Air Pollution in The Industrial Areas of Temple City, Bhubaneswar, And Various Measures for It

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Abstract: The presence of pollutants that are hazardous to the environment, human health, and the health of other living things is referred to as air pollution. Air pollution is also brought on by natural disasters like wildfires, volcanic eruptions, and sand/dust storms. All greenhouse gases emitted from various sources contribute to pollution. The majority of cities are polluted by PM2.5 and PM10. Many cities have SO_2 and NO_2 levels that are below the legal limit. There are a variety of poisons in the air, but PM2.5 is the most dangerous of them all. Monitoring pollutant gas levels on a regular basis can help with air pollution control. According to regional coefficients of variation, PM10 has greater variability than PM2.5, and this variability is stronger in traffic-affected inner city environments than in suburban places. The manufacturing, construction, energy, and mining industries of Bhubaneswar are particularly prone to releasing air pollutants. These may include particulate matter (PM), sulphur dioxide (SO2), nitrogen oxides (NOx), volatile organic compounds (VOCs), and other hazardous chemicals.

The federal government and municipalities have implemented a number of initiatives to combat air pollution. These include putting into effect car emission rules, encouraging the use of cleaner fuels, and creating programmes to cut industrial emissions. The government is also focusing on expanding green space, enhancing public transit, and raising public awareness of the significance of lowering air pollution.

Keywords: Air pollution, industrial air pollution, pollution control, particulate matter, regulation standards

1. INTRODUCTION

Air pollutant is described because the presence of substances harmful to human and other living beings' health, as well as to the environment. Natural calamities such as wildfires, volcanic eruptions, and dust/sand storms also cause air pollution[1]. Pollution is caused by all greenhouse gases, which are released from many sources. The Indian state of Odisha's capital, Bhubaneswar, has recently struggled with air pollution-related issues. Although the severity of air pollution can change throughout the year, there are a number of things that Bhubaneswar residents can do to help. These elements include vehicle pollution, industrial pollutants, garbage burning, burning during construction, and dust from unpaved roads[2]. The emissions from moving vehicles are one of the main causes of air pollution in Bhubaneswar. Due to the huge growth in automobiles in the city, pollutants such particulate matter (PM), nitrogen oxides (NOx), and volatile organic compounds (VOCs) have increased. It gets worse because of the heavy traffic during peak hours[3]. Air pollution in and around Bhubaneswar is also a result of industrial pollutants from companies and power plants.

The majority of cities have PM2.5 and PM10 pollution. Low amounts of SO2 and NO2 are prevalent in many urban areas. There are numerous toxins in the air, but PM2.5 is the most harmful one[4]. Controlling air pollution can be aided by routinely monitoring pollutant gas levels (NO2, NOx, SO2, CO2, CO, C6H6, O3, PM2.5, PM10, and other pollutants). Regional coefficients of variation show that PM10 is more variable than PM2.5. Sulphur dioxide (SO2), nitrogen dioxide (NO2), and particulate matter are released into the air as a result of the numerous industrial areas and companies that are present outside of the city[5]. Significant amounts of dust particles can be produced during

construction activities, especially when suitable dust control systems are not present.[6] When these particles are suspended in the air, they add to the city's overall air pollution levels. Another substantial cause of air pollution is the open burning of waste, such as garbage, agricultural waste, and other flammable materials[7]. When garbage is burned outside, it emits dangerous pollutants into the environment like particulate matter, carbon monoxide (CO), and poisonous gases[8].

2. AREA OF RESEARCH

As the state capital of Odisha, Bhubaneswar is home to a number of industrial parks and clusters. These industrial belts have a substantial impact on the region's economic development. The following are some well-known industrial regions close to Bhubaneswar:

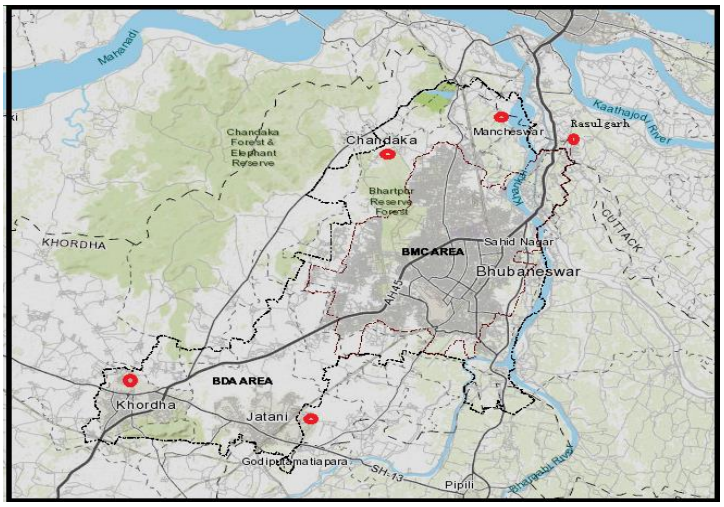

Fig. 1 Map of Bhubaneswar city with its spotted industrial belt

2.1. **Khurda Industrial Area:** One of the main industrial areas in the area is Khurda Industrial Area, which is near to Bhubaneswar. In addition to manufacturing, textiles, food processing, chemicals, and pharmaceuticals are just a few of the many industries that are housed there.

2.2. **Mancheswar Industrial Estate:** Mancheswar Industrial Estate is a reputable industrial sector located in Bhubaneswar's northern region. A wide variety of industries call it home, including engineering, electrical equipment, plastics, and automotive components.

2.3. **Rasulgarh Industrial Estate:** Rasulgarh Industrial Estate is another significant industrial belt in the area, and it is situated in the western portion of Bhubaneswar. Printing, packaging, textiles, and manufacturing are just a few of the industries it supports.

2.4. **Chandaka Industrial Estate:** Chandaka Industrial Estate is a developing industrial area outside of Bhubaneswar. It focuses on industries like small-scale manufacturing, food processing, and agro-based enterprises.

2.5. **Jatni Industrial Estate:** A new industrial development called Jatni Industrial Estate is situated about 25 kilometres from Bhubaneswar. It is home to businesses in the pharmaceutical, engineering, and textile industries.

These industrial belts aid in the region of Bhubaneswar's general industrial growth and job creation. They offer chances for a variety of industries to prosper and significantly contribute to the economic expansion of the state of Odisha.

3. AIR POLLUTION IN THE INDUSTRIAL BELT OF BHUBANESWAR

Air pollution in the industrial belt of Bhubaneswar can be a concern due to the presence of industrial activities and emissions. While specific data on air pollution levels in each industrial area may vary, industrial emissions can

contribute to the overall air pollution in these zones[9]. Here are some factors that can contribute to air pollution in the industrial belt of Bhubaneswar:

3.1. **Emissions from industries:** Industries in the area can release pollutants into the air during their manufacturing processes. These emissions may include particulate matter (PM), sulfur dioxide (SO2), nitrogen oxides (NOx), volatile organic compounds (VOCs), and other harmful gases[10]. The types and quantities of pollutants can vary depending on the industries present in the belt.

3.2. **Emissions due to Coal burning:** Some industries in the industrial belt may rely on coal as a source of energy. The combustion of coal can release significant amounts of pollutants, including sulfur dioxide (SO2), nitrogen oxides (NOx), and particulate matter (PM)[11].

3.3. **Particulate Matter:** Industrial activities such as construction, material handling, and transportation can generate dust and particulate matter. These particles, when suspended in the air, can contribute to air pollution.

3.4. **Emissions from vehicles:** Industrial areas often have a high concentration of vehicles, including trucks and heavy machinery, which can contribute to air pollution through exhaust emissions[12].

4. DENSITY OF AIR POLLUTANTS

Bhubaneswar is the state capital of Odisha. Though it is a planned city but now-a-days much construction work is going on with increasing traffic. We have collected some pollutants from five industrial areas of Bhubaneswar. The places chosen in Bhubaneswar city are Khurda industrial area, Mancheswar Industrial Estate, Rasulgarh Industrial Estate, Chandaka Industrial Estate and Jatni Industrial Estate. We collected the data of different pollutant like HCHO, TVOC, PM2.5 and PM10 in every 3hrs gap i.e at 8am, 11am, 2pm, 5pm and 8pm.

Separate graphs have been plotted for each pollutant. It is identified that in some places the pollutant is maximum and in some places it is minimum.

Table 1 Data of HCHO (mg/m3) at different places of Bhubaneswar at different times

Sl. No.	Industrial Area(s)	8AM	11AM	2PM	5PM	8PM
1	**Mancheswar**	0.015	0	0.045	0.006	0.006
2	**Rasulgarh**	0	0.013	0.062	0.082	0.092
3	**Jatni**	0	0.028	0.04	0.063	0.012
4	**Chandaka**	0.006	0.01	0.03	0.011	0.026
5	**Khurda**	0.001	0.033	0.068	0.032	0.006

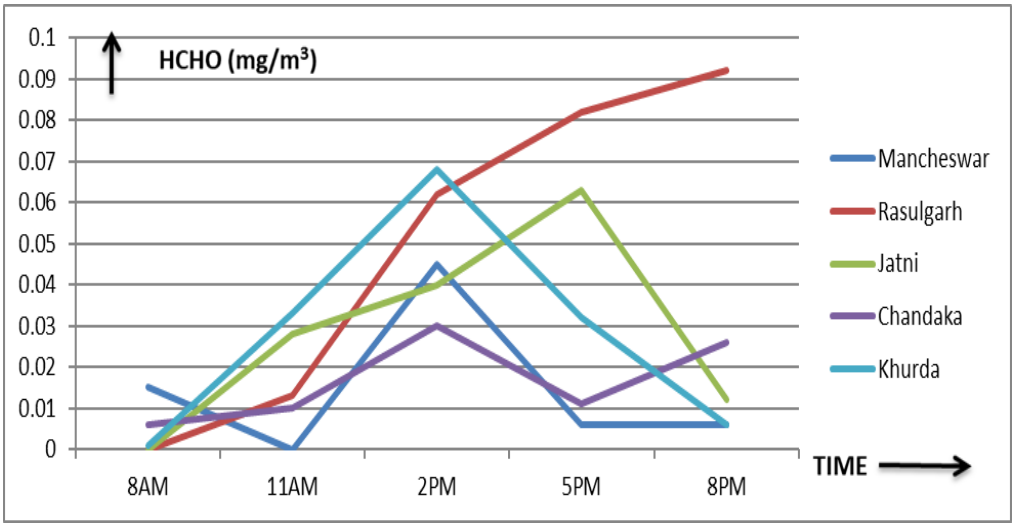

Fig. 2 Graph for HCHO at different places of Bhubaneswar vs different times

Table 2 Data of TVOC (mg/m3) at different places of Bhubaneswar at different times

Sl. No	Industrial Area	8AM	11AM	2PM	5PM	8PM
1	**Mancheswar**	0.002	0.002	0.003	0.002	0.001
2	**Rasulgarh**	0.002	0.003	0.003	0.003	0.003
3	**Jatni**	0.002	0.001	0.002	0.003	0.002
4	**Chandaka**	0.002	0.002	0.003	0.002	0.002
5	**Khurda**	0.003	0.003	0.002	0.001	0.003

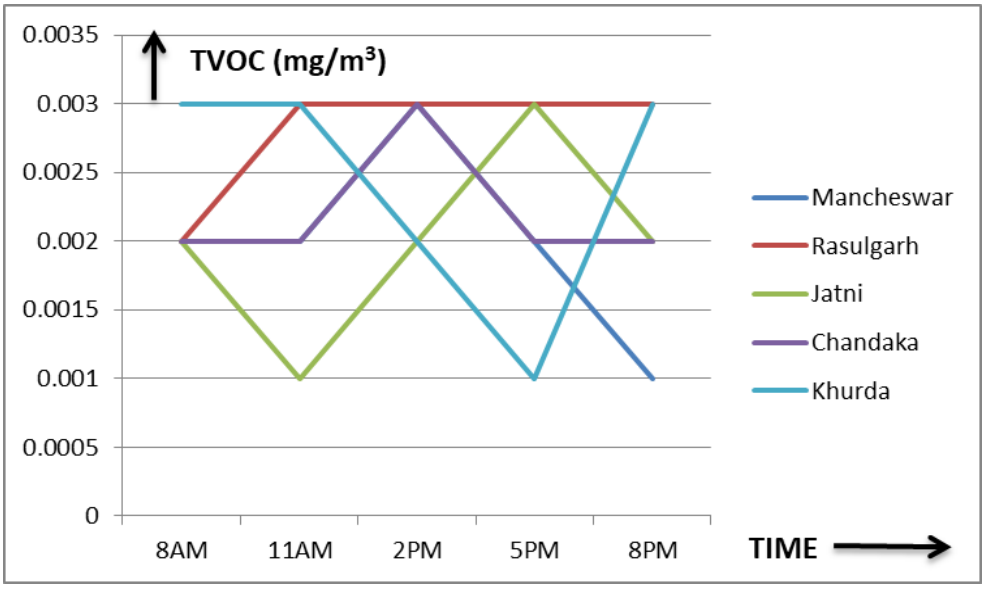

Fig. 3 Graph for TVOC at different places of Bhubaneswar vs different times

Table 3 Data of PM 2.5 (mg/m3) at different places of Bhubaneswar at different times

Sl. No	Industrial Area	8 AM	11 AM	2 PM	5 PM	8 PM
1	**Mancheswar**	124	54	39	129	341
2	**Rasulgarh**	163	47	36	43	79
3	**Jatni**	111	57	80	48	106
4	**Chandaka**	160	54	32	52	60
5	**Khurda**	123	94	114	175	234

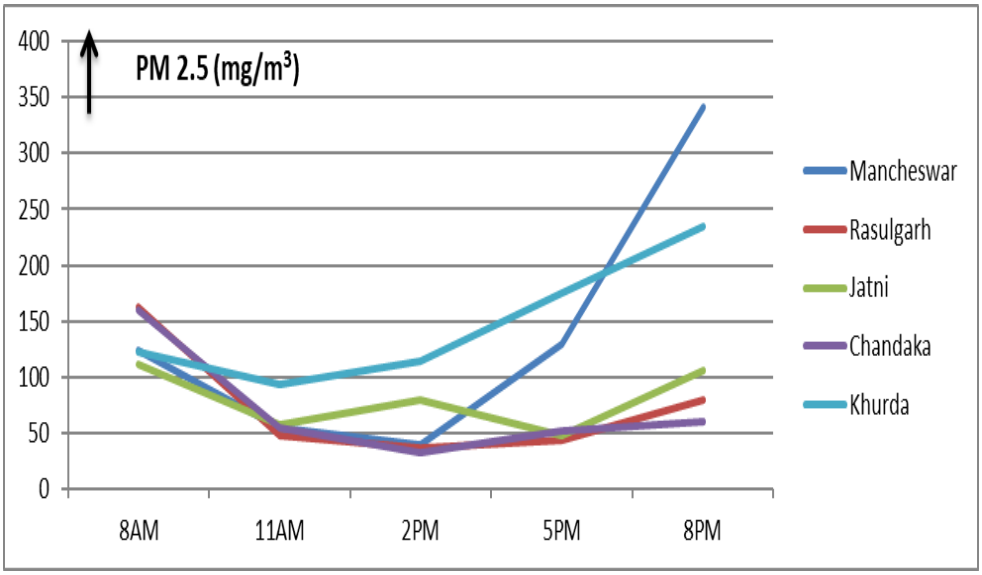

Fig. 4 Graph for PM 2.5 at different places of Bhubaneswar vs different times

Table 4 Data of PM10 (mg/m3) at different places of Bhubaneswar at different times

Sl. No	Industrial Area	8AM	11AM	2PM	5PM	8PM
1	**Mancheswar**	143	62	45	149	395
2	**Rasulgarh**	189	54	41	49	91
3	**Jatni**	128	66	34	55	122
4	**Chandaka**	185	60	37	60	69
5	**Khurda**	142	109	132	203	271

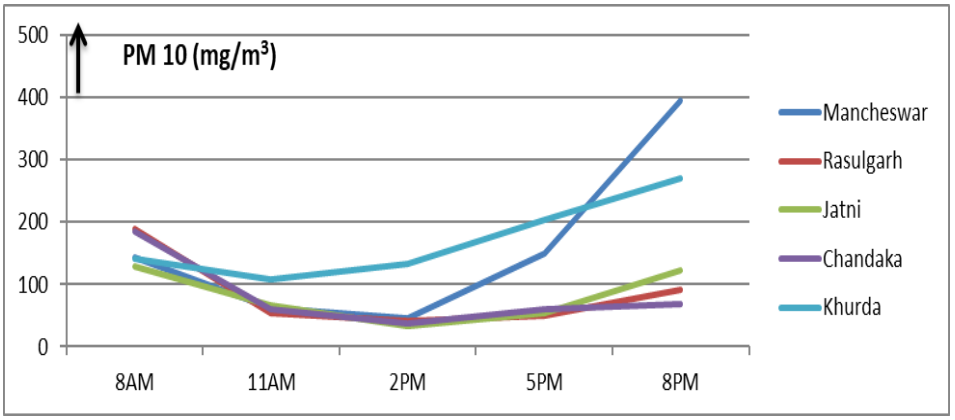

Fig. 5 Graph for PM 10 at different places of Bhubaneswar vs different times

5. RESULTS AND DISCUSSION

- It is found that from Table 1 HCHO is maximum at Rasulgarh Industrial Estate, Bhubaneswar where as it is minimum at Mancheswar and Jatni Industrial Estate, Bhubaneswar.
- It is found that from Table 2 TVOC is maximum at Rasulgarh Industrial Estate, Bhubaneswar where as it is minimum at Mancheswar Industrial Estate, Bhubaneswar.
- It is found that from Table 3 $PM_{2.5}$ is maximum at Mancheswar Industrial Estate, Bhubaneswar where as it is minimum at Chandaka Industrial Estate, Bhubaneswar.
- It is found that from Table 4 PM_{10} is maximum at Mancheswar Industrial Estate, Bhubaneswar where as it is minimum at Chandaka Industrial Estate, Bhubaneswar.

6. REMEDIES

Reducing pollution caused by industries in Bhubaneswar requires a multi-pronged approach involving the collaboration of industries, regulatory authorities, and the community[13]. Here are some measures that can be taken to mitigate industrial pollution in Bhubaneswar:

6.1. **Strict Enforcement of Environmental Regulations:** Regulatory authorities should enforce and strengthen existing environmental regulations, emission standards, and pollution control norms[14]. Regular inspections, monitoring, and penalties for non-compliance can incentivize industries to adopt cleaner technologies and practices.

6.2. **Adoption of Clean Technologies:** Industries should be encouraged to invest in cleaner and more efficient technologies that reduce pollution[15]. This can include the use of cleaner fuels, energy-efficient machinery, and advanced pollution control equipment.

6.3. **Pollution Control Measures:** Industries should implement effective pollution control measures such as installing air pollution control devices, wastewater treatment systems, and proper waste management practices. This can help minimize the release of pollutants into the environment[16].

6.4. **Promoting Sustainable Practices:** Encourage industries to adopt sustainable practices such as recycling and reusing materials, optimizing resource consumption, and minimizing waste generation. This can reduce the environmental impact of industrial operations[17].

6.5. **Encouraging Renewable Energy:** Promote the adoption of renewable energy sources within industries to reduce reliance on fossil fuels. This can involve incentivizing the use of solar power, wind energy, or other renewable sources for meeting energy requirements[18].

6.6. **Public Awareness and Participation:** Conduct awareness campaigns and engage the community to actively participate in reducing industrial pollution. Encourage residents to report any instances of pollution or non-compliance by industries and involve them in monitoring efforts[19].

6.7. **Collaboration and Information Sharing:** Foster collaboration between industries, regulatory bodies, and research institutions to share knowledge, best practices, and technological advancements for pollution control[20]. This can facilitate the development and implementation of effective pollution reduction strategies.

6.8. **Green Industrial Zones:** Establish designated green industrial zones with strict environmental standards and incentives for industries that adopt environmentally friendly practices[21]. These zones can serve as models for sustainable industrial development.

6.9. **Monitoring and Reporting:** Enhance air and water quality monitoring systems to ensure real-time monitoring of pollution levels in industrial areas[22]. Regular reporting and transparency can help identify areas of concern and facilitate timely corrective actions.

7. CONCLUSION

Air pollution is a terrible environmental issue, and the non-uniform dispersion of pollutants in urban areas necessitates better precision and spatial temporal resolution in pollution monitoring.

From the above graphs it is found that Mancheswar Industrial Estate and Rasulgarh Industrial Estate of Bhubaneswar city are more polluted in compared to the other industrial estates. The inner city is found more polluted because of industrialisation, heavy traffic and continuous constructions whereas the outside industrial estates are less polluted. In Bhubaneswar, reducing industrial pollution necessitates a multifaceted strategy including the cooperation of businesses, government regulators, and the local population. If we can follow the above suggested remedies and control our traffic and reduce the reconstruction works, then big cities pollution problem can be reduced.

It's important to remember that the exact amounts of air pollution can change over time and depend on a number of variables, including the weather, seasonal changes, and neighbourhood activities. For the most precise and recent information on the state of air pollution in Bhubaneswar, it is advisable to consult real-time air quality monitoring data and updates from local authorities. To tackle air pollution, the federal government and local governments have put in place a number of measures. Implementing car emission regulations, promoting the use of cleaner fuels, and developing programmes to reduce industrial emissions are a few of them. The government is also putting emphasis on increasing green space, improving public transportation, and educating the populace about the importance of reducing air pollution.

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