Promotion of Global Warming Countermeasures in Sewerage

(Study period: FY2014 to FY2016)

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1. Introduction

As global warming countermeasures in sewerage, NILIM has been checking the status of emissions of nitrous oxide (N_2O), one of the greenhouse gases ("GHG"), and studying on reduction of emissions.

2. Control of GHG emissions from water treatment process

It is known that N_2O gas is generated by bio-reaction in the water treatment system. In particular, with focus on the conventional activated sludge process ("CAS process"), which were observed higher N_2O emissions than others, we are studying the low N_2O emission method. From the results of the test using a bench scale reactor, we confirmed the possibility that N_2O emissions could be reduced by restricted aeration air-flow operation, which leads to the nitrogen removal. Accordingly, N_2O to be generated from water treatment system could be controlled by incorporating the process of conducting the nitrogen removal in the CAS process. Then, as continued from the last fiscal year, we have been checking the reproducibility with the test using a bench scale reactor (see Photo) and conducting an on-site survey on municipal sewage treatment plants that implement the staged advanced treatment operation (a modified CAS involving low air supply in the upstream side of the aeration tank). Not only improvement of the quality of treated water but also reduced emissions of N_2O can be expected from introduction of the staged advanced treatment operation, which removes nitrogen by modifying the operation method without changing the structure of facilities using the CAS process.

3. Effect of anaerobic digestion introduction on GHG emissions

Anaerobic digestion, one of the sludge treatment methods, contributes to reduction of GHG emissions since it can collect 40-60% of organic matter in excess sludge as energy, while digester liquid with high nitrogen concentration is generated since solubilization of sludge proceeds in the digester. The return water contained digester liquid is treated in biological processing by activated sludge, e.g., return to the water treatment process, N_2O emissions may increase due to the effect of high-concentration nitrogen contained. Therefore, for the effect of anaerobic digestion introduction on GHGs emissions in sewage treatment, we estimated N_2O emissions, consumed energy based on the case study and material balance. As the result of estimation, although N_2O emissions increased approx. 10% from the water treatment process due to the nitrogen increase by return water loaded with nitrogen, introduction of anaerobic digestion reduced N_2O emissions by approx. 35% (CO_2 equivalent) in total even including the effect of return water as the result of the reduced GHG emissions from the sludge treatment due to decreased sludge generation and of reduction due to the use of regenerated energy (see Figure). Thus, the result of calculation suggests that GHG can be reduced by introduction of anaerobic digestion even with the increase in N_2O emissions from the water treatment facilities due to the effect of return water loaded with nitrogen.

Photo: Bench scale reactor in the water treatment process

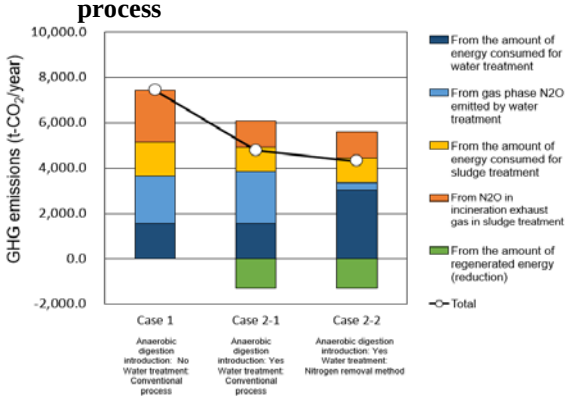

Figure: Results of estimation on GHG emissions in anaerobic digestion introduction

☞See the following for details.

1) Technical Note of NILIM, No. 950 (pp. 24-28)
http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn950.htm