

MEASUREMENT STUDY ON THE CONCENTRATION DISTRIBUTIONS OF  $\text{SO}_2$  AND  $\text{NO}_2$  IN THE CITY OF DHAKA, BANGLADESH IN WINTER 1995-96

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## 1. INTRODUCTION

Dhaka is the capital and the biggest city of Bangladesh, and is expanding very rapidly. Emissions from heavy traffic and many small industries and commercial complexes, newly developed in and around the city, have been polluting the air of Dhaka city. The air pollution is severe especially in winter due to adverse meteorological conditions such as low wind speed and dry, stably-stratified air, which restricts the mixing height to low levels and prevent dispersion of pollutants. But so far no study of air pollution of Dhaka city has been done. In this study, we have first measured the concentrations of  $\text{SO}_2$  and  $\text{NO}_2$  in Dhaka city in a large scale, and derived their spatial distributions over Dhaka. In the context of urbanization, this study should be useful for emission control strategies, decision making processes, planning and management of Dhaka city.

## 2. EXPERIMENTAL METHOD

Molecular diffusion tubes, which do not require power sources and are produced at low cost, have been used to measure the concentration distributions of  $\text{SO}_2$  and  $\text{NO}_2$  at 64 sites in Dhaka city and its suburbs during the period of December-January of 1995-96. In these measurements we have adopted the procedures described in Maeda et al.(1994). The diffusion tube samplers were calibrated using 6 automated air pollution monitoring stations in Aichi-prefecture, Japan. The samplers were analyzed using ion-chromatograph and spectrophotometer to determine the concentrations of  $\text{SO}_2$  and  $\text{NO}_2$  respectively. The contamination of unexposed tubes under field conditions was determined, and the value of the blank test was subtracted from the measurements made by the diffusion tube samplers.

The sampling period in Dhaka was from 18 December 1995 to 16 January 1996, and the sampling sites were selected to reflect the spatial distributions of the ambient concentrations of the pollutants over all types of area of Dhaka. Three samplers were exposed at a site for 7-10 days to measure the concentration of one pollutant species at that site, and the samplers were sealed into plastic bag after recapping at the end of the exposure period.

## 5. RESULTS AND DISCUSSION

The calibration line and the distribution of the concentration data (Fig.1) acquired by automatic measuring instrument at each location showed that the error range of measurements made by the molecular diffusion tube samplers after calibration was 2 ~ 27 %.

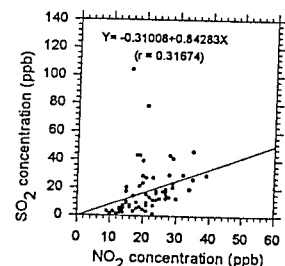
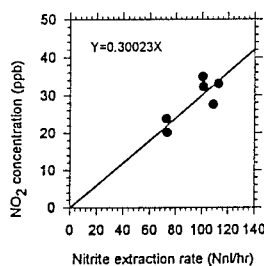
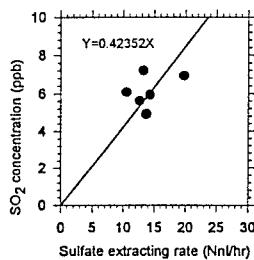


Fig. 1: Calibration line between sulfate & nitrite extraction rate and gaseous  $\text{SO}_2$  and  $\text{NO}_2$  concentration.

Fig. : Scatter diagram of 10-days-average  $\text{SO}_2$  and  $\text{NO}_2$  concentrations.

Spatial distribution of  $\text{SO}_2$  concentration over Dhaka (Fig.3(a)) shows extremely high  $\text{SO}_2$  concentrations in the south-eastern industrial and brick field zone where the highest 10-day-average concentration was 104 ppb, which is around 10 times larger than those at polluted area in Nagoya in the same season. Polluted zone, in which the average  $\text{SO}_2$  concentration was over 40 ppb, extended along major roads running from north-west to south-east, and also parallel to the Buriganga river. Brick fields and industries along the traffic and navigation routes as major emission sources, and north-western blowing along the river, as prevailing wind in winter may have formed this particular high  $\text{SO}_2$  zone. In case of  $\text{NO}_2$  (Fig.3(b)), the highest 10-day-average concentration was 35 ppb, which is about the same as those of urban Nagoya, and higher concentration appeared in the city center and along main roads of Dhaka, indicating traffic as major  $\text{NO}_2$  source.

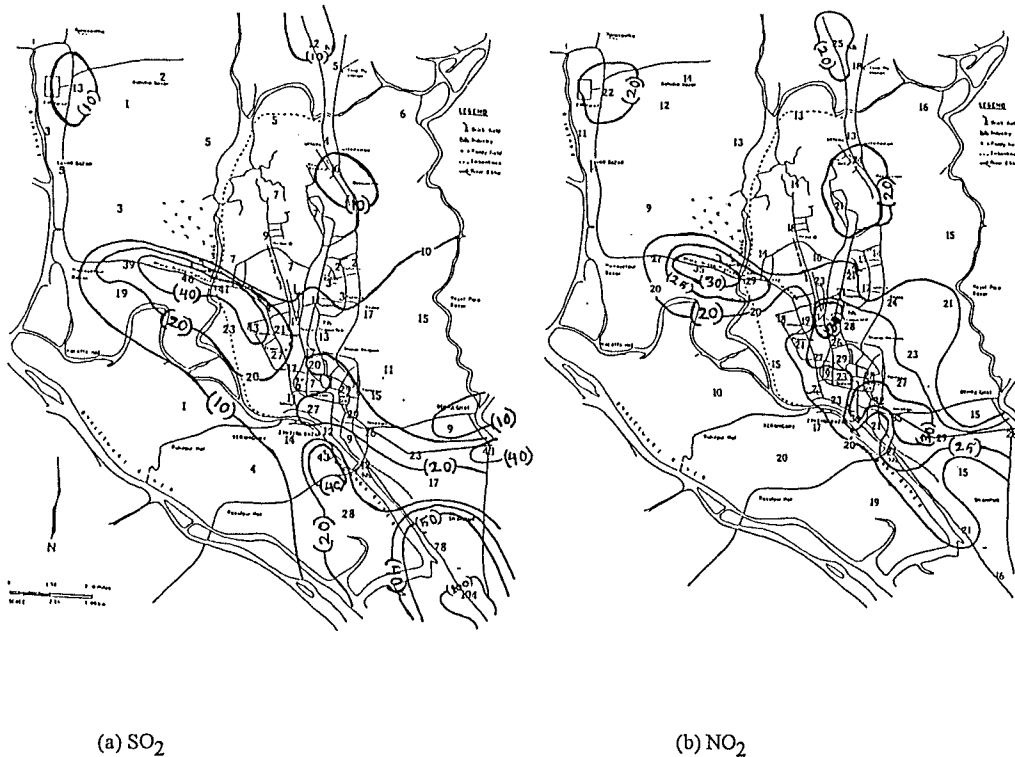


Fig.3 : Spatial distributions of  $\text{SO}_2$  and  $\text{NO}_2$  concentrations over Dhaka in winter 1995-96.

In order to assess the observed relationships between  $\text{SO}_2$  and  $\text{NO}_2$  concentrations, we have plotted scatter diagram as in Fig.2. In general,  $\text{SO}_2$  and  $\text{NO}_2$  are not highly correlated (correlation coefficient = 0.35). This indicates the different major source types of these pollutants - brick fields and industrial emissions for  $\text{SO}_2$ , and motor vehicles for  $\text{NO}_2$ .

### 3. CONCLUSIONS

Ambient  $\text{SO}_2$  and  $\text{NO}_2$  concentrations have been measured in Dhaka city at 64 sites using diffusion tube samplers. The overall results of the study may be summarised as follows :

- (1) Dhaka city is highly polluted by  $\text{SO}_2$ . At some places  $\text{SO}_2$  concentrations are more than two times to the Japanese ambient  $\text{SO}_2$  concentration standard, which is 0.04 ppm for daily average ; but  $\text{NO}_2$  concentrations are moderately high.
- (2)  $\text{SO}_2$  concentrations are high in the south-eastern industrial and brick field zone together with the routes running from north-west to south-east, and also parallel to the Buriganga river; whereas  $\text{NO}_2$  concentrations are high in the city center and along the major roads.
- (3)  $\text{SO}_2$  and  $\text{NO}_2$  concentrations distributions are not highly correlated (correlation coefficient is 0.35)

### REFERENCE

- Maeda T., Ohta S., Murao N., Mizoguchi I. and Kobayashi H. (1994): A measurement of the concentration distribution of  $\text{SO}_2$  and  $\text{NO}_2$  in Sapporo using molecular diffusion samplers (in Japanese) *Environmental Science* 7(2), 129 - 137.