ESTIMATION OF AIR POLLUTION IN VILLAGES OF KORBA DISTRICT

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1.0. *ABSTRACT*:

An investigation was carried out to study the Ambient air quality levels in industrial surrounding areas in Korba district. Due to presence of number of power plants & various industries in Korba district creates Environmental problem in this area. Thermal power plants, coal & Bauxite mines are continuously releasing industrial emissions in to the atmosphere. This paper presents Ambient air quality of Two different villages in Korba district of chhattisgarh state. Those villages are Lata Basti and Dhanras . The parameters analyzed are Respirable particulate matter (PM10, PM2.5), Sulphur Dioxide and Oxides of Nitrogen. The results obtained were compared with Central Pollution Control board limits of India.

2.0. INDEX TERMS

Air pollution[1], Estimation[2], Pollutanats[3] , human health[4].

3.0. INTRODUCTION

Air pollution is described as contamination of the atmosphere by gaseous, liquid, or solid wastes or by-products that can endanger human health and welfare of plants and animals, attack materials, reduce visibility, or produce undesirable odors.
Although some pollutants square measure free by natural sources like volcanoes, evergreen forests, and hot springs, the impact of this pollution is incredibly little compared thereto caused by
emissions from industrial sources, power and warmth generation, waste disposal, and the operation of internal combustion engines.
Fuel combustion is that the largest contributor to air waste product emissions, caused by man, with stationary and mobile sources equally responsible.

The Presence of range of power plants industries in Korba district gave a support for the existence of Environmental downside during this space.
Many industrial emissions from existing Thermal power plants, coal mines were being ceaselessly free in to the atmosphere.

4.0. STUDY AREA & OBJECTIVE

4.1. Study Area

Korba industrial area is part of Korba Dist.situated at 22-22' N and 82-42'E latitude with the 304.8 meter higher than sea level.The ambient air quality of Korba surrounding villages is continuously degrading due to industrial activities.Therefore, we've got set to investigate the close air quality of the study space, in order that some remedies for the development may be doable.

4.2. Objective

Hence In this study selected Two villages in Korba district are, Malgaon and Sirli and these are very closer proximate to many Thermal Power plants and Coal Mines. In said villages Air samples were collected by using standard methods.And analyzed for different pollutants like Particulate matter (PM10, PM2.5), Sulphur Dioxide and Oxides of Nitrogen.So the Ambient air analysis has been carried for various Air Pollutants like Particulate matter(PM10,PM2.5), Sulphur Dioxide(SO2), and Nitrogen oxides(NOx). The range of concentration of analyzed pollutants were compared with National Ambient air Quality Standards-NAAQS-2009,(Environment(Protection)seventh amendment rules - 2009), A Gazette notification released by Ministry of Environment and Forests, Government of India.

5.0. METHODOLOGY

5.1. Sample Collection

Ambient air samples were collected from four different villages Korba district during the pre monsoon season (March-April 2018) using standard methods of Indian standard and CPCB guidelines and analyzed in laboratory for different pollutants. Particulate matter(PM10,PM2.5) in ambient air were sampled and analyzed as per IS 5182, (Part IV) and followed Central Pollution Control Board guide lines(Gravimetric method), Sampling and analysis of Sulphur dioxde were done by following the strategy IS:5182,(part-II,West & Gaeke method), Sampling and analysis of Oxides of Nitrogen were done by following the strategy IS:5182(Part-VI,Sodium Arsenite method). Analysis

5.2. Analysis

5.2.1. PM10

A sampler called Respirable dust sampler (RDS) draws a known quantity of atmospheric air through an inlet, Inlet will admit specific proportions of particles based on their aerodynamic diameter. The dust collected with RDS is referred to as a suspended particulate matter (SPM)[9], Generally 10 micrometers or lesser than that in aerodynamic diameter are defined as PM_{10}[8]. In RDS, the PM_{10} can passes through the inlet and will be collected on a filter paper[9]. The weight (mass) difference before and after sampling of filter paper is particulate matter deposited on the filter paper. PM_{10} concentration will be reported in microgram per cubic meter of air.

5.2.2. PM2.5

An instrument called Fine dust sampler (FDS) draws atmospheric air at a fixed volumetric flow rate (16.7 LPM) maintained by a flow controller linked with a microprocessor special particle-size impactor, where the Dust(SPM) in the $PM_{2.5}$ size ranges is will be collected on a 47 mm polytetrafluoroethylene (PTFE) filter paper in a specific period of time[6]. The difference in weight(mass) of filter paper before and after sampling will be calculated and $PM_{2.5}$ concentration will be reported in microgram per cubic meter of air[7].

5.2.3. Sulphur Dioxide (SO2)

Sulphur dioxide(SO2) is collected from air in to absorbing solution of potassium tetrachloromercurate (TCM)[4]. A dichlorosulphitomercurate complex which results formation of a Dichloro Sulphito mercurate complex . This complex is very stable and will not oxidize by strong oxidants like Ozone and Nitrogen oxides[5]. The concentration of SO2 will be estimated by reacting this complex with para rosaniline and methylsulphonic acid with suitable spectrophotometer at 560nm[5].

5.2.4. Nitrogen Oxides (NOx)

Nitrogen Oxides (NOx) will be collected from air in to absorbing solution of sodium hydroxide and sodium arsenite[1]. The Nitrite ion Concentration (NO2) produced during sampling will be determined colorimetrically by reacting with phosphoric acid, sulfanilamide, and N-(1-naphthyl)-ethylenediamine di-hydrochloride (NEDA)[2] this mixture will from highly coloured Azo-dye. Absorbance of this coloured azo-dye will be measured with suitable spectrophotometer at at 540 nm[2].

6.0. ANALYSIS DATA:

6.1. Analysis Calcualtion of Particulate Matter (PM_{10})

6.1.1. PM_{10} (Lata basti) :

Weight of Filter Paper before sampling (I) = 2.8562g

Weight of Filter Paper after sampling(F) = 3.06817g

Weight Difference in Filter paper (D) =0.21197g

Flow Rate(F) = 1.15m3/min.

Duration of sampling Time(T) = 24hr = 1440min.

Total Volume of Air Sampled(V) = 1440*1.15 =1656m3

PM10 = D*10^6/V = 0.21197 *10^6/1656 = 128 µg/m3

10^6 is conversion factor from gram to micro gram.

6.1.2.PM$_{10}$ (Dhanras):

Weight of Filter Paper before sampling (I) = 2.73428g

Weight of Filter Paper after sampling (F) = 2.95920g

Weight Difference in Filter paper (D) =0.22492g

Flow Rate (F) = 1.1m3/min.

Duration of sampling Time (T) = 24hr = 1440min.

Total Volume of Air Sampled(V) = 1440*1.1 =1584m3

PM10 = D*10^6/V = 0.22492 *10^6/1584 = 142 µg/m3.

6.2.Analysis Calcualtion of Particulate Matter (PM2.5)

6.2.1.PM$_{2.5}$ (Lata basti) :

Weight of Filter Paper before sampling (I) = 0.09094g

Weight of Filter Paper after sampling (F) = 0.09258g

Weight Difference in Filter paper (D) = 0.00164g

Flow Rate (F) = 16.7 LPM.

Duration of sampling Time (T) = 24hr = 1440min.

Total Volume of Air Sampled(V) = 1440*16.7 =24048L=24.05m3

PM2.5 = D*10^6/V = 0.00164 *10^6/24.05 = 68 µg/m3

10^6 is conversion factor from gram to micro gram

6.2.2.PM$_{2.5}$ (Dhanras) :

Weight of Filter Paper before sampling (I) = 0.08965g

Weight of Filter Paper after sampling (F) = 0.09125g

Weight Difference in Filter paper (D) = 0.00178g

Flow Rate (F) = 16.7 LPM.

Duration of sampling Time (T) = 24hr = 1440min.

Total Volume of Air Sampled(V) = 1440*16.7 =24048L=24.05m3

PM2.5 = D*10^6/V = 0.00178 *10^6/24.05 = 74 µg/m3

10^6 is conversion factor from gram to micro gram

6.3.Standard Concentration & Linearity Graph of SO_2

Table 1: Standard concentrations for linearity of SO_2

S.No.	Concentration (µg)	Absorbance
1	3.38	0.043
2	6.76	0.079
3	13.52	0.138
4	20.28	0.234
5	27.04	0.312
6	33.8	0.386
7	40.56	0.480

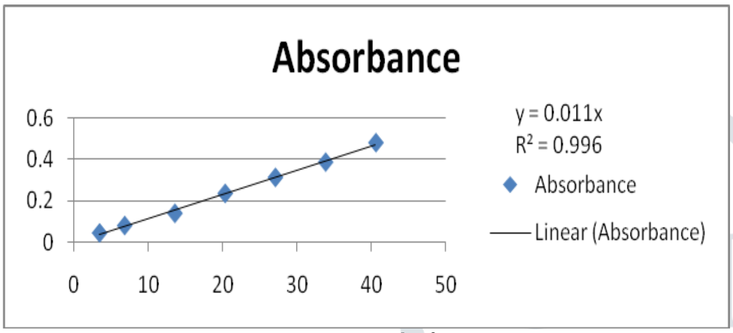

Fig.1:Linearity graph of SO_2

Slope from Graph is 0.0117
Factor =1/slope=85.5

6.2.1.SO_2 Calculation (Lata Basti)

Sample Absorbance(A) = 0.3372

Factor (F) = 85.5

Dilution Factor(D) = 3

Flow Rate = 1.1L/min.
Total time of Sampling =24hr=1440min

Total Volume of Air(V) = 1.1*1440=1584L = 1.584m3

Concentration of SO_2 = Abs*Factor*DF/V

0.3372*85.5*3/1.584 = 54.6µg/m3

6.2.2.SO_2 Calculation (Dhanras)

Sample Absorbance (A) = 0.218

Factor (F) = 85.5

Dilution Factor(D) = 3

Flow Rate = 1.0L/min.
Total time of Sampling=24hr=1440min

Total Volume of Air(V) = 1.0*1440=1440L = 1.440m3

Concentration of SO_2 = Abs*Factor*DF/V

0.295*85.5*3/1.440 = 52.5µg/m3

6.3.Standard Concentration & Linearity Graph of NOx

Table 2: Standard concentrations for linearity of NOx

S.No.	Concentration(µg)	Absorbance
1	1	0.023
2	2	0.057
3	4	0.095
4	6	0.136
5	8	0.170
6	10	0.222

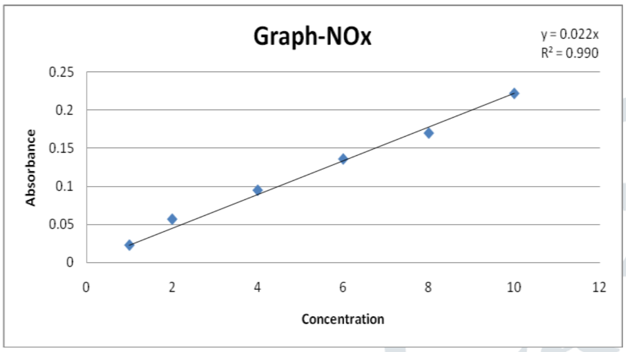

Fig.2:Linearity graph of NOx

Slope from Graph is 0.021
Factor =1/slope=47.6

6.3.1.NOx Calculation (Lata basti)

Sample Absorbance (A) = 0.204

Factor (F) = 47.6

Dilution Factor(D) = 6

Flow Rate = 1.1L/min.

Total Sampling Time=24hr=1440min

Total Volume of Air(V) = 1.1*1440=1584L = 1.584m3

Efficiency Factor of Method(E) = 0.82

Concentration of NOx = Abs*Factor*DF/V *0.82

0.204*47.6*6/1.584*0.82 = 44.8µg/m3

6.3.2.NOx Calculation (Dhanras)

Sample Absorbance(A) = 0.1757

Factor (F) = 47.6

Dilution Factor(D) = 6

Flow Rate = 1.0L/min.

Total Sampling Time=24hr=1440min

Total Volume of Air(V) = 1.0*1440=1440L = 1.440m3

Efficiency Factor of Method(E) = 0.82

Concentration of NOx = Abs*Factor*DF/V *0.82

0.1757*47.6*6/1.440*0.82 = 42.5µg/m3

6.4. Result

Table.3.: Result

S.N	Parameter (µg/m3)	Lata basti	Dhanras	CPCB Limit
1	PM10	128	142	100
2	PM2.5	68	74	60
3	Sulphur Dioxide	54.6	52.5	60
4	Nitrogen Oxides	44.8	42.5	60

7.0. CONCLUSION:

With the above analysis data it is clearly observed that Particulate matter concentration is very higher than the prescribed limit of Central Pollution Control Board(CPCB), Sulphur dioxide concentration is very nearer to the CPCB limit and concentration of Nitrogen Oxide is bit lower to the CPCB limit.Its very harmful to the human beings who residing in those villages. Hence It is necessary to implement more pollution control methods in surrounding villages of Coal mines and Coal based power plants.

8.0. REFERENCES:

(1). Christie.At.A et, al (1970): Field method for determination of Nitrogen Oxide in air. 95, pp.510-524, and NAAQS Monitoring & Analysis Guidelines Volume-I, Improved West and Gaeke method.

(2). Mageson J.H. et,al(1977): Evolution of Sodium Arsenite method for measurement of NO2 in ambient air.27, pp (553-556)

(3). Jacob M.B.:Hochheiser.Si.(1958)Continuous Sampling and ultrmicro determination of Nitrogen Oxide in Air Anal.chem.pp (30:426)

(4). Bolt.S.(1969): Method for measurement of air pollution part-3,sulphur dioxide, British standard institution

(5). O.E.C.D.Paris(1964): Report of Working party on methods od measuring air pollution and survey techniques.

(6). James.Paul.Lodge ; Jr.Editor (1996): Methods of Air sampling & analysis-3rd edition.

(7). Robert.e J. henson; Robert L.Kabel (2003): sources and control of air pollution

(8). E.Roberts alley & Associates (2001) Air quality control handbook.

(9). M.N.R; H.V.N Rao (2005): Air Pollution

(10). Roy .M.Horrison (2004): Hand book of Air Pollution analysis