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Impact of Chandrapur MIDC (M.S.) on Air Quality during winter 2010

Dr. V. R. Thakare
Assistant Professor, Department of Engineering Chemistry, College of Engineering and Technology, Akola (M.S.)-444002

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ABSTRACT

Chandrapur Industrial area is one of the best Industrial area in Vidarbha region and is the major coalfield of Maharashtra State. Chandrapur Industrial area is one of the best Industrial area in Vidarbha region of Maharashtra state; it spans a total area of 70.23 hectares. Chandrapur city has 86 industrial units at present which include chemical, auxiliary and engineering services industries. Beside this, Chandrapur city and surrounding area is rich in minerals and coal and include 26 coal mines of WCL, cement plants, paper industry, lime mining and steel plants. In addition, it has STPS having capacity of producing 2340 MW electricity. Air is considered as one of the important natural sources. It is most essential for human life and industries and vehicle effect quality of air. In view of these observations, during present work, air quality analysis of 5 locations from Chandrapur city was carried out to assess the quality of air during winter 2010. It is found that the order of locations with respect to pollution level of SPM, RSPM is observed as Padoli > Tadali > railway station > Mahakali area > Wadgaon i.e. Padoli area of Chandrapur city is most polluted part of the city. In the present work, however, the entire locations lay within 1-5 kms from each other and prevailing meteorological factors associated with contribution of nearby industrial activities results in uneven level of pollutants

Keyword: ***Coalfield, water quality, Pollution, Impact of Industries, Impact of mining***

1. INTRODUCTION

Environment is the natural condition which exists around us. It is sum total of biotic and abiotic factors that potentially influence the character of the natural setting, the climate, water, soil, rocks, minerals, landform, flora and fauna. The progress has placed extraordinary stress on the environment and accelerated the age old afflictions and depletion of environmental quality. In various ways environmental degradation has taken greater dimensions in the form of contamination and pollution of the land, water and air.[1]

Air is considered as one of the important natural sources. It is most essential for human life. Under ideal condition the air we inhale, quantitatively and qualitatively maintains the wellbeing of human being. Air pollution is the introduction into the atmosphere of chemicals, particulates, or biological materials that cause discomfort, disease, or death to humans, damage to other living organisms such as food crops, or damage the natural environment. The atmosphere is a complex dynamic natural gaseous system that is essential to support life on planet Earth. An anthropogenic source (human activities) which causes air pollution mostly related to burning of different kinds of fuel. It includes smoke, stacks of power plants, manufacturing factories and waste incinerators as well as furnaces and other types of fuel-burning, heating devices

Air pollution is a significant risk factor for multiple health conditions including respiratory infections, heart disease, and lung cancer according to the WHO.[2] The health effects caused by air pollution may include difficulty in breathing, wheezing, coughing and aggravation of existing respiratory and cardiac conditions. These effects can result in increased use of medication, increased visits of doctor or emergency room, more hospital admissions and premature death. The human health effects of poor air quality are far reaching but principally affect the body's respiratory system and the cardiovascular system. Individual reactions of air pollutants depend on the type of pollutant a person is exposed to, the degree of exposure, the individual's health status and genetics.[3] A 2007 review of evidences.[4,5] found ambient air pollution exposure is risk factor correlating with increased total mortality from cardiovascular events 12% to 14% increase. Air pollution is also emerging as a risk factor for stroke, particularly in developing countries where pollutant level is high.

According to Environment Canada (2001)[6] the industrial sector is responsible for the largest emission of SO_2 and the smelting of metals and power generations are major contributors. The WHO/UNEP Report (1992)[7] reveals the air pollution problems in metropolitan cities of India as some of these are among most polluted cities of the world. India has 23 major cities of over 1 million people and ambient air pollution levels exceed the WHO standards 30 in many

of them. The main reason for deterioration of air quality in cities is the growing number of rapid industrialization and vehicles. Air pollution possess significant threat to human health, property and environment through the developing and developed parts of world. The rapid industrialization, fast and drastic increased in vehicles on the roads and other activities of human beings have disturbed the balance of natural atmosphere. Air pollution scenario in Chandrapur industrial cluster (Maharashtra) and found that the magnitude of the problem of air pollution has increases alarmingly due to population explosion, industrialization, urbanization, automobiles and other human activities.[8]

Study Area

Chandrapur is the district head quarter of Chandrapur district in the state of Maharashtra. This district is situated in the eastern part of the Maharashtra State. Chandrapur is "A" class Muncipal Council. It is an old settlement having historical background. The Chandrapur city has number of places and monuments of historic importance like Ankaleshwar temple, Mahakali mandir, Kilton wall, Tomb of King Gond, Jatpura Gate etc. Chandrapur district is famous for its sprawling and Tadoba wildlife sanctuary, which is important Tiger destination in the country. The region is very rich in mineral wealth such as iron ore, limestone and coal.

Chandrapur Industrial area is one of the best Industrial Area in Vidarbha region of Maharashtra state; it spans a total area of 70.23 hectares. MIDC has acquired 214.40 hectares of land and developed 46 plots at Padolee and 154.62 hectares of land at Korpan, Bhoyegaon, Nandgaon, Ekodi and Kawtha villages to promote the Industrial growth in Chandrapur district. It is planned to utilize these areas for setting up of cement manufacturing plants, power plants, and lime mining activities. Tadali has been identified as growth centre for sponge iron manufacturing industries considering iron ore and coal in this region. Chandrapur city has 86 industrial units at present which include chemical, auxiliary and engineering services industries. Beside this, Chandrapur city and surrounding area is rich in minerals and coal and include coal mines of WCL, cement plants, paper industry, lime mining and steel plants. In addition, Super Thermal power plant of MSEB is the identity of Chandrapur which generate 2500 MW of electricity.

2. MATERIAL AND METHOD

In the present work different locations from different part in and around the city are selected for the studies. Air sampling sites were selected in such a way that the collected samples very nearly represent air that is actually breathed by the exposed population. Air sampling was also done to estimate level of SPM, RSPM, SOx and NOx in the surrounding air. In all the locations, the flat roof of buildings (having height about 13 - 16 feet) was selected for air sampling of particulate matter and gaseous pollutants using respirable high volume dust sampler (RDS).[9] Graphical representation of these parameters over entire period of study would a guide to understand the variation of the quality of air during tenure of the research work is expected to form valuable addition to the existing knowledge of air. These results will also be of great help in pinpointing the pollution level in the Chandrapur city and surrounding areas and will be useful for the preventive measures to be are located on the ground at the breathing level. The sampling locations in study area are as given below

Table 1. Sampling Locations in the study area

Air Sampling area	Locations	Type of Location	Code
Mahakali ward	Mahakali Mandir	Commercial	Site-I
Railway station area	Ajay Computers building	Commercial	Site-II
Wadgaon area	Mahesh Chopde's House	Residential	Site- III
Padoli area	Ganesh Temple	Industrial	Site-IV
Tadali area	Tata Tyres workshop	Industrial	Site- V

3. RESULT AND DISCUSSION

3.1 Air analysis Report:

Ambient air quality results obtained for suspended particulate matter (SPM), respirable suspended particulate matter (RSPM), SOx and NOx during winter 2010 for 48 air samples are as shown in Table for Mahakali, Railway station, Wadgaon, Padoli, Tadali area of Chandrapur city respectively. Limits of national ambient air quality standards (NAAQS) [10] as directed by Central Pollution Control Board notification 1994 and 1998 on annual and 24 hourly basis are also shown in these Tables.

3.2 Air quality in Mahakali Mandir area of Chandrapur city: Duration: December 2010:

As given in Table 2., overall minimum and maximum values of RSPM during month of December 2010 are 78 and 201 µg/m^3 with overall mean 136.6 µg/m^3. Even minimum value of RSPM was 30 % higher than that of annual

average values of NAAQS. Overall Minimum and maximum values of SPM ranged from 98 - 388 µg/m^3 with mean values 213 µg/m.^{3} Even mean value of SPM was 52 % higher than annual average (140µg/m^3) and 6% higher than 24 hourly (200 µg/m^3) NAAQS limit. SOx values ranged from 17 - 43 µg/m^3 with mean values 31 µg/m.^{3}SOx value of all samples during winter 2010 are within the limit (80 µg/m^3) prescribed by NAAQS. As shown in Table minimum and maximum values of NOx ranged from 9 - 32 µg/m^3 with mean values 24.4µg/m^3. All samples are within the prescribed limits of NAAQS limits (80 µg / m^3) as prescribed. Overall mean of RSPM (136.6 µg/m^3) and SPM (213. 6 µg/m^3) and were 10.6 % and 13.6 % higher than the NAAQS limits. However overall mean of SOx (30.9 µg/m^3) and NOx (24.4 µg/m^3) were within the NAAQS limits.

3.3 Air quality in Railway station area of Chandrapur city: Duration: December 2010:

Minimum and maximum values of RSPM are 48 and 231 µg/m^3 with overall mean 156 µg/m^3. Overall mean value of RSPM was 160 % higher than that of annual average values of NAAQS limits.

Minimum and maximum values of SPM ranged from 98 to 445 µg/m^3 with overall mean 271 µg/m^3. Overall mean of SPM at Railway station area was 93.5 % higher than annual average of prescribed NAAQS limits (140 µg/m^3). Minimum and maximum values for Sox , ranged from 6 - 56 µg/m^3 with mean values 25.2µg/m^3.SOx value of all samples during winter 2024 are within the limit (60 µg/m^3) prescribed by NAAQS. As shown in Table 2, minimum and maximum values of NOx ranged from 9 - 71 µg/m^3 with mean values 26.3µg/m^3. Overall mean of NOx during winter 2024 was 26.3 µg/m.^{3}All samples are within the NAAQS limits (60 µg/m^3) as prescribed. Overall mean of RSPM (155.6 µg/m^3) and of SPM (271 µg/m^3) were 93.5 % and 159.3 % higher than the annual NAAQS limits. However overall mean of SOx (25.2 µg/m^3) and NOx (26.3 µg/m^3) were within the NAAQS limits.

3.4 Air quality in Wadgaon area of Chandrapur city: Duration: December 2010:

As shown in Table 2., minimum and maximum values of RSPM are 40 and 158 µg/m^3 withoverallmean96 µg/m^3.Overall mean value of RSPM was 60.3 % higher than that of annual average values of NAAQS limits (60 µg/m^3). Minimum and maximum values of SPM are 60 and 405 µg/m^3 with overall mean 224.5 µg/m.^{3} Overall mean of SPM at railway station area was 60.3 % higher than annual average of prescribed NAAQS limits (140 µg/m^3). Minimum and maximum values of Sox were 18µg/m^3 and 56µg/m^3 with mean value 32.4 µg/m^3. Overall SOx value of all samples during the period of investigation was within the limit (60 µg/m^3) prescribed by NAAQS. As shown in Table 3, minimum and maximum values of NOx values ranged from 21 - 71 µg/m.^{3} with mean value 42 µg/m^3. Overall mean of NOx was 42.1 µg/m.^{3} All samples are within the NAAQS limits (60 µg/m^3) as prescribed. Overall mean of SPM (224.5µg/m^3) and RSPM (96.2µg/m^3) were 93.5% and 159.3 % higher than the NAAQS limits. However overall mean of SOx (32.4 µg/m^3) and NOx (42.1 µg/m^3) were within the NAAQS limits.

3.5 Air quality in Tadali area of Chandrapur city: Duration: December 2010:

As shown in Table 2., minimum and maximum values of RSPM ranged from 96 and 337 µg/m^3 with overall mean 185.1 µg/m^3. Even overall minimum value was 16% higher than that of annual average values of NAAQS limits. Overall mean value of RSPM was 208.5% higher than that of annual average values of NAAQS limits. Minimum and maximum values of SPM ranged from 216 to 1109 µg/m^3 with overall mean 484.0 µg/m^3. Even minimum value of SPM was as high as 154.2% of annual average values of NAAQS. Overall mean of SPM at Tadali area was 345.7 % higher than annual average of prescribed NAAQS limits (140 µg/m^3). Minimum and maximum values of Sox (Table 4) are 11and 59µg/m^3 with mean value 29.8 µg/m^3. SOx value of all samples during the period of investigation are within the limit (60 µg/m^3) prescribed by NAAQS. Minimum and maximum values of NOx ranged from 31 - 189 µg/m^3. Overall mean of NOx was 64.8 µg/m^3, which is 10.8% higher than the NAAQS limits (60 µg/m^3) as prescribed. Overall mean (Table 4) of SPM (484.0 µg/m^3) and RSPM (185.1 µg/m^3) were 145.7 % and 85 % higher than the NAAQS limits. However overall mean of SOx (29.8 µg/m^3), which is within the NAAQS limits and NOx (64.8 µg/m^3), which is 8% higher than the NAAQS limits. Figure given below shows drastic position of SPM and NOx level at Tadali area

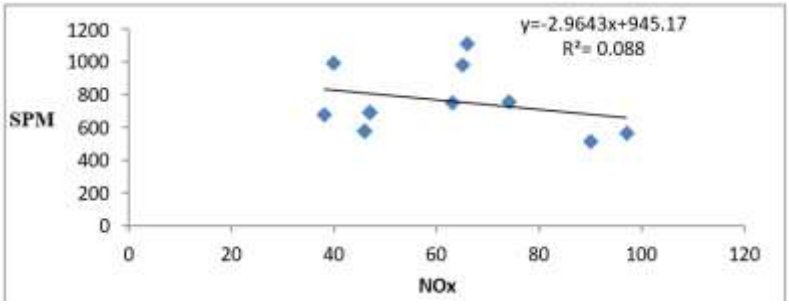

Fig.1 Graph showing drastic position of SPM and NOx level at Tadali area

3.6 Air quality in Padoli area of Chandrapur city: Duration: December 2010

As given in Table, minimum and maximum values of RSPM are 88 and 285µg/m^3 with overall mean189 µg/m^3. Even minimum value of RSPM was 46% higher than that of annual average values of NAAQS and overall mean value by 215 % higher than annual average and 89% higher than 24 hourly average value of NAAQS limit. Minimum and maximum values of SPM are 198 and 913 µg/m^3 with overall mean 505 µg/m^3. Even minimum value of SPM was higher by 41 % of annual average values of NAAQS. Overall mean of SPM at Padoli area was 260% higher than annual average and 152% higher than 24 hourly average of NAAQS limits (140 µg/m^3). Minimum and maximum values of Sox ranged from 4–58µg/m^3 with mean values 17.5 µg/m^3.SOx values of all samples during period of investigation are within the limit (60 µg/m^3) prescribed by NAAQS. minimum and maximum values of NOx ranged from 9- 46 µg/m^3 with mean values 23.1µg/m^3. All samples are within the NAAQS limits (60µg/m^3) as prescribed.

The values of standard deviation for all locations are higher for SPM, smaller for RSPM and negligible for SOx and NOx. High values of standard deviation of SPM and RSPM are mainly due to variation in presence of industries, use of coal, coal transportation, coal depot and wind direction.

Table 2: Overall Statistical analysis of air at Chandrapur during Winter 2010

Sr. No.	Location		SPM	RSPM	SOx	NOx
1	Mahakali	Min.	78	98	17	9
2		Max.	201	388	43	32
3		Mean	136.6	213.6	30.9	24.4
4		S.D	22.6	57.9	14.4	3.8
5	Railway	Min.	48	98	6	9
6		Max.	231	445	56	71
7		Mean	155.6	270.9	25.2	26.3
8		S.D	23.1	57.7	6.8	6.1
9	Wadgaon	Min.	40	60	18	21
10		Max.	158	405	56	71
11		Mean	96.2	224.5	32.4	42.1
12		S.D	32.4	86.9	4.9	9.6
13	Tadali	Min.	96	216	11	31
14		Max.	337	1109	59	189
15		Mean	185.1	484.0	29.8	64.8
16		S.D	45.8	147.2	9.4	16.4
17	Padoli	Min.	198	88	4	9
18		Max.	913	285	58	46
19		Mean	504.7	188.7	17.5	23.1
20		S.D	75.4	17.0	5.0	8.4
National Ambient Air Quality Standards (Industrial)		Annual average	140	60	60	60
		24 hourly	200	100	80	80

4. CONCLUSION

From above observation it is found that the order of locations with respect to pollution level of SPM, RSPM is observed as Padoli > Tadali > railway station > Mahakali area > Wadgaon i.e. Padoli area of Chandrapur city is most polluted part of the city. This is not surprising as it is the major industrial area and has vast traffic with loaded coal trucks and presence of coal depot. The major air pollution source for this area and whole Chandrapur city are power plants, coal mining activities, domestic use of coal due to easy & cheap availability, steel plants, apart from this various other small and medium scale industries and automobile exhausts. All these activities and fly ash emitted from the power plants which causes a major problem of emission of respirable dust particles have resulted in tremendous increase in air pollution in this area. Next to Padoli, Tadali found high SPM and RSPM due to same reasons, major pollution source for this area are exhaust from steel plants, other industries situated in this area and heavy traffic. Compared to the other industrial areas. SPM and RSPM concentration in commercial zone like railway station area and Mahakali mandir area of Chandrapur city is comparatively low. The level of SPM in these areas is mainly due to heavy vehicle population and dispersion of pollutants from industrial exhaust. Residential area like Wadgaon shows comparatively low values of SPM, RSPM, SOx and NOx due to absence of these sources of pollutants.

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