The Relation between HONO Emission and the Amount of Carbon and Nitrogen Compounds in the Activated Sludge

*Chika Minejima[1], Yuta Orii[1], Ryosuke Fujinuma[1], Toshikazu Suenaga[2], Shohei Riya[2], Akihiko Terada[2], Masayuki Ohyama[4], Norimichi Takenaka[5], Keiichi Sato[3]

1. International Christian University, 2. Tokyo University of Agriculture and Technology, 3. Asia Center for Air Pollution Research (ACAP), 4. Osaka Institute of Public Health, 5. Osaka Prefecture University

Introduction & Research Purpose

OH radical is a strong oxidant and an essential component in the earth’ s atmosphere. However, quantification is very difficult because of its extremely high reactivity and low concentrations (Akimoto et al., 2002). Therefore, measuring precursor concentrations of OH radical is used to estimate its concentration. Gaseous nitrous acid, HONO, is one of the major OH precursors (Kleffmann, 2007).

$HONO + h\nu\ (\lambda < 400nm) \rightarrow NO + OH$

Despite the importance of HONO, its source is still not well understood. Soil was suggested as one of the missing sources (Su et al., 2011); thus, we use activated sludge to surrogate soil as it contains various organisms the same as any soil. Activated sludge is used in most of wastewater treatment plants. This study aims to elucidate the relation between HONO emission under aerobic conditions with carbon content, nitrogen content, and concentrations of inorganic nitrogen species such as NH_4^+, NO_2^-, and NO_3^-.

Experiments and Results

HONO fluxes from activated sludge were measured every 3 hours during daytime (AM9:00~PM6:00), October 6th, 2020 to 9:00, October 8th, 2020 using the filter pack method and ion chromatography. The measurement was started from the point of feeding the activated sludge. The filter pack was replaced every 3 hours. At night, samples were taken continuously for 15 hours from PM6:00 to AM9:00. Non-Purgeable Organic Carbon (NPOC) as carbon content and Total Nitrogen (TN) were also measured at the same time using TOC instrument (SHIMADZU TOC-V CSH). Secondly, NH_4^+, NO_2^-, NO_3^-, NPOC and TN concentration measurement was tried from the time of feeding on a separate day in order to find the change in chemical forms of nitrogen.

The result suggests that the HONO flux has strong relation with the carbon content under aerobic conditions. Further details will be discussed at the presentation.

Keywords: nitrous acid, activated sludge, soil

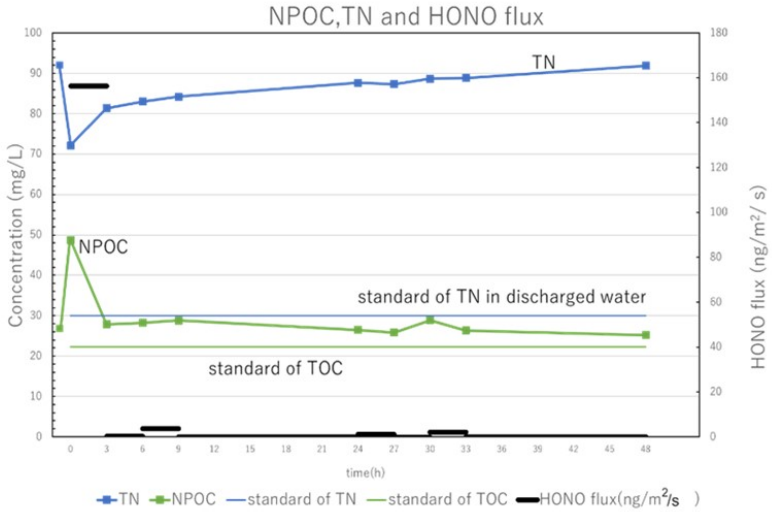

Figure 1. Time series of HONO fluxes, Carbon content (Non-Purgeable Organic Carbon (NPOC)) and Total Nitrogen (TN). Standards of Total Organic Carbon (TOC) and TN indicate the concentrations of TOC and TN in the released water from a wastewater treatment plant in Tokyo (TOC 22.2 mg/L, TN 30 mg/L). Feeding time was at the hour 0.

