

## **A Review of Study of Air Quality Index for Particulate Matter at various Location**

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**Abstract** - The presence of certain substances in the air negatively affects human health, the environment and the climate. These chemicals are mainly added due to human activities. Maintaining air quality requires regular monitoring, identification of the source of pollution and adoption of preventive measures. This rapid growth and related civic activity has affected their ecological services. Air pollution is mainly considered an urban problem as the rate of industrialization and unsystematic urbanization increases day by day. It has become a major environmental problem faced by people globally in developing and developed countries. Three criteria pollutants measured regularly and over a longer period of time, sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>) and respirable particulate matter (PM<sub>10</sub>) were investigated for air quality analysis.

**Keywords:** Air pollution, SO<sub>2</sub> and NO<sub>x</sub>

### **1 Introduction**

The accumulation of certain substances in the air that negatively affect the well-being of man, plants, animals and the environment causes air pollution. These chemicals are added in various ways, for example pesticides, fumigants etc are intentionally released, hydrocarbons during fuel use and solvents escape when used (solvents etc.). Some of these chemicals change their nature through reactions under atmospheric conditions. Air quality is naturally maintained as these chemicals disperse soon after release. The recent problem of air pollution is really emerging as the rate of addition of pollutants is much higher than their removal.

Air pollution is one of the biggest serious problems in the world. It causes health related problems such as respiratory diseases, skin problems, risk of developing cancer and other serious illnesses. Pollutants in the air through various natural and anthropogenic means, released into the air due to various industrial, commercial activities and construction works increase the number of vehicles. The high level of pollutants

that contribute to ambient air pollution are sulfur dioxide, nitrogen oxides, suspended particulate matter, breathable suspended particulate matter and the hazards that air pollution affects us all. Air pollution can cause health problems and can lead to death.

As much of the air pollution is caused by burning fossil fuels such as coal, oil and petroleum, reducing these fuels can drastically reduce air pollution. Titanium dioxide has been researched for its ability to reduce air pollution. The burning of municipal solid waste also creates high air pollution. Ambient air related to the air in the usual environment in which the human being lives. Ambient air monitoring is the surveillance of air quality in a certain polluted area or city. It is not related to the monitoring of chimney emissions. Topical ambient air quality can be broken down by various sources such as motor vehicles and power plant emissions.

Common subjects monitored include dust deposition, SPM, RSPM and SOX, NOX. Air pollution is mainly considered an urban problem as the rate of industrialization and unsystematic urbanization increases day by day. It has become a major environmental problem faced by people globally in developing and developed countries. Some workers observed higher concentration of SO<sub>2</sub> in ambient air compared to the present investigation (Mukhopadhyay and Mukherjee 2013, Nandanwaret al. 2014). Several studies were carried out by Rani et.al, 2011; Chakrabarti and Mitra, 2014; Richhariya, 2015; Simbi et.al, 2017; Dwivedi and Tripathi, 2018 to assess ambient air pollutants (SO<sub>2</sub>, NO<sub>x</sub> and SPM). Hasan et.al, (2018) observed that nitrogen oxides play an important role in the formation of ozone in the atmosphere and sulfur dioxide is a highly reactive gas that affects the environment.

Particulate pollution is one of the main causes of environmental health problems that cause approximately two to three million deaths each year worldwide (WHO, 2001). Particulate matter (PM) is actually a mixture of various substances that can differ in various sizes. Particulate matter mainly consists of suspended and breathable particulate matter. Again, breathable particulate material consists of two sizes, namely PM<sub>10</sub> whose size is less than 10 $\mu$ m and PM<sub>2.5</sub> whose sizes are less than 2.5 $\mu$ m. Atmospheric pollutants have different variations, that is, seasonal, short-term and long-term variations. The prevailing atmospheric conditions determine the fate of pollutants and gases after they are released into the atmosphere. The three important criteria in the dispersion of air pollutants are - average transport wind speed, turbulence and mass diffusion. Meteorology plays an important role in the study of air pollution. Wind direction and

speed play a crucial role in the dispersion of various atmospheric pollutants. Wind direction is the measure of where the wind blows, measured in compass points viz. North, south, east and west. Wind direction plays an important role in the distribution and dispersion of pollutants from stationary and mobile sources to downwind areas. Wind speed can be defined as the measure of the horizontal movement or direction of the wind relative to the earth's surface per unit of time. It determines the travel time from a source to a receiver while in the other causes it shows the dilution of particulate pollutants in the direction of the wind. The dissipation and dilution of pollutants emitted will be greater if the wind is stronger. The frequency and direction of wind speed varies considerably from month to month.

## 2 Literature Review

Today, the ambient air in most Indian cities is severely polluted and this pollution has a tremendous impact not only on the health of the population but also on the ecosystem. Industrialization and the growth in the number of vehicles in urban areas have led to pollution of ambient air quality by the emission of various types of atmospheric pollutants. Urban air pollution has grown in cities such as Kolkata, Mumbai and Delhi across the Indian subcontinent in the last decade at an alarming rate (Agarwal et al., 1999).

The World Health Organization has ranked Delhi as one of the most polluted metropolitan cities in the world (UNEP/WHO, 1992). However, in the Indian subcontinent, it is not just Delhi, but even small and medium-sized cities are rapidly deteriorating air quality (CPCB, 1995). Of the 23 megacities, Delhi is declared the most polluted, followed by other cities like Mumbai, Kolkata, Bangalore, Chennai, Kanpur, Ahmedabad and Nagpur. They have serious air pollution problems primarily with the levels of particulate matter that is far in excess of the standards prescribed by the CPCB. India's large cities appear to have high concentrations of fine particles (World Bank, 2004).

In India, the Central Pollution Control Board (CPCB) regularly monitors ambient air quality in several cities. As per the CPCB report in 2008 Chennai had shown all three pollutant criteria viz. RSPM, SO<sub>2</sub> and NO<sub>2</sub> within national standards. Another three megacities, such as Mumbai, Kolkata and Delhi, showed that the annual concentration of SO<sub>2</sub> and NO<sub>2</sub> is well within the limits suggested by the National Ambient Air Quality Standards (NAAQS), while the RSPM indicated an upward trend in all five consecutive years. . In India, due to increased traffic, industrial development, energy consumption, alarming levels and poor road

quality, a large number of particulate matter has been deposited in the atmosphere in recent years by various researchers and environmentalists.

Among particulate materials, RSPM is an important source as it contains heavy metals that are easily deposited in the respiratory tract. Due to the deposition of metals in the human body, various harmful diseases like asthma, chronic obstructive pulmonary disease (COPD), cystic fibrosis etc. are caused. Various standards and guidelines are presented to regulate ambient air quality by CPCB, New Delhi. Therefore, for the evaluation of the air quality for the projects in progress, the monitored values are compared with the respective values of the norms.

### **3 Sampling and monitoring**

Sampler of gaseous pollutants (Envirotech model APM 443) for 8 hours a day at an average flow of 1.5 LPM according to the standards of the Central Pollution Control Board (India). Monitoring is carried out once a month at the sampling sites. Suspended particulate matter (SPM) and respirable suspended particulate matter (RSPM) were collected in the dust cup and glass tissue filter paper (GRA-3), respectively. Samples for determination of gaseous pollutants (SO<sub>2</sub> and NO<sub>x</sub>) were collected by bubbling air samples in absorbent solutions of sodium tetrachloromercurate and sodium hydroxide arsenate respectively in impingers with a flow rate of 1.5 LPM.

These samples were analyzed spectrophotometrically for SO<sub>2</sub> and NO<sub>x</sub>. Air pollution is a serious environmental problem around the world that causes enormous damage to human health and the environment. Over population, urbanization and industrialization have led to serious problems related to air pollution all over the world. Growing air pollution has emerged as a serious concern in the city, with vehicular emission and dust contributing a major part of the deteriorating air quality. Urban air pollution episodes are mainly due to increased concentrations of pollutants, viz. local weather, emissions and dispersion conditions.

### **4 Materials and methods**

Monitoring was done during the winter season and summer season. For carrying out the project work, the West Zone of Nagpur was considered as the study area. Monitoring areas included- Residential Areas, ie G.H. Rasoni Boy's Hostel (R1), Colônia de Amigos (R2) and Dutta Wadi (R3); Commercial Areas, ie Wadi

Naka (C1), Dharampeth (C2), Shankar Nagar (C3) and Industrial Areas, ie MIDC (I1, I2, I3). Samples during 24 hours were collected at all sampling stations. SPM and RSPM were monitored using the Breathable Powder Sampler. Whatman Glass microfiber filter paper, popularly known as 8x10 ins size GF/A filter paper, was used to determine the RSPM and the flow rate was maintained at 1-1.5 m<sup>3</sup>/min. The NPM - HVS/R model is used, which has a cyclonic separator that separates particulate matter larger than 10µm from the air stream (pulled into the sampler) in the beaker before filtering through GF/A filter paper.

The EPA has already established national air quality standards for each of these pollutants to protect public health. Tropospheric ozone and particulate air pollution are the two pollutants that pose the greatest threat to human health in this country. Air quality is determined by comparing the RSPM values obtained during sampling with the Air Quality Index table suggested by the Central Pollution Control Board, New Delhi.

The AQI is primarily categorized into six zones, each zone describing ambient air quality. The highest AQI value indicates the highest level of air pollution and the greatest concern about health risks. If an AQI value is 50, it represents good air quality with little potential effect on public health, whereas if an AQI value is greater than 300, it represents hazardous air quality of great public health concern. AQI values below 100 are generally considered satisfactory. If the AQI values are above 100, the air quality is considered unhealthy for children and the elderly and then it becomes unhealthy for everyone as the AQI values increase. The EPA has assigned a specific color to each AQI category to make it easier for everyone to quickly understand whether air pollution is reaching unhealthy levels in their communities or not. Various health-related impacts associated with each zone are also suggested by the CPCB.

## 5 Conclusion

Ambient air pollution is something that we absolutely cannot ignore at the present time. Ambient air pollution is mainly generated by anthropogenic disorders which are general sources of ambient air pollution, including the use of vehicle fuels. Industrialization, factorial installations, burning of municipal waste and lighting with polluting fuels also include ambient air pollution. Ambient air pollution creates all kinds of health risks. The health impact ranges from increased hospital and emergency meetings to increased risk of premature death.

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