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Trends of the concentrations of some gaseous pollutants in Bombay

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ABSTRACT. The monthly average concentrations of sulphur dioxide, nitrogen oxides, total oxidants and ammonia over the years 1968-1971 at the BARC site, Bombay are presented. The figures indicate an overall tendency of increasing concentrations year after year.

The sulphur dioxide concentrations as measured by the lead peroxide method at several sites in Greater Bombay over the past few months as monthly averages are also presented. These figures indicate widespread sulphur dioxide pollution with a few pockets with relatively higher concentrations.

1. The first part of this paper deals with the concentration levels of four of the important major pollutants, namely, sulphur dioxide, nitrogen oxides, oxidants and ammonia, at the Bhabha Atomic Research Centre, Trombay, over the past few years. Using standard gaseous sampling procedures (Zutshi *et al.* 1970) results of estimations are summarized as monthly average levels for the various years and presented in the form of graphs in Figs. 1 to 4, against the background of some international air quality standards along with their effects on life, vegetation and property.

From the figures it can easily be seen that there is a clear trend of increase in the concentration of these pollutants during the period under review. Also a seasonal variation in the levels could be observed indicating the influence of average meteorological conditions prevailing during the various seasons.

In the case of oxidants*(Fig. 3) our estimations during the earlier years were restricted to day time sampling and therefore the values presented (as daily averages) are higher than what they could be if twentyfour-hour sampling was undertaken. This is because the oxidant concentrations are usually higher during the period of sunshine.

2. The second part of this paper deals with the survey being undertaken for assessing the sulphur dioxide levels in the Greater Bombay region, using the lead peroxide sulphation method (Huey 1968). Although this method is not very specific for SO_2 estimations, because of its simplicity and convenience we made use of it for estimating the monthly average concentrations at about twelve locations in Greater Bombay.

The correlation between the sulphation rate as determined by this method and the gaseous SO_2 concentration in air was evaluated by simultaneously estimating the SO_2 levels in the atmosphere at BARC site using both the West and Gaeke method (West and Gaeke 1956) and the lead peroxide method on a monthly basis—over a period of six months. Our findings are that within about $\pm$ 15 per cent, the factor for conversion of sulphation rate (mg SO_3/100 sq. cm/day) to SO_2 concentrations in parts per million was:

1·0 mg SO_3/100 sq. cm/day corresponds to 0·038 ppm SO_2.

This compares well with the values obtained by other investigators (Stalker *et al.* 1963). We are inclined to believe that using this conversion factor to estimate the concentrations of SO_2 at different sites we are not likely to be in error exceeding $\pm$ 15 per cent. The results of this study are presented in Table 1.

These results show that the monthly average SO_2 concentration in most of the places investigated exceed 1 pphm (parts per hundred million of air) —the concentrations above which are internationally regarded as objectionable in ambient air. Few pockets of very high SO_2 concentrations are also seen from this table.

3. It is felt that for a reasonable assessment of the concentrations of a pollutant at any location it is necessary to conduct the survey at least for a whole year perhaps a longer duration would be better. This is because over a few weeks or months the influence of local meteorological factors may give a completely false picture of the actual average conditions. However, to assess the potential hazards caused by short time exposure to high concentrations of these pollutants it is also essential to conduct short term observations extending over a couple of hours.

*Which includes ozone, alkyl peroxides etc.

4. Summary

Pollution of the environmental air is on the increase in the Greater Bombay area necessitating the enforcement of early control measures.

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TABLE 1

Monthly average sulphur dioxide concentrations (pphm) around Greater Bombay

(Lead peroxide Method)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
						1969						
BARC (Mod. Labs.)	—	—	—	—	1·0	1·3	1·3	1·0	1·0	0·9	1·0	1·0
,, (Cirus Jetty)	—	—	—	—	—	—	—	—	—	3·0	3·6	4·2
Collector's Colony, Chembur	—	—	—	—	—	6·2	5·2	4·1	2·6	1·7	2·4	1·7
						1970-1971*						
BARC (Mod. Labs.)	2·1 (1·3)	1·8 (1·2)	1·5 (1·3)	2·3 (1·3)	2·3 (0·4)	1·8	1·3	1·5	1·0	0·8	0·8	1·1
,, (Cirus Jetty)	3·9	4·1	4·4	—	—	—	—	—	—	—	—	—
Bandra	— (1·0)	— (1·0)	— (0·7)	— (0·7)	— (0·3)	—	—	—	—	—	—	1·0
Collector's Colony, Chembur	1·8 (2·0)	1·8 (1·8)	1·8 (1·6)	1·6 (1·5)	3·0 (1·9)	4·6	3·3	5·5	4·5	2·2	1.9	1·7
Chinchpokli	(—)	(—)	(3·7)	(1·8)	(1·7)							
Deonar	— (1·1)	— (0·8)	— (1·0)	— (0·8)	— (0·5)	—	—	—	—	0·2	0·2	0·9
Ghatkopar	— (0·8)	— (0·3)	— (0·3)	— (0·6)	— (0·1)	—	—	—	—	0·9	0·8	0·8
Koliwada	—	—	—	—	—	—	—	—	—	0·3	0·3	0·5
Mahul (Bahri Nagar)	— (1·5)	— (0·8)	— (0·7)	— (0·7)	— (0·5)	—	—	—	—	2·5	2·5	1·7
Matunga	— (1·8)	— (0·9)	— (0·9)	— (0·9)	— (1·0)	—	—	—	—	1·8	1·8	1·7
Parel	— (1·7)	— (1·5)	— (1·5)	— (0·6)	— (0·5)	—	—	—	—	1·3	2·1	2·1
Sion	(—)	(1·3)	(1·2)	(0·6)	(0·3)							
Worli	— (1·6)	— (0·9)	— (0·7)	— (0·7)	— (0·3)	—	—	—	—	3·1	3·1	1·2

*Figures in brackets indicate concentrations during 1971

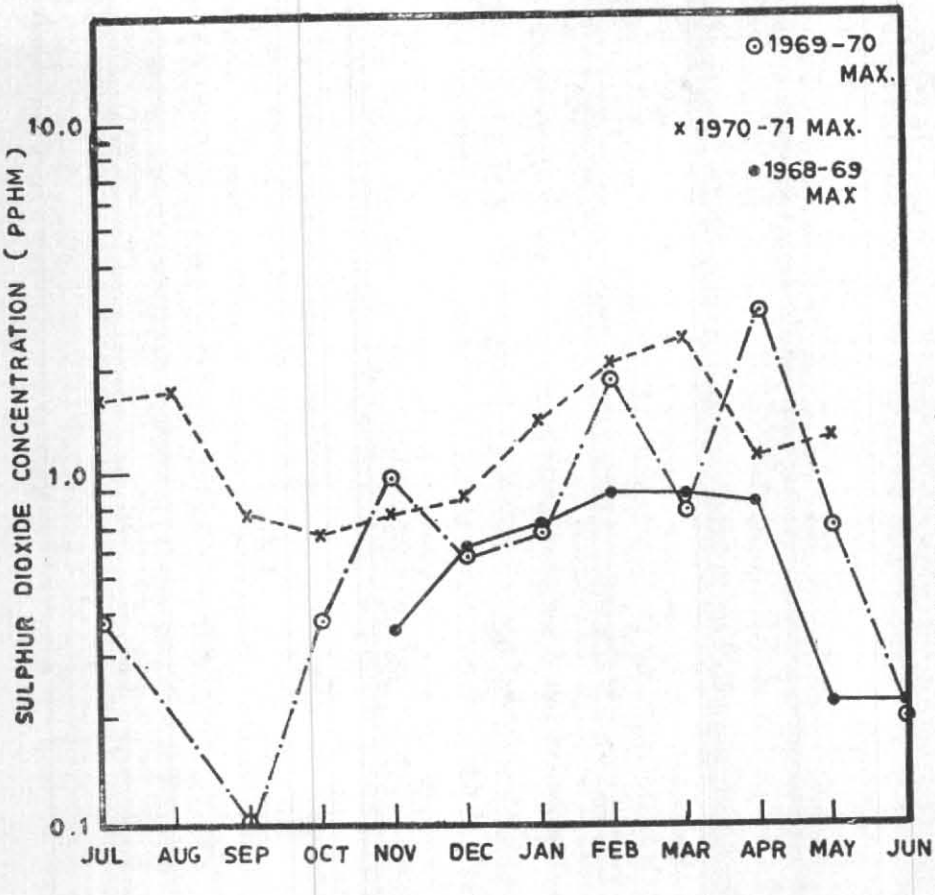

Fig. 1

Atmospheric concentrations of Sulphur Dioxide observed at the BARC site, Bombay. Separate points shown outside the curves represent the maximum observed concentrations during different years for a four-hour sampling period. These maximum values are indicated against the months in which they were observed.

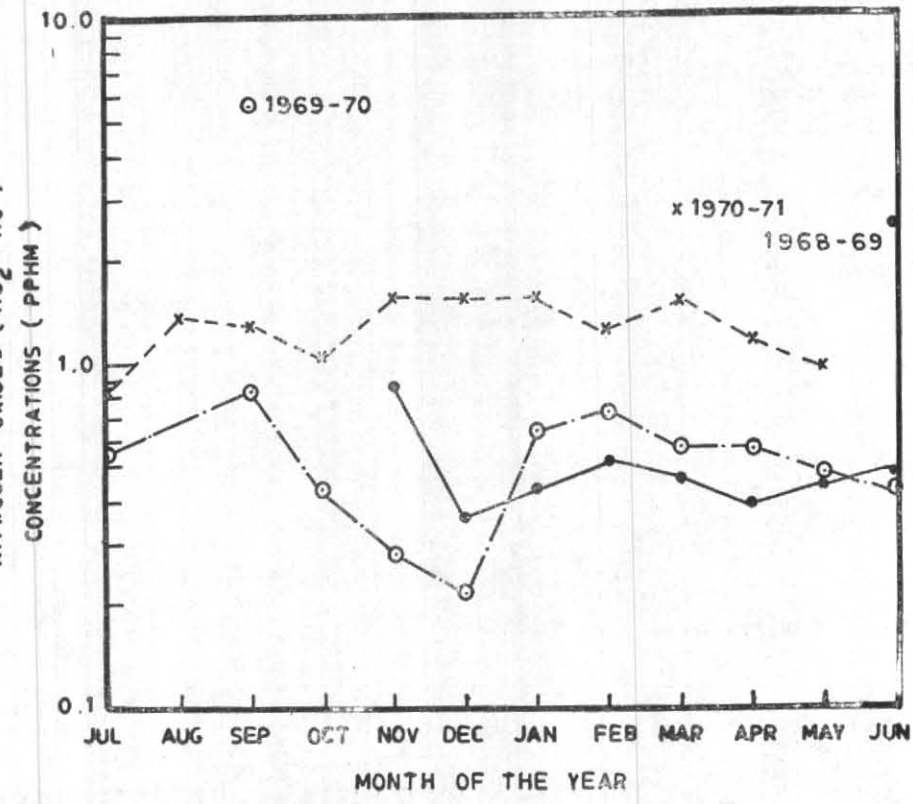

Fig. 2

Atmospheric concentrations of Nitrogen Oxides observed at the BARC site, Bombay. Separate points shown outside the curves represent the maximum observed concentrations during different years for a four-hour sampling period. These maximum values are indicated against the months in which they were observed.

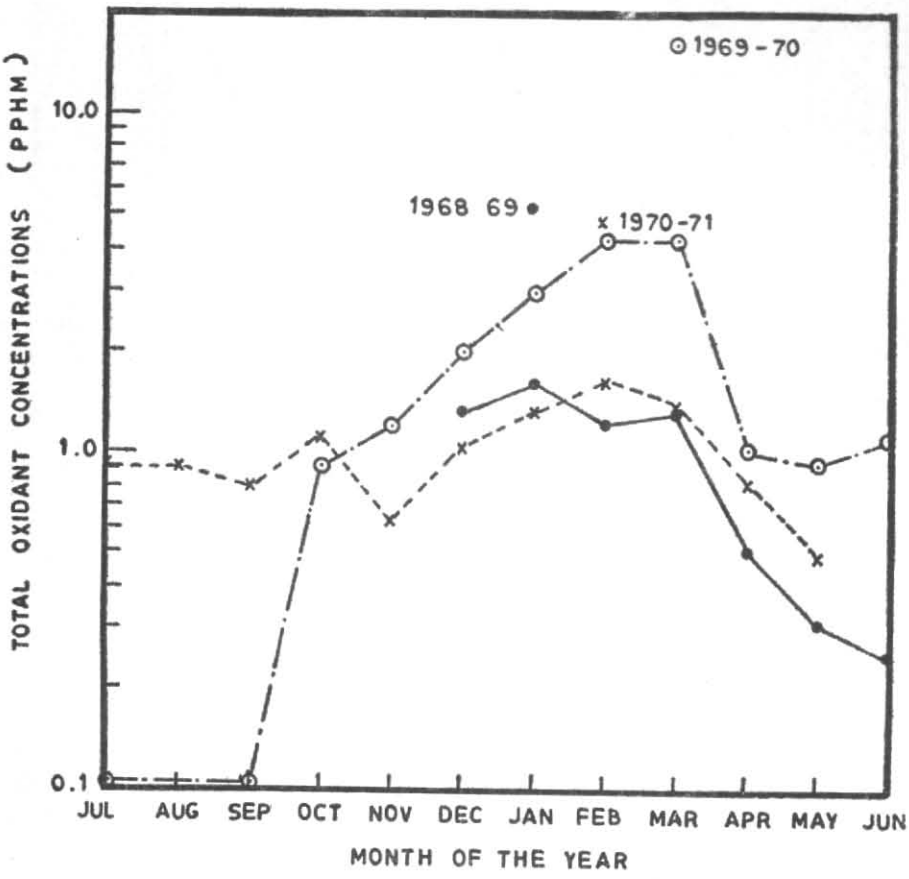

Fig. 3

Atmospheric concentrations of total oxidants including Ozone observed at the BARC site, Bombay. Separate points shown outside the curves represent the maximum observed concentrations during different years for a four-hour sampling period. These maximum values are indicated against the months in which they were observed.

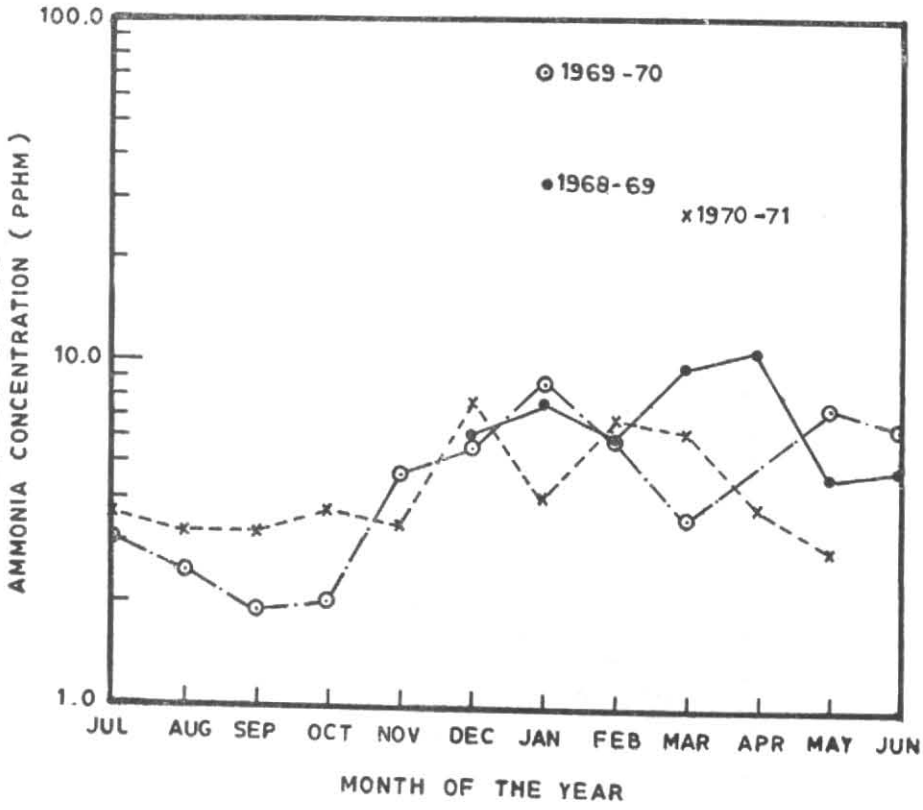

Fig. 4

Atmospheric concentrations of Ammonia observed at the BARC site, Bombay. Separate points shown outside the curves represent the maximum observed concentrations during different years for a four-hour sampling period. These maximum values are indicated against the months in which they were observed.