[EJ] Evening Poster | A (Atmospheric and Hydrospheric Sciences) | A-AS Atmospheric Sciences, Meteorology & Atmospheric Environment

[A-AS06]Atmospheric Chemistry

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Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
This session provides a forum for the presentation of the broad spectrum of tropospheric and stratospheric chemistry, including various research topics (e.g., dynamical processes, air quality and climate), approaches (modeling, field measurements, remote sensing, and laboratory studies), and species (gas and aerosol). This session also provides an opportunity for discussing possible future collaboration with other research fields relevant to atmospheric chemistry.

[AAS06-P33]GC/MS and IC Analysis of Nicotine Reaction with HONO ~As the first step of examining the effect of surfactant on carcinogen formation~

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Introduction &Research Purpose

Smoking in an indoor environment produces second-hand smoke (SHS), and the residual SHS is reported to react with other atmospheric species in an indoor environment[*1]. As an example, nicotine, which is emitted as SHS, was reported to react with gaseous HONO, and to produce carcinogenic tobacco-specific nitrosamines (TSNAs): 1-(N-methyl-N-nitrosamino)-1-(3-pyridinyl)-4-butanal (NNA), 4-(methylnitrosamino)-1-(3-pyridinyl)-1-butanone (NNK) and N-nitroso nornicotine (NNN)[*1]. The method for TSNAs reduction, however, has not been found. Decreasing the amount of SHS might be one way for TSNAs reduction, but a more direct way to reduce TSNAs is needed. In this research, deodorant was focused as the substance that might affect the reaction, since some deodorants deodorize smell by reacting with odor molecules. I propose a hypothesis that the main components of deodorants, non-ionic surfactant might somehow affect the reaction of nicotine and HONO. Therefore, the purpose of this research is to see how surfactant affects the reaction of nicotine and HONO by comparing HONO concentration after reaction with nicotine only and with a mixture of nicotine and surfactant. Reaction products are analyzed by GC/MS.

Methods

Comparative experiments using filter-pack (FP) were performed. FP is used for collecting HONO, and the FP was set up from 4 stages of filters: F1, additional filter F*, F2 and F2’. F1, F2 and F2’ collected HONO, and the HONO concentration was calculated as follows:[HONO]=NO_2^-(F1)+ NO_2^-(F2)+NO_3^-(F2)- NO_2^-(F2’)- NO_3^-(F2’) [*2]. In this research, 4 different types of F* were set up: (1) no F* filters, (2) a blank F* filter, (3) F* with nicotine, (4) F* with a mixture of nicotine and

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surfactant. Polyethylene glycol monododecyl ether was used as a typical non-ionic surfactant. After gaseous HONO was generated from the HONO generator, it was flown into the FP, HONO concentrations after the FP were measured by IC, and products on F* was analyzed by GC/MS.

Result &Discussion

The HONO concentrations in (1)and(2) showed no statistical difference between these two measurements. Comparison of HONO concentration of (3) and (1) showed that 81.1% of the original HONO concentration decreased in (3), which showed that a part of reaction might have been somehow disturbed by nicotine. Also, the HONO concentration of (3) was 43.7% higher than (4). HONO reaction might have been interrupted by the presence of surfactant. The reasons of decreasing HONO concentration, however, might be reacting with the substances on the F*, or/and remaining on the F*. In GC/MS analysis, the nicotine concentration on (3) was 1.76×10^{-5} mol/ml, and 2.24×10^{-5} mol/ml on (4). Compared to the initial nicotine concentration, 2.99×10^{-5} mol/ml, 41.1% of the initial nicotine concentration decreased in (3), and 25.1% decreased in (4). The residual amount of nicotine in (4), which was with surfactant, was 21.4% larger than the that in (3). One reason of the losing nicotine in (3)&(4) might be transfer of some nicotine to the following filter, F2. This reason was proved by observing a peak of nicotine on the chromatograph of the extraction solution of F2 filter in (3)&(4), which contained 6.92% and 0.50% of the initial nicotine concentration were observed, respectively, and it was found to be minor.

Furthermore, three new peaks were observed on the chromatograph of F* extraction solution of (3), but none of these peaks refer to TSNAs. Therefore, It was not able to compare the quantitative differences of TSNAs affected by surfactant.

Future plan

The reason of no TSNAs produced was assumed be the low humidity of the reaction environment. Based on the reaction mechanism developed by Sleiman et al, H_2O plays an important role in hydrolysis during the formation of TSNAs. Therefore, setting higher humidity of the reaction environment is the next step in this research.

Reference

[*1] Sleiman et al., *PNAS*, **107**(15), 6576-6581 (2010)

[*2]Noguchi et al., *J. Jpn. Soc. Atmos. Environ.*, **42**(3), 162-174 (2007)

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