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SULPHATION RATE IN GHAZIABAD AND MEERUT AREA OF NATIONAL CAPITAL REGION INDIA

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ABSTRACT

The objectives of the present study was to have a general idea of air pollution profile with respect to SO_2 levels in different areas based on land use pattern i.e. residential, commercial and industrial area in Ghaziabad and Meerut area of National Capital Region India during July, 2009 to June, 2011.Seasonal variation in sulphation rate as well as trend analysis were carried out. Furthermore, increasing trends of average sulphation rate level from residential (0.138 to 0.310mgSO_3/100cm^2/day) to commercial (0.221 to 0.411mgSO_3/100cm^2/day) and to industrial are (0.285 to 0.542mgSO_3/100cm^2/day) have been observed. On the basis of present study, various industrial pockets and sources of air pollution where sulphation rate levels exceed the critical level were also identified. The finding of the study demand the necessity of phase wise SO_2 reduction from the industrial areas, where SO_2 is coming mainly from small and medium scale industries.

KEYWORDS: Air Quality, Air Pollution Profile, Sulphation Rate, Trend Analysis

INTRODUCTION

Environmental pollution possesses a serious health hazard to modern civilization. Industrialization and urbanization growth has created the problem of "Environmental pollution" in some of the major cities like Delhi, Calcutta and Bombay, where typical air pollution problems are experienced[1]. Sulphation Rate (S.R.) measurement has been generally accepted as an average index of atmospheric pollution by sulphur compounds (mainly sulphur dioxide) in ambient envirnment[2]. A number of Techniques have been developed for measurement of S.R.[3-8] Sulphation rate study is widely used because of its simplicity low cost and suitability for extensive air quality surveillance programmed. An extensive study has carried out on S.R. levels in the NCR (National Capital Region) India during the period July, 2009 to June, 2011. The objectives of the study were

To assess the seasonal variations in S.R.

To assess the trend of S.R. in residential, commercial and industrial area.

Area Investigated

Ghaziabad and Meerut area of NCR is located in the extreme part of Western Uttar Pradesh, state of India Ghaziabad covers an area of 2950 km with 30 Lakh approximate population. It lies between 28° 26 and 28° 59 North latitude and 77° 12 and 78° 13 East longitude while Meerut covers an area of 3911 Sq. Km with 38 lakh approximate population. It lies between 77° 7 and 78° 7 East longitude and 28° 45 and 29° 16 North latitude. Ghaziabad and Meerut area of NCR is bounded by Muzaffarnagar District while Bulandshahr lies to the South. The river Yamuna forms the Western limit of district while river Ganga Eastern limit. Delhi is in the West of Ghaziabad. Ghaziabad and Meerut is located in the sub-topical belt. The climate is mainly influenced by its inland position and prevalence of air of the

continental type, the climate of both the area is of semi acid nature due to marked diurnal differences of temp. high saturation deficit and moderately law rainfall. The desert area of Rajasthan to West and South West. The Gangatic plains of U.P. to East, across which the monsoon air travels and reaches Ghaziabad and Meerut. Both have their respective share in affecting the climate of the region. Extremely dryness with an intensely not summer and a cold winter from Oct. to Feb. and warm monsoon period from July to Sept. which causes increased humidity, cloudiness and perspiration. A large number of industries and enterprises are located in the city. More than 5 lakh vehicles and more than 60 Lakh population of both the area also add considerable contaminants every day.

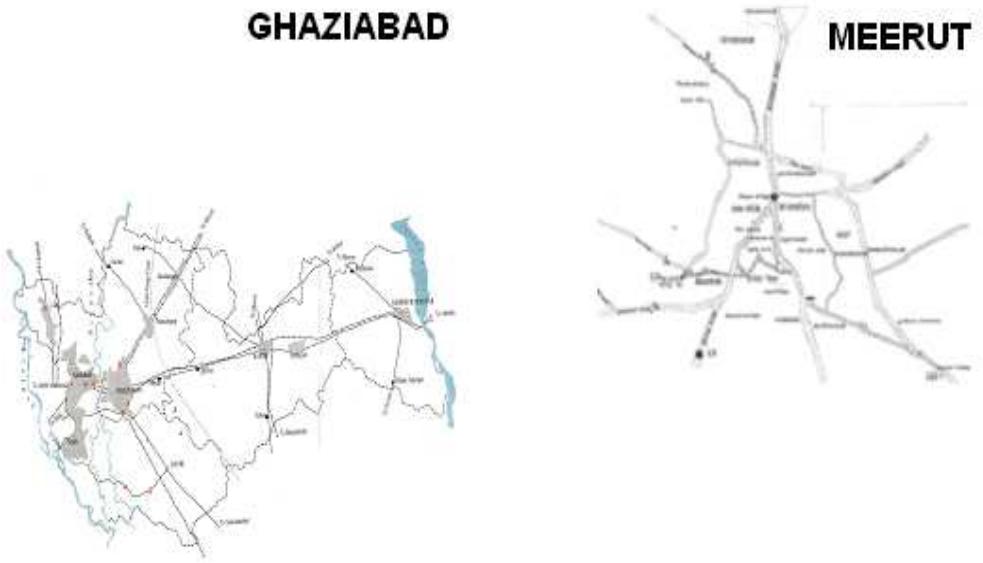

Figure 1: Map Showing Location of Sulphation Rate Study in Ghaziabad & Meerut of NCR

MATERIAL AND METHODS

In order to determine S.R. levels in Ghaziabad and Meerut area, various sites in a comprehensive network were selected based on land use patter i.e. residential (two stations), commercial (two stations) and industrial zones (three stations), meteorological conditions and existing air pollution sources. The locations are shown in Figure.-1 and Table-1.

The lead oxide paste coated to a cylindrical surface (100 sq. cm) of a PVC tube was exposed for 30 days. Sulphate formed due to sulphur containing gases of the air with the peroxide is then determined in a laboratory by precipitation ($BaSO_4$) method. Precipitation concentration was measured turbiditimetrically method as per recommended method, using spectrophotometer at 420 nm wavelength.

RESULTS AND DISCUSSIONS

Result of the S.R. Study are summarized in Table-2 (Seasonal Avg. values are given in mg of $SO_3/100cm^2/day$).

The seasonal average values of corresponding monthly sulphation rate values as follows

- Monsoon (July to Sept.)
- Post Monsoon (Oct. to Nov.)
- Winter (Dec. to Feb.)
- Summer (March to June).

Sulphation Rate in Residential Area

The average seasonal S.R. levels are below the critical level viz. 0.500 $mgSO_3/100cm^2$/day (Standard Adopted by some Western countries) at both the residential area. The higher value was found is railway road that is 0.396 $mgSO_3/10cm^2$/day during summer 2009 probable due to industrial and traffic activities.

Sulphation Rate in Commercial and Mixed Use Area

The average seasonal S.R.levels exceeded the critical values at ModiNagar Bus Stand

i.e.0.540$mgSO_3/100cm^2$/day during summer 2009 out of the two stations in this category.

Sulphation Rate in Industrial Area

The average seasonal S.R. levels exceeded the critical values almost at all three stations. Average sulphation rate profile observed at different industrial area is given in Table-3.

Seasonal Sulphation Rate Trends Analysis

The seasonal S.R. trends analysis in different areas based on land use and utility pattern depicted in Fig.ure-2 shows that

- The average seasonal S.R. Levels gradually increases from residential area to commercial area to industrial as given in Table-4.
- The highest S.R. levels have been observed during summer 2010 in all areas.
- The average S.R. has increased from that in monsoon 2009-2010 to 2010-2011 to all areas.

CONCLUSIONS

In general gradual increase in S.R. from residential area to commercial and mixed use area to industrial area is observed. It has also increased from monsoon to summer in all areas indicating overall increase in pollution load in the atmosphere. Maximum values occurred in summer as against those expected in winter. However, over all highest S.R. level (0.727 $mgSO_3/100cm^2$/day) observed at Sahibabad industrial area is well below the highest S.R. observed in Calcutta (1.45$mgSO_3/100cm^2$/day and in Delhi 0.907 $mgSO_3/100cm^2$/day) observed at Nazafgarh Industrial Area (S. K.Tyagi 1992). However the average S. R. Level in all seasons at all industrial zones under study in Ghaziabad and Meerut area of NCR exceeded the critical levels 0.500 mg $mgSO_3/100cm^2$/day and therefore demands the necessity of phase-wise SO_2 reduction from the industrial zones, where SO_2 reduction from the industrial zones, where SO_2 is coming mainly from small and medium scale industries.

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APPENDICES

Table 1: Sampling Station is Ghaziabad and Meerut Area of NCR Location

Area	Location
Ghaziabad Residential Commercial Industrial	Rajnagar, (roof of house app. 200m away from Main Road) * Modi Nagar (N.H. Road Side) ** Sahibabad G.T. Road Industrial area (heavy and Small Scale Industry) Bulandshahr Road Industrial area (Small & Medium Scale Industry)
Meerut Residential Commercial Industrial	Railway Road (Roof of house along with Sadar Bajar & Keshar Bazar) Begam Bridge (Road Side along with bus stand and Lal Kurti Commercial Area) Partapur Industrial (Small Scale Industry)

* Modi Nagar Station is surrounded by Air polluting industries.
** Sahibabad, Bulandshahr Station is surrounded by Air polluting industries

Table 2: Sulphation Rate (S.R.) in Ghaziabad and Meerut Area of NCR ($mgSO_3/100\ cm^2/day$) Period July 2009 to June 2011

Name of Station	Monsoon (Jul. to Sept.)	Post Monsoon (Oct. to Nov.)	Winter (Dec. to Feb.)	Summer (March to June)	Monsoon (Jul. to Sept.)	Post Monsoon (Oct. to Nov.)	Winter (Dec. to Feb.)	Summer (March to June)
Residential Area								
Rajnagar	.109	.100	.187	.202	.177	.258	.272	.301
Railway Road	.166	.219	.25	.313	.149	.272	.265	.314
Commercial and Mixed Use Area								
Modinagar	.222	.326	.398	.402	.232	.404	.424	.415
Begum Bridge	.200	.300	.409	.387	.219	.417	.360	.403
Industrial Area								
Sahibabad	.330	.418	.483	.584	.381	.537	.499	.606
Bulandshahr	.274	.443	.480	.523	.306	.476	.489	.547
Industrial Area								
Partapur Industrial Area	.251	.383	.351	.454	.254	.379	.371	.472

Table 3: Sulphation Rate Profile in Industrial Zones

Industrial Zone	Sulphation Rate ($mgSO_3/100cm^2/day$)
Sahibabad Industrial Area	.490 (.286 to .727)
Bulandshahr Road Area	.446 (.249 to.632)
Partapur Industrial Area	.371 (.184 to.512)

Note: Values in brackets denote range of Sulphation rates levels

Table 4: Seasonal Sulphation Rate ($mgSO_3/100cm^2/day$)

Name of Station	Monsoon	Post Monsoon	Winter	Summer	Monsoon	Post Monsoon	Winter	Summer
Residential Area (Avg. of two Station)	.138	.160	.229	.268	.263	.265	.269	.310
Commercial & Mixed use Area (Avg. of two station)	.211	.313	.404	.395	.225	.411	.392	.409
Industrial Area (Avg. of three Station)	.285	.415	.438	.520	.314	.464	.453	.542

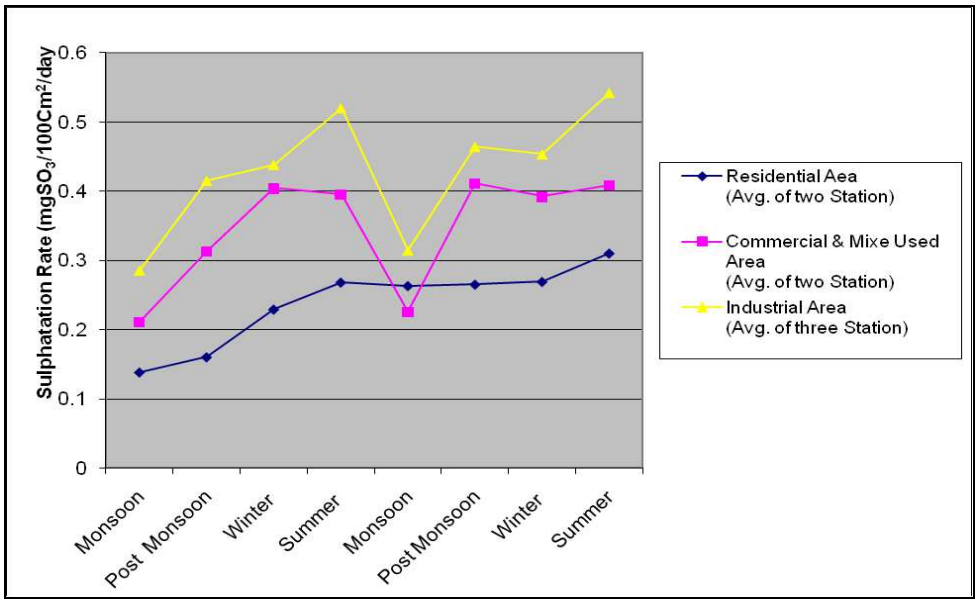

Figure 2