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Study and Analysis on Ambient Air Quality at different location of Satna City M.P.

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***Abstract*— The problem is further compounded by the large share of poorly maintained old vehicles, a considerable share of poorly maintained two-stroke engines and uncontrolled emissions from diesel buses that circulate in city corridors using low quality fuel. The current research work aims to evaluate the ambient air quality of the city of Satna. The objective of the study is to know the air quality of the city of Satna in residential, commercial and industrial areas. Monitoring and estimation of PM_{10}, PM $_{2.5}$, SO_x and NO_x was carried out at all selected stations. Significant variation was observed in the distribution of particulate matter, as the concentration of PM_{10} ranged from 74.62-253.95 µg/m^3 while PM 2.5 was recorded from 42.22-86.5 µg/m^3 NOx and Sox were found within of the limit allowed in all stations.**

Index Terms: **air quality, air pollution, particulate matter.**

1.INTRODUCTION

Air pollution occurs due to the presence of undesirable solid or gaseous particles in the air in amounts harmful to human health and the environment (Agbaire, et al., 2009). It can be defined as the presence of gaseous or particulate foreign matter or a combination of both in the air that is harmful to the health and well-being of human beings. Air pollution is one of the main problems faced by urban areas. It causes more harmful effects on human health (Ashen den, et al., 1980), on the environment and on building structures. The increasing level of motorization in urban areas with poor traffic management strategy and inadequate separation between work, life and circulation space in the main corridors has resulted in traffic congestion, leading to longer travel time, extra fuel consumption and associated problems. to air pollution. The increasing emissions from automobiles cause great discomfort to road users. Maintaining acceptable air quality has become an important task for decision makers as well as non-governmental organizations. Particulate matter and gaseous pollutant emissions from industries and automobile exhausts are responsible for increased discomfort, increased airway disease, and deterioration of artistic and cultural heritage in urban centers (Ashen den, et al., 2009).

In developing countries, a large part of the urban population around the world is exposed to high levels of air pollutants. Such levels of air pollution have drawn attention to the regular monitoring and mitigation of the city's air quality. There are several sources of atmospheric pollutants in urban areas such as vehicle exhaust emissions, generators, industrial operations, burning of solid waste from urban cuisine, soil resuspension, etc. These sources usually generate a series of pollutants in the environment. air, namely particulate matter (PM), sulfur dioxide (SO2), nitrogen dioxide (NO2) and other inorganic pollutants (trace elements) and organic polyaromatic hydrocarbons (PAHs) etc. The main sources of these pollutants arise from the burning of fossil fuels [gasoline, diesel, compressed natural gas (CNG), liquefied petroleum gas (LPG), coal, etc.]. Due to changing technologies and changing fuel consumption patterns, the proportion of composition of each pollutant is changing over time. The changing landscape requires continuous assessment of air quality. Pollutants released into the environment interact with other existing pollutants and micrometeorological factors can form more intricate pollutants that are more harmful to human health.

2 WAYS TO SAMPLE AMBIENT AIR

There are 5 main methods of sampling air quality:

2.1 Passive Monitoring

1. Diffusion tubes absorb a specific pollutant from ambient air - no power supply required.

2. Diffusion tubes typically monitor for 2-4 weeks at a time.
3. The tubes should be sent to a lab for analysis to see how much pollution they have detected.

2.2 Active (Semi Automatic) Sampling

1. An analyzer pulls ambient air through a filter for a set period of time, e.g. one filter per day.
2. The filters are then collected and sent to a laboratory for analysis to see how much pollution they have detected.

2.3 Automatic point monitoring

Ambient air is drawn through an analyzer that recognizes the chosen gas and calculates its concentration

1. Automated sites monitor pollutants 24 hours a day.
2. Data is sent from the website directly to your computer, which means it can be viewed instantly.

2.4 Photochemical and optical sensor systems

1. These are portable monitoring tools that can continuously monitor a variety of pollutants. The sensors are of low sensitivity and primarily suitable for identifying hotspots on roads and near point sources.
2. Data can be downloaded to your computer and analyzed.

2.5 Remote optical/long-path monitoring

1. This sampling method detects pollution between a light source and a detector that are placed separately at a location.
2. Real-time measurements can be made with this type of sampling.
3. Data can be sent from the analyzer directly to your computer, which means it can be viewed instantly.

3 STUDY AREA

Satna is a city in the Satna district of Madhya Pradesh, India, which borders neighboring Uttar Pradesh. It is located at 24,340 N 80,55^0 E with an average altitude of 317 meters (1033 ft). Satna is the limestone belt of India. The place is known for the dolomite and limestone mines. As a result, it contributes around 7% to 10% of India's total cement production. There is an abundance of dolomite and limestone in the area and the city has many cement factories that produce and export cement to other parts of the country. Electric cable company Universal Cable, Satna is among the pioneers in the country. Satna is known as the cement city of India.

4 MATERIALS AND METHOD

Five sampling sites were selected for ambient air quality monitoring to generate representative ambient air quality data. The sampling station detail is shown in table-1. Weekly air quality was monitored at all five sampling stations from March to June 2020 to determine ambient air quality. PM_{10}, $PM_{2.5}$, SO_x and NO_x were monitored according to Central Pollution Control Council methods prescribed for polluting gases and particulate pollutants.

Table 1 Showing details of sampling stations for monitoring ambient air quality

Sl.No.	Name of Station	Station code	Type of Station
1.	Bihari Chowk	S1C	Commercial
2.	Sindhi Campus	S2I	Industrial
3.	Gahra Nalla near main road	S3C	Commercial
4.	Ramtekari	S4C	Commercial
5.	Utaily	S5R	Residential

Table 2 Average ambient air quality at various sampling stations.

Sl.No.	Station code	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)	SO_2 (µg/m^3)	NO_x (µg/m^3)
1.	S1C	168.25±17.22	72.75±9.74	17.84±1.03	24.12±2.13
2.	S2I	217.35±18.32	79.75±4.52	17.85±1.28	21.77±3.25
3.	S3C	124.85±17.14	87.48±3.315	14.74±5.62	17.85±5.24
4.	S4C	128.74±13.12	87.42±4.68	12.27±2.10	13.14±2.67
5.	S5R	76.85±5.72	42.33±5.14	5.87±0.88	8.96±8.54

Table 3 National ambient air quality (NAAQM) standards

Sl.No.	Parameters	Standards
1	PM_{10}	100
2	$PM_{2.5}$	60
3	SO_x	80
4	NO_x	80

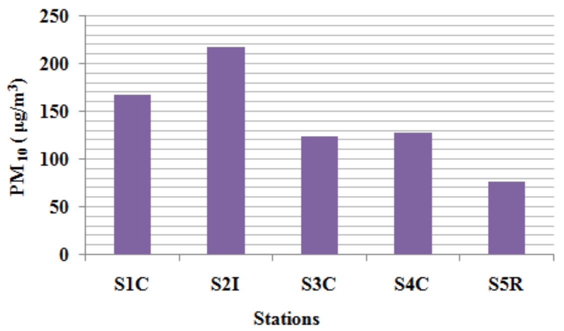

Figure 1 PM_{10} at various sampling station

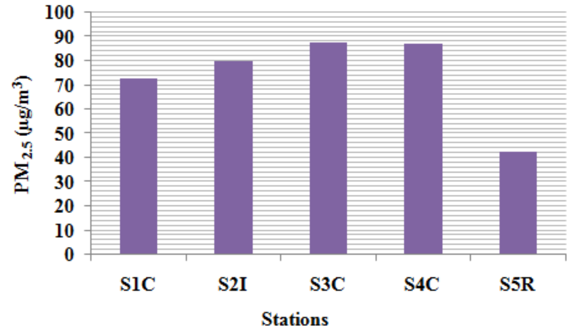

Figure 2 $PM_{2.5}$ at various sampling station

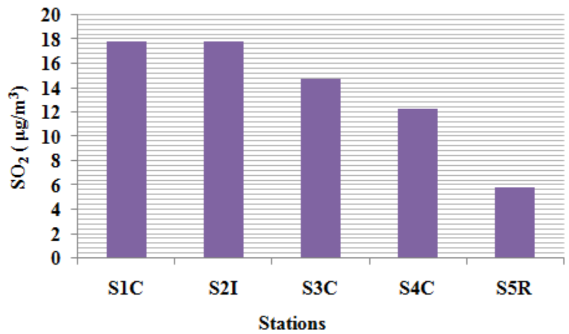

Figure 3 SO_2 at various sampling station

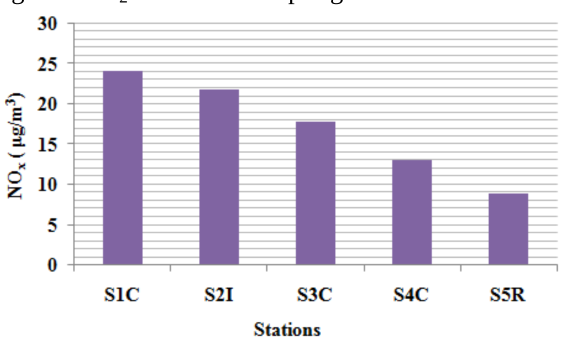

Figure 4 NO_x at various sampling station

5 RESULT AND DISCUSSION

1 Particulate matter (PM_{10}):- PM_{10} was measured at the Bihari Chowk station with the aid of the RDS. PM_{10} concentration ranged from 76.85 – 217.35 µg/m^3. The minimum concentration found was 76.85 µg/m^3 in the residential area S5R (Utailly) within the limit and the maximum value was found to be 217.35 µg/m^3 in the S2I Industrial Sindi Campus.

2 Particulate matter ($PM_{2.5}$):-$PM_{2.5}$ was measured at five ambient air quality stations with the help of ambient fin dust sampler control module. PM2.5 concentration ranged from 42.33–87.48 µg/m^3. The minimum concentration found was 42.33 µg/m^3 in residential area S5R (Utailly) within the limit and the maximum value was found to be 87.48 µg/m^3 in the S3C Gahra Nalla near main road.

3 Particulate matter (SO_2):- SO_2 was measured, SO_2 concentration ranged from 5.87–17.85 µg/m^3. The minimum concentration found was 5.87 µg/m^3 in residential area S5R (Utailly) within the limit and the maximum value was found to be 17.85 µg/m^3 in the S2I Industrial Sindi Campus.

4 Particulate matter (NO_x):- NO_x was measured, NO_x concentration ranged from 8.96–24.12 µg/m^3. The minimum concentration found was 8.96 µg/m^3 in residential area S5R (Utailly) within the limit and the maximum value was found to be 24.12 µg/m^3 in the S1C Bihari Chowk.

6 CONCLUSION

From the result of the maximum value, it was concluded that PM_{10} was found (217.35) in S2I (Industrial Area of Sindhi Campus) and $PM_{2.5}$ (87.48) in S4C Ramtekari (Commercial Area). PM_{10} and $PM_{2.5}$ at all sampling stations were found to be beyond the limit prescribed by the NAAQM (100µg/m^3 and 60µg/m^3), except at the Utaily station. Pollutant gases were found within the limit at all sampling stations.

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