Development of an Estimation Methodology Based on Clarification of the Mechanism of Greenhouse Gas Emission from Treated/Untreated Wastewater Discharged into Water Environment

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[Abstract]

Key Words: Greenhouse Gases (GHGs), Nitrous Oxide (N_2O), Methane (CH_4), Treated Wastewater, Untreated Wastewater, Estimation Methodology of GHGs Emission, Reduction method of GHGs Emission, Clarification of Mechanism of GHGs Emission, Stable isotopes

Country-specific emission factors (EFs) of CH_4 and N_2O for wastewater treatment plants (WWTPs) have been developed in Japan, however, IPCC default emission factors are used for treated and untreated wastewater. This study aimed to develop a method for estimating accurate greenhouse gases emissions from the natural decomposition of organic and nitrogen compounds in treated wastewater and untreated wastewater. Based on the continuous monitoring of N_2O in several WWTPs, non-negligible amount of dissolved N_2O in the treated wastewater was found as a new emissions source. Detailed understanding of the spaciotemporal distribution of dissolved GHGs in the wastewater treatment processes enabled us to develop a new EF of dissolved N_2O in the effluent of WWTPs. Country-specific CH_4 and N_2O EFs in rivers were also developed through the year-round field surveys. A methodology of the simultaneous evaluation of true N_2O production/consumption rate in river sediments was developed by use of ^{15}N isotope tracer. Molecular microbiological analysis identified some key microbes in the N_2O generation and consumption. Overall greenhouse gases emissions from wastewater management including CH_4 and N_2O emissions from WWTPs and CO_2 emissions derived from energy consumption were estimated for several cases. Comparing these estimations, scenarios to minimize overall greenhouse gases emissions are suggested.

[References]

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