the surface layer. However, emitted N₂O was estimated to be produced from denitrification by isotope analysis. The results can be explained by the following mechanism: nitrate produced by nitrification at the surface layer diffused inside the compost pile, where the nitrate was converted to N₂O by denitrification under anaerobic condition.