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Ambient Air Quality in Korba District

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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. Two different villages are (Malgaon and Sirli) were selected for the study . The parameters analyzed are particulate matter (PM10, PM2.5), Sulphur Dioxide and Nitrogen Oxides. The results were compared with National Ambient air Quality Standards-NAAQS-2009 of Government of India.

Index Terms- Industrial pollution[1], Ambient air[2], Pollutanats[3] , parameters[4]**.**

1. 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[8].
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 byemissions from industrial sources, power and warmth generation, waste disposal, and the operation of internal combustion engines[9].
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.

2. STUDY AREA & OBJECTIVE

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.

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.

3. METHODOLOGY

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[1] 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) [6]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)[4], Sampling and analysis of Oxides of Nitrogen were done by following the strategy IS:5182(Part-VI,Sodium Arsenite method). Analysis[2].

Analysis

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.

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].

Sulphur Dioxide (SO2)

Sulphur dioxide(SO2) is collected form 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].

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].

4. ANALYSIS DATA

Analysis Calcualtion of Particulate Matter [7]

PM_{10} (Malgaon) :

Initial Weight of Filter Paper(I) = 2.84132g

Final Weight of Filter Paper(F) = 3.03773g

Difference in Filter paper weight (D) =0.19641g

Sampling Flow Rate(F) = 1.2m3/min.

Sampling Time(T) = 24hr = 1440min.

Volume of Air Sampled(V) = 1440*1.2 =1728m3

PM10 = $D*10^6/V$ = 0.19641 $*10^6/1728$ = 113.6 µg/m3

106 is conversion factor from gram to micro gram.

PM_{10} (Sirli):

Initial Weight of Filter Paper(I) = 2.72510g

Final Weight of Filter Paper(F) = 2.93935g

Difference in Filter paper weight (D) =0.21425g

Sampling Flow Rate(F) = 1.1m3/min.

Sampling Time(T) = 24hr = 1440min.

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

PM10 = $D*10^6/V$ = 0.21425 $*10^6/1584$ = 135.3 µg/m3.

Analysis Calcualtion of Particulate Matter (PM2.5)

$PM_{2.5}$ (Malgaon) :

Initial Weight of Filter Paper(I) = 0.09091g

Final Weight of Filter Paper(F) = 0.09241g

Difference in Filter paper weight (D) = 0.0015g

Sampling Flow Rate(F) = 16.7 LPM.

Sampling Time(T) = 24hr = 1440min.

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

PM2.5 = $D*10^6/V$ = 0.0015 $*10^6/24.05$ = 62.4 µg/m3

10^6 is conversion factor from gram to micro gram

$PM_{2.5}$ (Sirli) :

Initial Weight of Filter Paper(I) = 0.08965g

Final Weight of Filter Paper(F) = 0.09125g

Difference in Filter paper weight (D) = 0.0016g

Sampling Flow Rate(F) = 16.7 LPM.

Sampling Time(T) = 24hr = 1440min.

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

PM2.5 = D*10^6/V = 0.0016 *10^6/24.05 = 66.5 µg/m3

10^6 is conversion factor from gram to micro gram

Standard Concentration & Linearity Graph of SO_2[4]

Table 1: Standard concentrations for linearity of SO_2

S.No.	Concentration (µg)	Absorbance
1	3.5	0.035
2	7.0	0.073
3	10.5	0.105
4	14	0.13
5	17.5	0.167
6	21	0.19
7	28	0.248

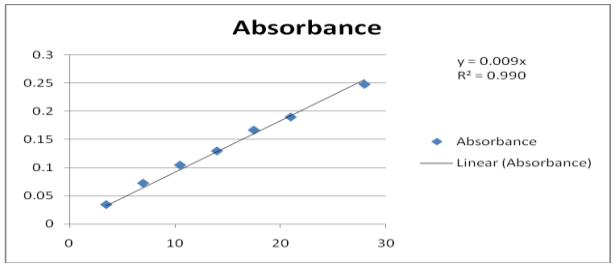

Fig.1: Linearity graph of SO_2

Slope from Graph is 0.009
Factor =1/slope=111

SO2 Calculation (Malgaon)

Absorbance of Sample(A) = 0.231

Factor from Graph(F) = 111

Dilution Factor(D) = 3

Flow Rate = 1.1L/min.
Sampling Time=24hr=1440min

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

Sox Concentration = Abs*Factor*DF/V

0.231*111*3/1.584 = 48.6µg/m3

SO2 Calculation (Sirli)

Absorbance of Sample(A) = 0.218

Factor from Graph(F) = 111

Dilution Factor(D) = 3

Flow Rate = 1.0L/min.
Sampling Time=24hr=1440min

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

Sox Concentration = Abs*Factor*DF/V

0.218*111*3/1.440 = 50.4µg/m3

Standard Concentration & Linearity Graph of NOx[2]

Table 2: Standard concentrations for linearity of NOx

S.No.	Concentration (µg)	Absorbance
1	1	0.02
2	3	0.055
3	5	0.092
4	7	0.136
5	9	0.173
6	11	0.207

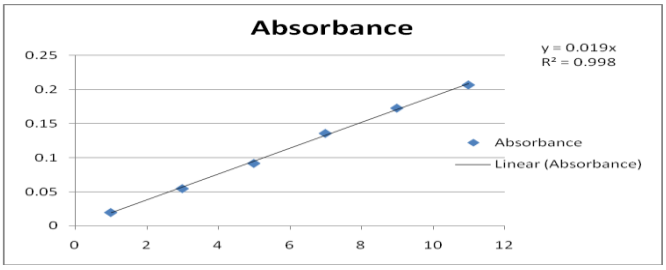

Fig.2: Linearity graph of NOx

Slope from Graph is 0.019
Factor =1/slope=52.6

NOx Calculation (Malgaon)

Absorbance of Sample(A) = 0.196

Factor from Graph(F) = 52.6

Dilution Factor(D) = 3

Flow Rate = 1.1L/min.

Sampling Time=24hr=1440min

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

Efficiency Factor of Method(E) = 0.82

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

0.196*52.6*3/1.584*0.82 = 23.8µg/m3

NOx Calculation (Sirli)

Absorbance of Sample(A) = 0.185

Factor from Graph(F) = 52.6

Dilution Factor(D) = 3

Flow Rate = 1.0L/min.

Sampling Time=24hr=1440min

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

Efficiency Factor of Method(E) = 0.82

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

0.185*52.6*3/1.440*0.82 = 24.7µg/m3

5. RESULT

Table.3.: Result

S.N	Parameter (µg/m3)	Malgaon	Sirli	CPCB Limit
1	PM10	113.6	135.3	100
2	PM2.5	62.4	66.5	60
3	Sulphur Dioxide	48.6	50.4	60
4	Nitrogen Oxides	23.8	24.7	60

6. 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 villagers. Hence It necessary to implement more pollution control methods in surrounding villages of Coal mines and Coal based power plants.

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