International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
doi : https://doi.org/10.32628/IJSRST

Concentration of Sulphur Dioxide in Ambient Air with Respect to Various Air Pollutants at Varanasi

Sateesh Kumar Pandey
Department of chemistry, S.B.P. G. College, Baragaon Kiremasi

Article Info
Volume 9, Issue 2
Page Number : 597-600
Publication Issue
March-April-2022
Article History
Accepted : 01 March 2022
Published : 30 March 2022

ABSTRACT

This paper deals with the study of concentration of sulphur dioxide, a strong air polluting gas at Varanasi, generated from brick industries and automobiles (heavy and light vehicles). The study was performed during the year 2004 - 2005 at the five different sites, located in different areas of Varanasi, at monthly interval. The result indicates that the concentration of sulphur dioxide is higher than the permissible limit at all the study sites except at control site.

Keywords : Polluting, Control Site.

I. INTRODUCTION

Now a days, almost all the important cities in India are being highly polluted. During general survey at Varanasi, various sources of pollution have been marked, which include industries, locomotives, automobiles, aircrafts, open refuge burning, various kinds of kitchen stoves, domestic furnaces and electric generators etc. As already stated, Varanasi is an ancient city of Uttar Pradesh (25° 18' N. 83° 24' E and 76.19 m above the sea level). It consists of traditional and narrow roads, which ultimately lead to the traffic congestion, during which excess amount of pollutants are emitted by incomplete combustion of fuels. Due to clumping of tall buildings and poor ventilation in some areas, the emitted pollutants remain confined at lower level in the atmosphere.

It was revealed that, there is heavy load of vehicular transportation and about 1588 small scale industries are located in and around the city of Varanasi, where crude oil and coal are used as a fuel material for power generation. In Varanasi, locomotives and automobiles play a significant role in polluting the atmosphere by the continuous discharge of Nox, Sox, Co, hydrocarbons, SPS etc. Huge amount of the above pollutants are released every day into the ambient air due to the operation of heavy and light vehicles. Air composition also varies from place to place and time to time. CO_2, Sox and NOx may be presented in higher proportion in the place, where fuel combustion is taking place Li et al.[5]. In proportion, sulphur containing gases are reported to be relatively higher in the paddy growing area Yang et al. [11] and Mueller et al.[7].

Among industries, although numerical strength of brick industries is very low in Varanasi i.e. 3.34%. However, brick industries are treated as most polluting industries because, the brick kilns are provided with the most inferior quality of coal (Grade III/IV), which has very high ash and volatile matter content i.e. 45 - 70%

Aslam[1] Higher quantity of sulphur dioxide is also released from burning of these III/IV grade coal. Burning of one ton of grade III coal releases 0.4536 kg of sulphur dioxide in the air Pandey[8]. At national level, more than one lac brick industries are working, which consume 20 million tones of coal per year. According to one estimate, about 9.072 million kg (0.4536 x 20 million kg) SO_2 is released in the atmosphere every year.

By advancement of science and technology, the variety of pollutants is also increasing. This geometrical increase in the rate of pollution has ruined the quality of air Cooper and Jenkins[3], Elbir et al.[4]. However, scientific study still lacks some essential information about the actual impact of the automobile exhaust and brick industries on the surrounding pollution and its management.

Materials and Methods :

For detailed investigation, five study sites were selected in the different parts of the city -

Site-I : Bhelkhan (Brick Industry Site

Site - II : Chamaun (Brick Industry Site)

Site - III : S. B. P.G. College, Baragaon (Control Site)

Site - IV : Chaukaghat (Heavy Vehicle Site)

Site - V : Godowalia (Slow Moving, Light Vehicle Site)

For ambient air quality monitoring at the various sites of brick kilns and road side, air samples were collected and analysed using High Volume Air Sampler (Environment APM - 410) at least six samples were collected at an interval of thirty minutes for ambient air analysis.

The concentration of SO_2 is calculated as follows -

Concentration of SO_2 = (μg SO_2/ml x V) Vair

where μg SO_2/ml = Value from Standard Curve,

V = Total volume of absorbing solution

and Vair = Volume of air in m^3 (flow rate x time).

With the above mentioned method, the concentration of SO_2 at various selected sites has been computed.

Results and Discussion : Concentrations of SO_2 were estimated from the samples of ambient air collected at different study sites, with regular interval of one month. The results obtained on monthly basis are given in the Table.

Analysis shows that the site II (brick industry site at Chamaun) was the most polluted site. This brick industry has a high kiln capacity i.e. 29,000 bricks are produced in a day i.e. 3,000 more than that of the brick industry at site - I. Due to low stack height at site II, the pollutants are released at a lower height, which remains suspended in the air very close to the earth surface. Similar observations for low height stacks were also reported by Boev et al. [2]

Sulphur dioxide concentration in the stack was found to be in between 194.31 to 197.52 μg m^{-3} at site - I, whereas 223.31 to 227.81 μg m^{-3} at site - II. In July, August, September and October (2004) due to rainy season, all the brick industries were found to be non-functional. This may be the major factor for appearance of low level of pollutants in ambient air. During these four months, the wind rose was also more or less symmetrical.

Sulphur dioxide concentration in ambient air, at road sites with vehicular movement was found to be ranging from 40 to 21 μgm^{-3} at site - IV, while 43 to 25 μgm^{-3} at site-V, which is higher than that of site - IV due to slow moving vehicles and clumping of tall buildings and poor ventilation in some areas. Pollution load

in the ambient air of brick industry study sites - I and II was much higher as compared to the control site - III, similar observations were also observed by Singh et al. [*] and Matkoric and Juretic[6].

Table

Concentration of SO_2 ($\mu g\ m^{-3}$) in Ambient Air at Different Study Sites in Varanasi

Months	I (Bhelkhan)	II (Chamaun)	III (C) College	IV (Chaukaghat)	V (Godowaliya
May 2004	195.95 ± 4.76	225.38 ± 2.89	18.31 ± 0.89	39.00 ± 0.81	42.00 ± 1.31
June	195.76 ± 4.09	226.18 ± 5.98	18.00 ± 1.45	40.00 ± 0.92	43.00 ± 0.81
July				33.00 ± 0.32	31.00 ± 1.30
August				21.00 ± 1.00	25.00 ± 1.05
September				29.00 ± 0.68	29.00 ± 1.07
October				30.00 ± 0.78	34.00 ± 1.11
November	197.52 ± 6.06	227.25 ± 4.87	14.62 ± 1.09	29.00 ± 0.35	36.00 ± 1.31
December	197.31 ± 3.00	227.81 ± 1.78	16.51 ± 1.48	32.00 ± 0.48	37.00 ± 1.03
January 2005	196.50 ± 4.43	222.71 ± 2.89	16.89 ± 1.65	34.00 ± 0.69	30.00 ± 1.07
February	196.35 ± 7.00	224.53 ± 6.09	17.41 ± 1.87	33.00 ± 0.89	33.00 ± 1.07
March	195.52 ± 4.59	225.61 ± 4.90	17.91 ± 1.09	35.00 ± 1.20	37.00 ± 1.06
April	194.31 ± 2.09	223.31 ± 4.89	18.02 ± 1.50	37.00 ± 0.89	39.00 ± 1.31

References :

1. Aslam, M. (1999): Pollution Prevention in Brick Kilns. Bricks and Tiles News, pp 16-20.
2. Boev, V. M.; Perepelking, S. V.; Zhelu-deva, G. N.; Setko, N. P. and Barkhatova, L. A. (1998). Hygienic Aspects of Pollution of the Ambient Air by Sulphur Containing Substances. Gigiena I Sanitariya, 0(6), pp 17-20.
3. Cooper David, M. and Jenkins, Alan (2003): Response of Acid Lakes in the UK to Reductions in Atmospheric Deposition of Sulphur. Sci. Total Envi., 313(1-3), pp 91 - 100.
4. Elbir, T. and Aysen, M. (2004): Estimation of Emission Strengths of Primary Air Pollutants in the City of Izmir Turkey. Atmos. Envi., Vol. 38(13), pp 1851 – 1857.
5. Li, Y. F.; Zhang, Y. J.; Cao, G. L.; Liy, J. H. and Barrie, L. A. (1999) : Distribution of Seasonal SO_2 Emissions from Fuel Combustion and Industrial Activities in Shanes Prornica, China with 1/6 Degree XI/4 Degree Longitude/Latitude Resolution. Atmosphere Environment, Vol. 33(2): 257 - 265.
6. Matkoric, N. and Juretic, A. A. (1998): Emission and Ambient Levels of SO_2 in the Rijeka Bay Area. Arhiv za Higigenu Rada; I Toksikologiju, Vol. 49(2), pp 155 - 163.
7. Mueller, Spephon, F.; Bailey, E. M. and Kelsoe, J. J. (2004): Geographic Sensitivity of Fine Particle Mass to Emissions of SO_2 and NOx. Envi. Sci. Tech., Vol. 38(2), pp 570 - 580.
8. Pandey, G. N. (1997): Air Pollution and its Control, in Environmental Management Vikas Publishing House, New Delhi - 14.

9. Singh, M. P.; Goyal, T. S.Panwar; Agrawal, P. and Nigam, S. (1990): Predicted and Observed Concentrations of SO_2, SPM and NOx Over Delhi. Atmos. Environ., Vol. 24A(4), pp 783 788.
10. Tripathi, A.; Bajpai, A.; Tripathi, D. S. and Tiwari, D. (1995): Assessment of Some Tocic Heavy Metals in Atmosphere of Varanasi City. Energy Environ. Monitor, Vol. 11(2), pp 183 - 186.
11. Young, Z.; Kong, L. Z.; Wang, L. and Li, S. (1998): Emission of Bioferic Sulphur Gases from Chinese Ice Paddies. Science of the Total Environment, Vol. 224(1-3), pp 1-8.