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A STUDY OF AIR POLLUTION IN TWO CITIES OF HARYANA

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A Study of Air Pollution in Two Cities of Haryana

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Abstract – Air pollution is a major problem not only in Haryana but all over world. Now a days due to growing industries Haryana is heavily polluted which is disturbing the ecological balance. Although pollution is as old as man himself but awareness about it is only recent. Air has never been pure, foreign substances have been present in air all the time. The main pollutants in air are sulfur di oxide, nitrogen di oxide, SPM, RPM, and because the numbers of industries in Haryana are increasing day by day due to increasing population the amount of these pollutants are also increasing. When the monitoring was conducted in two cities namely Hisar and Gurgaon in Haryana we found that in both the cities the concentration of so₂ was with in prescribed limits of CPCB. however the no₂ values cross the maximum limits at vehicular area in Hisar. Highest values of SPM, RPM was at Gurgaon which is a serious concern.

Key Words:- Pollution, Air contaminants, Industrialization, Quality assessment, Hisar, Gurgaon.

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INTRODUCTION

With an area of 44212 sq.km Haryana has Shivalik hills in north and river Yamuna in the east. The aravalli range acts as Haryana's south western boundary and runs through its Gurgaon region. The river Ghaggar provides a kind boundary in the west of the state. Haryana is divided into 19 districts. Out of which 2 cities Gurgaon, Hisar were selected for the pollution monitoring. Air pollution of city. The anthropogenic activities are the major causes for air pollution.

MATERIAL AND METHODS:- Keeping in view the objective for air quality monitoring suitable number of sampling stations were selected. Attempts were made to assess criteria pollutants such as SPM, RPM, NO₂ & SO₂.

SELECTION OF SAMPLING STATIONS:- The sampling site must be located in a way that the collected samples represent air that is breathed by exposed population.

DESCRIPTION OF SAMPLING STATION:- For air quality monitoring of Haryana 2 cities Hisar & Gurgaon were selected. and both cities were divided into four areas.

Residential area where the population density was more

Civil hospital

High vehicular traffic area, where the maximum number of vehicles were crossing.

Industrial areas

LOCATION OF SAMPLING SITES WITH THEIR DETAILS:-

City	Zone	Location	General features
Gurgaon	R	Sector-15 part 1,2.	Well maintained road, moderate traffic.
	S	Civil hospital	High traffic, main road near.
	V	IFFCO chowk	Heavy traffic, national highway
	I	39 Milestones	Industrial area, national highway.
Hisar	R	Urban estate	Well maintained road
	S	Civil hospital	Near bus stand
	V	Nagori gate	Commercial activity, high traffic
	I	Industrial area	Jindal strip, railway nearby

MONITORING EQUIPMENT

For monitoring RPM (PM₁₀), TSP, SO₂, NO₂ Envirotech make High Volume Respirable Dust Sampler, Model APM 460 with APM-411 Gaseous Sampling Attachment has been used.

METHOD OF SAMPLING AND ANALYSIS

Procedure given in Indian Standard Institution Publication IS: 5182: part II (1969), Part VI (1975), Part IV (1973) have been followed and efforts were made to generate most accurate data.

		parameters		
Particulars	SPM	RPM	SO ₂	NO ₂
Equipment	High volume sampler	Respirable dust fractionators	Tapping in the hopper	Tapping in the hopper
Flow measuring device	Pressure drop across orifice in the hopper	Pressure drop across orifice in the hopper	Rota meter	Rota meter
Flow rate	0.8-1.3m ³ /min	0.8-1.3m ³ /min	0.5-1.5m ³ /min	0.5-1.5m ³ /min
Sampling period	24 hourly	24 hourly	24 hourly	24hourly
Analytical method	Gravimetric	Gravimetric	West and Geake	Jacobs andHochheiser
Wave length			560nm	540nm
Technique	Pre-weighed cyclone cup	Filtered through glass microscope filter paper	Absorbed in TCM	Absorbed in Na Arsenite

PRINCIPLE OF OPERATION

The APM-460 Respirable Dust Sampler has cyclone. this cyclone has been designed provide separation of 120 micron particals.As the air enter s the cyclone, coarse non respirable dust is separated from the air by centrifugation forces. these suspended particulates fall in cyclone cups. fine dust forming the respirable fraction passes through cyclone gets collected on glass filter paper.

PROCEDURE

Respirable dust concentration was determined gravimetrically using Whatman filter paper.

CONDITIONING OF FILTER PAPER

Each filter paper was exposed to sources of light and was inspected for imperfections. Filter paper were kept in oven at 95-100C for 3 hours. After drying filter paper were removed from oven and kept in desiccators for 3 hour and were allowed to cool. Each filter paper was weighed and was kept in flat box with out folding.

SAMPLE COLLECTION

The fiter paper was mounted on the filter adoptor assembly the sampler was switched on. Allowed the manometer flow to stabilized for a min.Initial time totalizer reading was noted.initial manometer flow was

noted.Fater the time was over,switchoff the instrument,final manometer flow was noted and final time totalizer reading was noted The filter paper was removed and kept.

ANALYSIS

Filter paper was conditioned and final weight of filter paper was determined.

CALCULATION

Mass concentration of respirable particulate matter(RPM):

$$\text{RPM}(\mu\text{g}/\text{m}^3) = (\text{Wf}-\text{Wi}) \times 10^6 / \text{Va.}$$

Mass concentration of non respirable particulate matter

$$\text{NRPM}(\mu\text{g}/\text{m}^3) = (\text{CCf}-\text{CCi}) \text{multiply by } 10 \text{ raised to power } 6 / \text{Va.}$$

$$\text{TSPM}(\mu\text{g}/\text{m}^3) = \text{RPM} + \text{NRPM}$$

Where :

Wf = final weight of the filter paper(g.)

Wi = initial weight of the filter paper(g.)

CCf = final cyclone cup weight(g.)

CCi = initial cyclone cup weight(g.)

Va = volume of air passed (cub. M/min)

SAMPLING OF NO₂&SO₂

The most common methods for collection are grab sampling and absorption in liquid.mostly midget impinger is used. Adsorbing media are different for different gases.sampling of NO₂ and SO₂ has been done by using AMP-411 which was attached toAMP-460.

MEASUREMENT OF NITROGEN DIOXIDE:

Sodium arsenite modification of Jacobs-Hochheiser method is recommended as manual method.

PRINCIPLE:

NO₂is absorbed in alkaline solution(NaOH-sodium arsenite absorbent)to form a stable solution of sodium nitrate. The nitrite ions produced during sampling were determined calorimetrically by reaching the exposed absorbing reagent with hydrogen peroxide.

PREPARATION OF REAGENT:

Hydrogen peroxide reagent is prepared by diluting 0.2 ml of 30%hydrogen per oxide to 250.

NEDA:-Dissolve 0.5gms of NEDA in 500ml distilled water.

PROCEDURE:

50 ml absorbing reagent was taken in impinger. Initial time totalizer reading was noted and rotameter flow was set at 1.0 LPM of air & final reading was noted.

ANALYSIS:

10ml of exposed absorbent was taken. Add 1ml of hydrogen peroxide solution, 10 ml of sulphanilamide solution & 1.4ml of NED with thorough mixing and made the final volume with distilled water. after 20 min of colour development, the absorbance of exposed solution was measured against blank as 0.000 absorbance with spectrophotometer at 540 nm. Micrograms of NO₂ present per ml of the solution was calculated.

CALCULATION:

The concentration of NO₂ in air was using the following formula:

$$\text{NO}_2(\mu\text{g}/\text{m}^3) = (A - A_o) \times F \times 1000 \times V_f / V_a \times V_t \times 0.82.$$

Where:

A = Sample absorbance

A_o = Reagent blank absorbance

F = Final calibration factor (μg/absorbance unit)

V_f = Volume of absorbing reagent (ml)

0.82 = Factor for collection efficiency

V_a = Volume of air sampled (litres)

V_t = Volume of sample taken for analysis.

MEASUREMENT OF SULPHUR DIOXIDE:

West and Geake method for quantitative analysis of SO₂ as recommended both by EPA as well as ISI, India was adopted.

PROCEDURE:

50 ml absorbing reagent TCM (Tetrachloromercurate 10.86g mercuric chloride + 0.06g EDTA + 4.68g sodium chloride + 1lt distilled water) was taken in the impinger. Initial time totalizer reading was noted and rotameter flow was set at 1.0 LPM of air, final time totalizer and rotameter reading was noted.

ANALYSIS:

At end of sampling distilled water was added to adjust evaporative losses. 10 ml of exposed absorbing reagent was added. Then add 2ml each of p-rosaniline dihydrochloride working solution and formaldehyde solution. and made up the final volume with distilled water. Blank was prepared using 10ml unexposed TCM solutions. These solutions were left for about 30 min for development of red violet colour. Absorbance of samples was measured using spectrophotometer at 560 nm with reagent blank as references.

CALCULATION:

$$\text{SO}_2(\mu\text{g}/\text{m}^3) = (A - A_o) \times F \times V \times 1000 / V_a \times V_t$$

Where:

A = Sample absorbance

A_o = Reagent blank absorbance

F = Calibration factor (μg/absorbance unit)

V_f = Final volume of absorbing reagent (ml)

V_a = Volume of air sampled (Av. flow rate time)

V_t = Volume of sample taken for analysis.

RESULT AND DISCUSSION

The ambient air quality (AAQ) data with respect to five parameters i.e. SPM, NRPM, RPM, SO₂ & NO₂ conducted at 8 stations of 2 cities. Which are given in the following table.

AIR QUALITY OF GURGAON:-

Site	Concentration Of SO ₂ .	NO ₂	RPM	NRPM	SPM
Residential	15.13	40.17	318.25*	170.56	488.81*
Sensitive	14.88	29.37*	269.15	237.98	507.13*
Traffic	7.36	42.00	252.70*	227.38	480.04*
Industrial	8.54	52.13	300.45*	98.90	399.42

*Value exceeds permissible levels recommended by CPCB.

Concentration is in μg/m³.

AIR QUALITY OF HISAR:-

Site	SO ₂	NO ₂	RPM	NRPM	SPM
Residential	3.25	10.11	103.61*	179.25	282.86*
Sensitive	3.75	20.06	122.52*	191.44	313.96*
Traffic	20.87	82.24*	392.09*	1492.95	1885.04*
Industrial	27.39	80.65	170.15*	100.28	270.43

*Value exceeds permissible levels recommended by CPCB

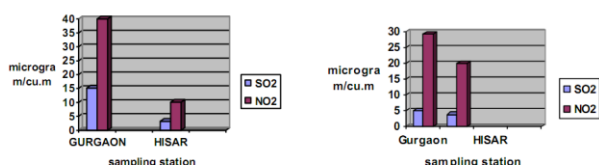
Concentration are in $\mu\text{g}/\text{m}^3$. Minimum and maximum concentrations of SPM, RPM, SO₂&NO₂ of different areas are given in table.

Location	SPM	RPM	SO ₂	NO ₂
RA	158.34-488.81	78.13-318.25	3.25-31.92	10.11-50.78
SA	104.08-507.13	56.47-269.15	2.06-15.32	14.78-35.53
VA	191.29-1885.0	81.63-929.99	6.09-20.87	21.47-82.24
IA	98.93-807.62	59.47-39.42	6.77-55.21	22.13-80.65

The data has been compiled in term of bar charts. Following inferences can be drawn from monitoring results.

SULFUR DIOXIDE:-

Sulfur dioxide is a serious pollutant. It accounts for about 29% of total weight of all pollutants. SO₂ concentration in residential area varies from 3.25 $\mu\text{g}/\text{m}^3$ in Hisar & 15.13 $\mu\text{g}/\text{m}^3$ in Gurgaon due to commercial activity found nearby. All values are below :-



Level of SO₂&NO₂ in residential area. Level of SO₂&NO₂ in sensitive area.

The limits prescribed by C.P.C.B for residential area i.e., 80 $\mu\text{g}/\text{m}^3$. Concentration of SO₂ in sensitive areas are 4.88 $\mu\text{g}/\text{m}^3$ in Gurgaon & 3.75 $\mu\text{g}/\text{m}^3$ in Hisar. In dense vehicular traffic area the SO₂ concentration was noted to be 20.87 $\mu\text{g}/\text{m}^3$ in Hisar and 7.36 $\mu\text{g}/\text{m}^3$ in Gurgaon. However concentration of SO₂ in industrial area are 48.46 $\mu\text{g}/\text{m}^3$ in Hisar and 8.54 $\mu\text{g}/\text{m}^3$ in Gurgaon. Which is lower than the prescribed limits of 120 $\mu\text{g}/\text{m}^3$.

NITROGEN DIOXIDE:-

NO₂ concentration for residential area varied from 10.11 $\mu\text{g}/\text{m}^3$ in Hisar and 40.17 $\mu\text{g}/\text{m}^3$ in Gurgaon. But in sensitive area the concentration cross the higher value prescribed by CPCB i.e. 30 $\mu\text{g}/\text{m}^3$ for

24 hour in Gurgaon (30.37 $\mu\text{g}/\text{m}^3$) but lower in Hisar (20.06 $\mu\text{g}/\text{m}^3$). In vehicular areas the concentration of NO₂ at IFFCO Chowk in Gurgaon was 42.00 $\mu\text{g}/\text{m}^3$ and in Hisar it was 82.24 which cross the maximum limit prescribed. The highest NO₂ concentration in industrial area was noted in Hisar 80.65 $\mu\text{g}/\text{m}^3$. Gurgaon shows 52.13 $\mu\text{g}/\text{m}^3$, which may be due to some influence of rain which occurred before the sampling.

SUSPENDED PARTICULATES MATTER:-

The SPM concentration in residential area varies from 489 $\mu\text{g}/\text{m}^3$ in Gurgaon and 283 $\mu\text{g}/\text{m}^3$ in Hisar. Both the sites cross the prescribed limit of 200 $\mu\text{g}/\text{m}^3$ for residential area. The SPM concentration at all sensitive site cross the limit prescribed by CPCB (100 $\mu\text{g}/\text{m}^3$). The maximum concentration was noted in Gurgaon (507 $\mu\text{g}/\text{m}^3$) and 231 $\mu\text{g}/\text{m}^3$ in Hisar. The concentration at vehicular site was found extremely high i.e. 1885 $\mu\text{g}/\text{m}^3$ in Hisar and 580 $\mu\text{g}/\text{m}^3$ in Gurgaon. Industrial site at Gurgaon (399 $\mu\text{g}/\text{m}^3$) show higher SPM concentration and Hisar showed 270 $\mu\text{g}/\text{m}^3$.

NON RESPIRABLE PARTICULATE MATTER:-

The NRPM concentration in residential areas is 179 $\mu\text{g}/\text{m}^3$ in Hisar. At sensitive area the concentration is 238 $\mu\text{g}/\text{m}^3$. Where as at vehicular site it was 1443 $\mu\text{g}/\text{m}^3$ in Hisar and while at industrial site the concentration was 40 $\mu\text{g}/\text{m}^3$ in Hisar.

RESPIRABLE PARTICULATE MATTER:-

The RPM concentration in residential area was 318 $\mu\text{g}/\text{m}^3$ in Gurgaon and Hisar (104 $\mu\text{g}/\text{m}^3$) i.e. higher than recommended by CPCB (100 $\mu\text{g}/\text{m}^3$). In sensitive area it was 269 $\mu\text{g}/\text{m}^3$ in Gurgaon and 123 $\mu\text{g}/\text{m}^3$ in Hisar i.e. higher than the maximum limit prescribed by CPCB (75 $\mu\text{g}/\text{m}^3$) for sensitive area. The RPM level in vehicular area was 392 $\mu\text{g}/\text{m}^3$ in Hisar and 253 $\mu\text{g}/\text{m}^3$ in Gurgaon. Which cross the CPCB limit i.e. 100 $\mu\text{g}/\text{m}^3$. In industrial area also the limit was more than the CPCB (150 $\mu\text{g}/\text{m}^3$) it was 300 in Gurgaon and 170 in Hisar where the site was located near the monitoring site.

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