

Status of Ambient Air Quality Monitoring in and around Chandrapur Region

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Abstract

Ambient (Outdoor) particulate matter (PM) represents a significant and growing concern in the field of environmental health due to its widespread presence and its direct association with adverse health outcomes.

Ambient air quality in surrounding areas of Chandrapur (Black Gold City) has been studied from January to December 2023. A total of 1287 ambient air samples have been collected from 11 Sampling stations i.e. Mahanagar Palika Chandrapur, Gadchandur Nagar Parishad, Mahatma Gandhi School, Ballarpur, MIDC Tadali, Multi Organics, MIDC, Chandrapur, Ghughus Nagar Parishad, Dall Mill, MIDC, Wani Gram Panchayat, Chikhalgaon Tahasil Office Wani, Bhadrawati Nagar Parishad, and District Collector Office, Gadchiroli.

The present study and Analysis of Ambient Air Quality reveals the highest concentration of RSPM (268 $\mu\text{g}/\text{m}^3$) at Gadchandur Nagar Parishad and at MIDC Dall Mill Wani (240 $\mu\text{g}/\text{m}^3$) in Winter season whereas the lowest concentration of RSPM found (55 $\mu\text{g}/\text{m}^3$) at Mahanagar Palika Chandrapur and at Ballarpur Nagar parishad (58 $\mu\text{g}/\text{m}^3$) was recorded in Rainy season.

The composition of PM varies by geographic location and is influenced by sources such as vehicle emissions, industrial activities, biomass burning, and natural phenomena like wildfires and dust storms. This paper explores the sources, composition, and size-related health effects of particulate matter in and around Chandrapur area. It also highlights the urgent need for enhanced air quality and monitoring of PM_{2.5}.

By addressing this Current status of Ambient matters policymakers and researchers can work towards developing more effective interventions and regulatory frameworks to mitigate the impact of particulate matter on public health in and around Chandrapur Region.

Keywords: Particulate Matters, Nano Particles, Ultrafine Particles, Oxidative Stress, RSPM SPM, PM₁₀, Aerosols, Volatile Organic Compound.

1.0 Introduction

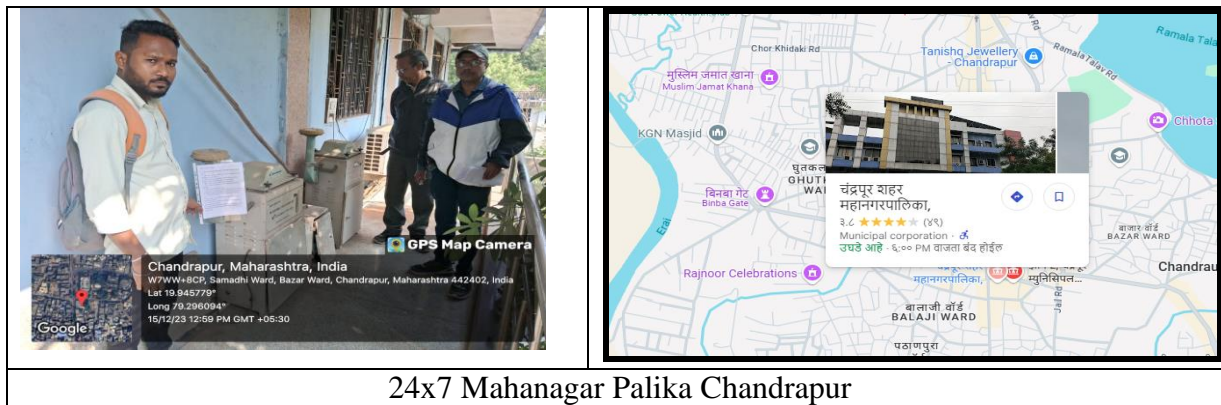
Air pollution, particularly due to particulate matter, is one of the leading environmental risk factors for disease worldwide. The **WHO** estimates that air pollution causes **approximately 7 million premature deaths each year** and two million people die annually because of atmospheric pollution (Tranfield & Walker, 2012). A large portion of these deaths are due to exposure to PM_{2.5} and PM₁₀. Key data points include **Outdoor air pollution** (ambient air pollution) alone causes **4.2 million deaths** annually, largely from heart disease, stroke, chronic obstructive pulmonary disease (COPD), lung cancer, and acute respiratory infections in children. Particulate is a term employed to describe dispersed airborne solid and liquid particles larger than a single molecule (molecule are approximately 0.0002 in diameter) but smaller than 500µm. These particles have a lifetime in suspension varying from a few seconds to several months. (Kenneth Wark et al. 1976). The process of particle generation and removal in air is continuous and depends on the specific sources of pollution both natural and anthropogenic and the meteorology and topography of the air basin. They are also subject to chemical reactions with components of the gas phase which surrounds them and to the foraging effect of the various forms of precipitation in the atmosphere. Studies have indicated deterioration of air quality due to Mining, Industrial, transportation including mining activity transportation in and around Chandrapur Region are responsible for release of huge Solid particulate Pollutant Matters and extraction and transportation activities are responsible for the release of huge quantity of particulate matter. Air quality status in Indian environment is dominated by SPM causing great concern to environmental planners (Ravindra 1991). They can exert ill effects on plant and animal life, so efforts continue and trends of worldwide basis to determine the concentration and trends of SPM in urban and coal rich extraction region like Black gold city (Chandrapur). In tropical Area particulate matter released from the open cast coal mining activities remain suspended in the surrounding ambient air due to thermal turbulence in the air movement (Goyal 2000).

2.0 Sampling site data collection

For quantification of SPM in the ambient air of in and around Chandrapur Region, eleven sampling sites/station have been selected for detailed sampling and analysis under NAMP/SAMP Monitoring Station of Maharashtra Pollution Control Board.

2.1 Site Description

Site-01 24x7 Mahaagar Palika Chandrapur: It is located in the heart of the city close proximity around Mahan agar Palika include Business area of Chandrapur, Gandhi chowk, city police station with high density population around it.



Site-02 Bhadrawati Nagar Parishad: This station is lies 26 km from Chandrapur city also connected with major cities like Chandrapur, Nagpur, Pune, Aurangabad, Adilabad, Akola, Amravati, Yeotmal, Pusad, Asifabad, Hyderabad Raipur, Washim, Gadchiroli, Darwha, Digras, etc.



Bhadrawati Nagar Parishad

Site-03 District Collector Office, Gadchiroli: This Monitoring station is located in Urban area which is part of the Vidarbha region of Maharashtra. The district is categorised as Tribal and undeveloped district and most of the land is covered with forest and hills. The district has forests cover near about 76 % of the geographical area of the district.

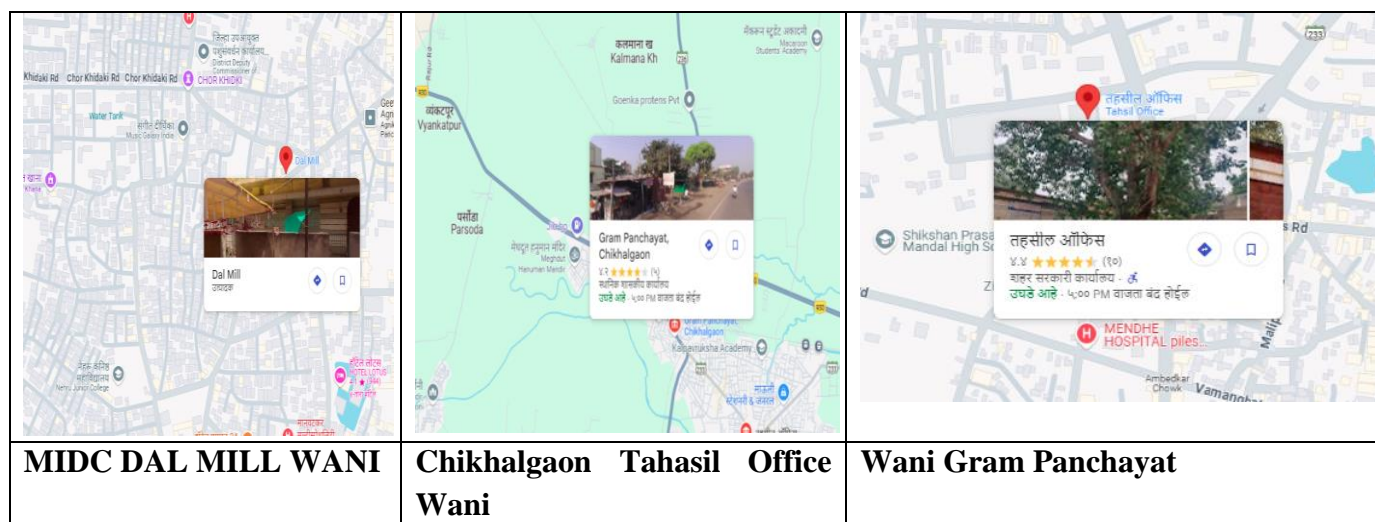
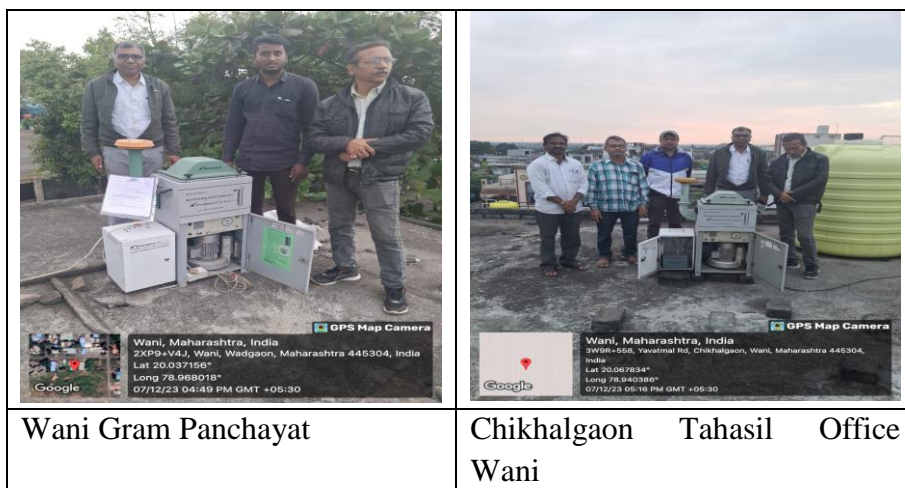


District Collector Office, Gadchiroli

Site-4 MIDC DAL MILL WANI: Dall Mill, MIDC located in rural or semi-urban area which have excess production of pulses through Ball mill Which is the sources of fine particle and dust and connected to market in and around wani area

Site-5 Chikhalgaon Tahasil Office Wani: This Monitoring station is located at semi-urban area where large numbers of people come together for their local administrative work.

Site-6 Wani Gram Panchayat: This station ios purely located in rural area of Wani Grampanchyat part of Amravati Zila Parishad. There are total 3 Villages under Wani Gram Panchayat jurisdiction. Gram Panchayat Tiwsa is further divided into 3 Wards. Gram Panchayat Tiwsa has total 2 schools.



Site-7 MIDC, Tadali: This station purely located in industrial area which is surrounded by industrial hub such as Grace industry, Siddhbali sponge iron, Chandrapur Super thermal power plant and many others sponge iron mid size company.

Site-8 Multi Organic Chandrapur: Monitoring station is located at chemical base organic plant which produces exclusive base gradient for the company like ideal and solar explosive which is mainly consumed in WCL and in other Mining activities.

Site-9 Ghughus Nagar Parishad: is located near maintenance office of the coal handling plant. Most of the time, it is affected by mining activities.

Site-10 Mahatma Gandhi school Ballarpur: This station is located near the BILT Paper mill and surrounded by educational institutions, Ballarshah interstate railway junction and Ballarpur State transportation Bus stand of Maharashtra government.

Site-11 Nagar Parishad Gadhchandur: This monitoring station located in purely residential area which is rounded by cement plant of UltraTech ManikGhar and Ambuja cement.



Air quality Monitoring station (PM10) in and around Chandrapur



3.0 Material and Methods

For the sampling of particulate matter, High Volume Sampler Supplied by M/s EnviroTech Instruments Pvt. Ltd. New Delhi is used. Samples are collected for one year starting January to December 2023 using glass fibre filter paper on daily basis for **24x7 Mahaagar Palika Chandrapur and weekly two days for all other stations**. 24 hours sampling round the clock is applied by drawing air through high volume sampler at a rate of 1-1.8 m³/min (Robson et al. 1962). Concentration of SPM was determined gravimetrically from the difference in weights of the filter paper before and after sampling. (Schlein et al. 1966). The filter papers were dried and cooled at normal temperature in a Decicator before weighing, both prior to sampling and after. Results were expressed in µg/m³ collected during the study period.

4.0 Results and Discussion:

Month	RSPM	SPM	Sox	Nox
Jan	144	225	12	30
Feb	135	274	8	28
March	102	283	10	25
April	84	187	10	28
May	78	95	11	21
June	78	84	9	22
July	63	72	10	19

Aug	55	61	9	21
Sep	85	86	10	23
Oct	63	68	11	29
Nov	124	129	10	29
Dec	136	139	9	31

Table: 01 24x7 Mahaagar Palika Chandrapur

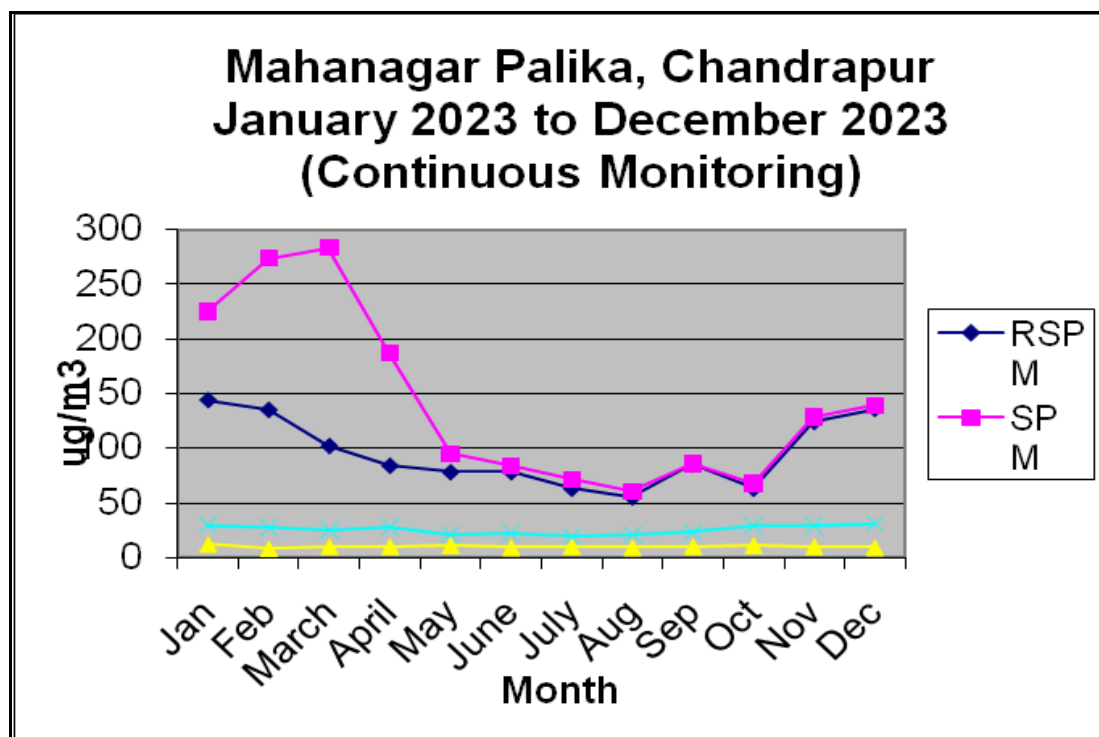


Fig.1 (4.0) 24x7 Average Concentration Sheet January 2023 to December 2023

Considering present observation (Fig.1) and comparison of results with the standards annual average ($60\mu\text{g}/\text{m}^3$ as per CPCB), it may be concluded that Site-1 (**24x7 Mahaagar Palika Chandrapur**) is highly polluted where concentration of RSPM reached $144\mu\text{g}/\text{m}^3$ in winter season (January 2023) and minimum concentration was recorded $55\mu\text{g}/\text{m}^3$ in rainy season (August 2023). The annual average RSPM concentration for the period January 2023 to December 2023 was found to be $95.58\mu\text{g}/\text{m}^3$.

Months 2023	Site-1	Site-2	Site-3	Site-4	Site-5	Site-6	Site-7	Site-8	Site-9	Site-10	Site-11
Jan	144	166	74	159	127	145	112	119	189	147	219
Feb	135	170	43	131	125	125	131	125	200	138	160
March	102	224	66	143	198	166	120	82	228	118	210
April	84	198	84	190	166	177	170	88	269	95	204
May	78	205	66	133	181	215	162	135	219	106	182
June	78	248	64	238	213	179	143	114	273	124	238
July	63	203	79	181	192	192	125	119	163	120	207
Aug	55	120	38	142	150	124	118	94	175	84	174

Sep	85	140	91	150	130	188	131	70	183	75	187
Oct	63	118	85	157	139	113	116	69	148	59	254
Nov	124	216	91	240	166	164	169	120	256	150	253
Dec	136	177	130	225	185	122	172	116	261	138	268
Annual Avg.	95.58	182.08	75.92	174.08	164.33	159.17	139.08	104.25	213.67	112.83	213.00

Table 02: Annual Average of PM10

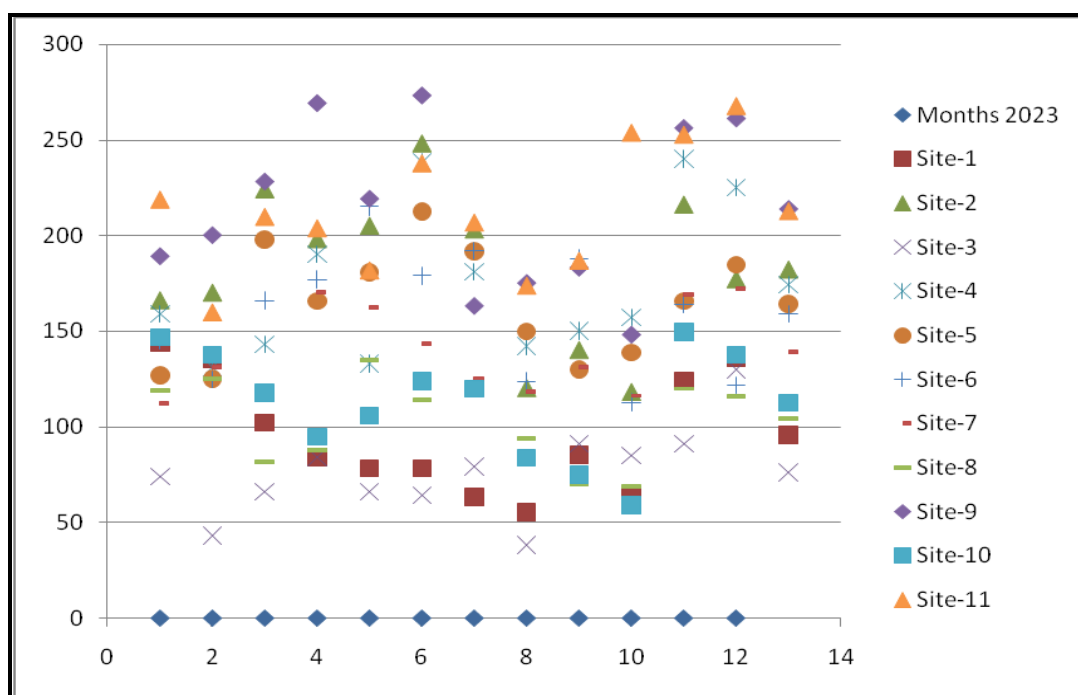


Fig.02: Data representation of Annual Average of PM10

At other station (Site-2 to Site-11) data has been collected two days per week. The Monthly average RSPM concentration is given Table No.02 as per data analyzed the Minimum annual average concentration of RSPM was observed at Site No- 03 and Maximum annual average concentration of RSPM was observed at Site No- 09 & 11. It is pertinent that at all the PM10 Monitoring station the yearly average RSPM concentration exceeds the stipulated $60\mu\text{g}/\text{m}^3$, thus justifying the need of installing and rigorous monitoring in and around Chandrapur. But sometimes (in summer followed by winter) the concentration was found above the permissible limit.

Highest concentration of RSPM was found in winter season followed by summer and rainy season (lowest) respectively (Fig. 1). In winter the concentration is found high due to the phenomenon of thermal inversion. In summer season the RSPM concentration is moderately high as the temperature here is high which causes thermal turbulence in the air movement. The least concentration was found in rainy season because the particulate matter is washed out from the heavy rain.

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