Study on Ambient Air Quality of Satna City M.P.

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Abstract— Current research work is aimed for assessment of ambient air quality of Satna city. The objective of the study is to know the air quality of Satna city in residential, commercial and industrial area. The monitoring and estimation of PM2.5, PM10, Sox, & NOx was done at all the selected station. Significant variation was observed in distribution of particulate matter as the concentration of PM10 varied from 75.72-213.95 µg/m3 while PM2.5 was recorded 44.32-81.5 µg/m3 NOx & Sox were found within permissible limit at all the stations. After air samples analysis the results were compared with maximum permissible limit as per guidelines provided by Central Pollution Control Board New Delhi (CPCB) for National Ambient Air Quality Standard (NAAQS).

Keywords: Ambient air quality, air pollution, particulate matter, Sox & NOx

I. Introduction

Air pollution occurs due to the presence of undesirable solid or gaseous particles in the air in quantities that are harmful to human health and environment (Agbaire, et al., 2009). It can be defined as presence of foreign matter either gaseous or particulate or combination of both in the air which is detrimental to the health and welfare of human beings. Air pollution is one of the major problems faced by urban areas. It causes more ill effects on human health (Ashen den, et al., 1980), environment as well as building structures. The growing level of motorization in urban areas with poor traffic management strategy and inadequate separation among working, living and moving space on major corridors have resulted in traffic congestion leading to longer travel time, extra fuel consumption, and associated air pollution problems. The problem is further compounded by the large share of ill maintained old vehicles, sizable share of ill maintained two stroke engines, and uncontrolled emissions from diesel engine buses plying on city corridors using poor quality fuel. The growing emissions from automobiles cause great discomfort to road users. Keeping the air quality acceptable has become an important task for decision makers as well as for non-governmental organizations. Particulate matter and gaseous emissions of pollutant emission from industries and auto exhausts are responsible for rising discomfort, increasing airway diseases and deterioration of artistic and cultural patrimony in urban centers (Ashen den, et al., 2009).

In developing countries, the large numbers of urban population in worldwide are exposed to high levels of air pollutants. Such levels of air pollution have drawn attention towards regular monitoring and mitigation of city air quality. There are several sources of air pollutants in urban areas such as tail pipe emission from vehicles, gen sets, industrial operations, burning of solid wastes from urban kitchen, re-suspension of soil, etc. These sources generally generate a number of pollutants in the air namely particulate matter (PM), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and other inorganic (trace elements) and organic pollutants poly aromatic hydrocarbon (PAHs) etc. Major sources of these pollutants are arising due to burning of fossil fuels [petrol, diesel, compressed natural gas (CNG), liquefied petroleum gas (LPG), coal, etc.]. Due to change of technologies and change of fuel consumption patterns, the composition ratio of each pollutant is changing over time. The changing scenario demands continuous assessment of air quality. Pollutants released in the ambient environment interact with other existing pollutants and micrometeorological factors may form more intricate pollutants and that are more harmful to human health. So it is necessary to identify the pollutants, (Chaurasia et al 2013).

II. Study Area

Satna is a city in the Satna District of Madhya Pradesh in India, which shares a border with neighboring Uttar Pradesh. It is located at 24.34^0 N 80.55^0 E with an average elevation of 317 meters (1033 feet). Satna is the limestone belts of India. The location is renowned for dolomite mines and limestone. As a result, it contributes around 8%–9% of India's total cement production. There is an abundance of dolomite and limestone in the area and the city has many cement factories producing and exporting cement to other parts of the country. The electrical cable company Universal Cable, Satna is among the pioneers in the country. Satna is known as the cement city of India.

A. Objectives of Study

1) To know the ambient air quality of Satna.
2) To compare the air quality with standards.

III. Materials and Method:

Five sampling locations were selected for ambient air quality monitoring to generate representative ambient air quality data. The detail of sampling station is shown in table-1.

S.N.	Name of Station	Station code	Type of Station
1.	Semariya Chowk	S1	Commercial
2.	Sindhi Campus	S2	Industrial
3.	Gahra Nalla	S3	Commercial
4.	Ramtekari	S4	Commercial
5.	Utaily	S5	Residential

Table 1: Showing sampling stations detail for ambient air quality monitoring

Weekly air quality was monitored at all the five sampling station from March –June 2019 to determine ambient air quality. PM_{10}, $PM_{2.5}$, SOx and, NOx was monitored according to the CPCB (Central pollution control board) methods prescribed for the pollutant gases and the particulate pollutants.

Fig. 1: Map of Satna showing sampling stations.

IV. Result and Discussion

1) Particulate matter (PM_{10}):- The PM_{10} was measures at fi station within the help of RDS .PM_{10} the concentration ranged from 75.72 – 213.00 µg/m^3 (table 2)Fig-2. The minimum concentration was found 75.72 µg/m^3 at S5 (Utaily) residential area within the limit and maximum value was found 213.00 µg/m^3 at Sindhi Campus industrial beyond the limit prescribed by NAAQM (100 µg/m^3) Table-3.
2) Particulate matter ($PM_{2.5}$):-$PM_{2.5}$ was measures at five ambient air quality station within the help of ambient fin dust sampler control module.$PM_{2.5}$ the concentration ranged from 44.32–80.76 µg/m^3 (table 2)Fig-3 . The minimum concentration was found 44.32 µg/m^3 at S5 (Utauly) residential area within the limit and maximum value was found 80.76 µg/m^3 at S4 (Ramtekari) commercial area beyond the limit prescribed by NAAQM (60 µg/m^3) Table-3.
3) Oxide of Sulpher(so_x):-Sox was measures at five ambient air quality stations with the help of RDS. Sulphur dioxide (SO_2) concentration was ranged from 4.77–17.15 µg/m^3 (table 2) Fig-4. The minimum concentration was found 4.77 µg/m^3 at S5 (Utaily) area and maximum value was found 17.15 µg/m^3 at S2 (Sindhi campus industrial area).All the value were found within the limit prescribed by NAAQM (80 µg/m^3) Table-3.
4) Nitrogen dioxide(NO_2). The NO_2 concentration ranged from 9.19–26.80 µg/m^3 (table 2)Fig-5. The minimum concentration was found 9.19 µg/m^3 at S5 (Utaily) residential area and maximum value was found 26.80 µg/m^3 at Sindhi Campus industrial within limit prescribed by NAAQM (80 µg/m^3).Table-3.

S.N.	Name of Station	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)	SO_2 (µg/m^3)	NO_x (µg/m^3)
1.	S1	158.25±18.68	72.75±9.84	15.94±1.03	20.02±1.47
2.	S2	213.95±26.04	79.75±5.5	17.15±0.97	26.80±1.35
3.	S3	127.95±15.04	80.46±3.35	12.89±1.07	14.67±1.16
4.	S4	126.88±13.62	81.5±6.91	12.82±2.10	13.88±1.12
5.	S5	75.72±5.92	44.32±4.80	4.77±0.96	9.19±1.29

Table 2: Average ambient air quality at various sampling stations.

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

Table 3: National ambient air quality (NAAQM) standards

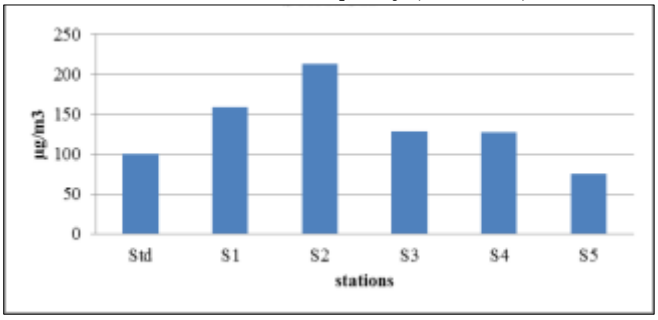

Fig. 2: PM_{10} at various sampling station

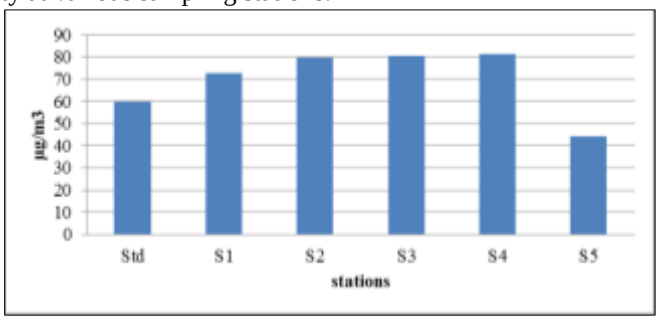

Fig. 3: $PM_{2.5}$ at various sampling station

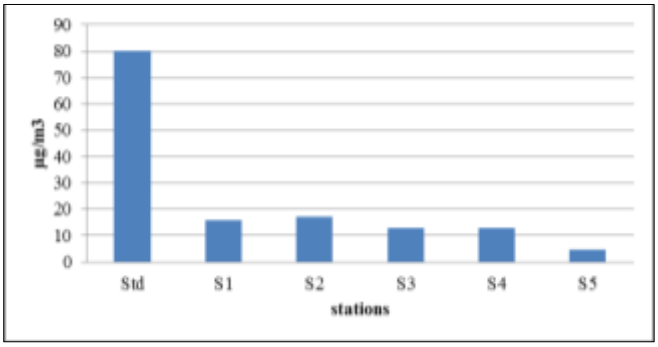

Fig. 4: SO_2 at various samling station

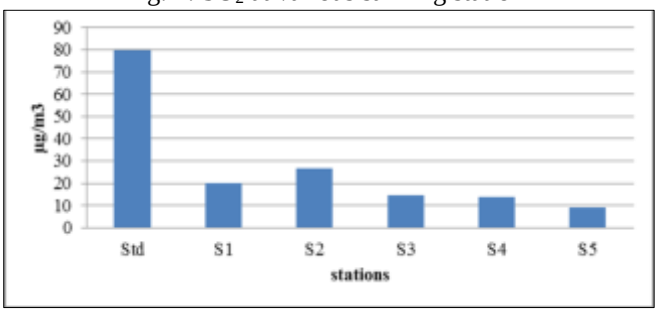

Fig. 5: NOx at various sampling station

V. CONCLUSION & SUGGESTION

From the result of average value it was concluded that PM_{10} was found (213.00) at S2 (Sindhi Campus Industrial area) and $PM_{2.5}$ (80.46) at Ramtekari (Commercial area). PM_{10} and $PM_{2.5}$ at all sampling station was found beyond the limit prescribed by NAAQM (100µg/m^3 and 60µg/m^3) except Utaily station. Gasses pollutant was found within the limit at all sampling station.

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