

Composite Air Quality Index Assessment for Bilaspur District (Chhattisgarh)

Neeta Mishra¹, Manish Upadhyay²

^{1,2}Dr. C. V. Raman University, Bilaspur (C.G.) India.

ABSTRACT

The current study's objective is to evaluate the district of Bilaspur's ambient air quality. The data collected has been calculated to determine the Air Quality Index (AQI) on a five-point scale for quantifying air pollution. This index is based on measuring parameters like sulphur dioxide (SO₂), nitrogen dioxide (NO₂), respirable suspended particulate matter (PM₁₀), and total suspended particulate matter (TSPM) at designated locations such as residential areas, marketable areas, and business crossings. The status of the air quality has been estimated at each point, as shown by the air quality scale. According to the study, marketable regions and commercial crossings have the highest air quality indicator values, while domestic areas have the lowest levels.

Keywords: Ambient air - Bilaspur, SO₂, NO₂, particle matter

I INTRODUCTION

With an expanded speed of industrialization particularly in creating nations, environmental issues have gotten worse as well. In parallel, there has been a rapid surge in air pollution sources due to population growth, lucrative development, and more transportation options. The advancement of air pollutants including SPM, SO₂, NO_x, and other organic and inorganic pollutants, as well as their detrimental effects on human and environmental health, are caused by vehicular emigration (Kaushik, Ravindra, Yadav, Mehta and Haritash, 2006). Because of the negative effects on ambient air quality, the continuous emigration of adulterants from the automotive industry is a source of concern. A key factor in determining health is air quality. The negative effects on health brought on by air pollution may include breathing difficulties, gasping, coughing, and a worsening of existing respiratory and heart diseases. As a result, it's crucial to consider an area's Air Quality Index (AQI). The ambient air pollution measured at monitoring sites on a specific time period is reported using the AQI standing scale. Since AQI takes into account the accretive effect of several debasements, the general medium air nature or air quality of a designated region can be assessed more effectively. The main goals of AQI are to implement necessary non supervisory measures and to educate the public about the dangers of exposure to polluted circumstances. In India, a few studies were conducted to determine the Air Quality Index in order to understand the people's health and pollution levels (Mohan and Kandya, ; Bhaskar and Mehta, 2010; Mamta and Bassin, 2010; Sarkar and Srivastava, 2010; Panda and Panda, 2012). The air pollution problem is getting worse every day in Chattishgarh as well. The primary source of air pollution in the megacity of Bilaspur is the motor vehicle industry because the number of cars keeps growing (Sharma and

Raina, 2012). In Bilaspur, Chattishgarh, there are about 9 lakh vehicles on the road, making it conceivably the state with the highest vehicle population in the nation. There have been a veritable plethora of research on ambient air pollution that have been recognised to determine the AQI of various areas in Chattishgarh. However, no systematic investigations have been conducted for lower municipalities, notably in hilly areas like Bilaspur City, a known crossroads and the starting point of Mahamaya Devi Ratanpur. Construction and demolition to provide better structures for tourists is an increasing tendency in Bilaspur, a religiously and economically significant city of Chattisgarh (22.0797° N, 82.1409° E, 207 feet). Due to the steady rise in tourists, there are also an increasing number of automobiles and other pollution-producing sources. The city confirms the daily influx of tens of thousands of pilgrims (Navratri Festival). In 2012, more stores, hospices, cafes, and other businesses were added to Bilaspur's burgeoning demand.

II OBJECTIVE AND METHODOLOGY

(a) Objective-

- (i) To measure AQI at different crowded place in Bilaspur and develop a composite Air Quality Profile
- (ii) To compare AQI levels of Residential and Commercial areas

(b) Methodology

- (i) Identification of Nine locations (three residential, three marketable, and three business crossings)
- (ii) The data collection and dimension of the air quality indicator following an extensive review of the city.



Fig. 1: Satellite picture of study region.

- (iii) Periodicity of the slice performance once a year, utilising a gassy slice attachment and an Envirotech High Volume Respirable Dust sample APM 460 BL.

III ANALYSIS

Particulate matter (APM 411). Nitrogen dioxide (NO₂) was analysed using the Jacob and Hochheiser system, IS 5182, part VI; particulate matter (RSPM and NRSPM) was analysed using the gravimetric system, IS 5182, part IV; and sulphur dioxide (SO₂) was analysed using the Adjusted West and Gaeke Technique or method, IS 5182, part II. Casting up the two has been used to determine TSPM attentiveness. The Tiwari and Ali, 1987 technique was used to construct the Air Quality Index (AQI). Each contaminant's air quality score was first determined for AQI using the following formula:

$$Q = 100 \times V/V_s$$

Where

Q = Quality rating

V = Noticed worth of boundary

V_s = Standard worth suggested for the boundary

On the off chance that 'n' quantities of boundaries are thought of, AQI is the Mathematical mean (GM) of all the 'n' number of value appraisals.

IV OUTCOME AND CONVERSATION

The following tables show the results that were achieved. Table 1 displays the benefits of the Air Quality Record as assessed from data obtained for the local air quality of

Bilaspur town at nine locations between July 2010 and June 2011. The equivalent is graphically depicted in Figure 2. The analysis of the data showed that at all of the selected locations, the concentrations of SO₂ and NO₂ were within the permissible outer limits of the Public Surrounding Air Quality Guidelines (NAAQS) established by CPCB, while the concentrations of RSPM and TSPM were above the permissible outer limits at the majority of the locations.

The AQI scale was separated into five classifications, every class depicts the scope of air quality and its related potential wellbeing impacts. The file utilizes wellbeing based portrayals to give significant data to general society.

The five levels of AQI are depicted in Table 2. During the evaluation period, the Air Quality Record values varied by at least 19.52 to a maximum of 56.58. According to the AQI theory, it was observed that local sites had lower AQI values whereas business districts and traffic intersections had higher contamination levels. Sites VII and VIII had the highest AQI, whereas site II had the lowest. All three commercial locations (sites V and VI) and one traffic crossing (site IX) have light-detected air contamination. Sites VII (Transport Stand) and site VIII (Railline Street) were found to be just mildly contaminated whereas every single private location (sites I, II, and III) is in the clean class, as seen in table 1. Thus, when compared with the other nine destinations, two traffic crossings all displayed a similarly higher contamination level. This could be attributed to how these two locations handle the busy traffic junctions in the community.

Table 1
AQI and AAQ class at chosen destinations during the review time frame

site	(AIR QUALITY INDEX) AQI	(AMBIENT AIR QUALITY) CLASS AAQ
A. Residential Areas		
1. Nehru Nagar	24.28	CA - CLEAN AIR
2. Rajkishore Nagar	18.42	CA - CLEAN AIR
3. Vashali Nagar	21.28	CA - CLEAN AIR
B. Commercial Area		
4. Gol Bazar	36.04	LAP - LIGHT AIR POLLUTION
5. CIMS Hospital Road	33.60	LAP - LIGHT AIR POLLUTION
6. Vyapar Vihar	31.13	LAP - LIGHT AIR POLLUTION
C. Travel Crossings		
7. Bus Stand	41.23	LAP - LIGHT AIR POLLUTION
8. Railway Station Road	55.57	MAP - MODERATE AIR POLLUTION
9. Tarbahar	38.02	LAP - LIGHT AIR POLLUTION

Table 2
score scale of AQI values

S.No.	key Value	comments
1	0-24	CA - CLEAN AIR
2	25-51	LAP - LIGHT AIR POLLUTION
3	52-76	MAP - MODERATE AIR POLLUTION
4	77-99	HEAVY AIR POLLUTION - HAP
5	Above 100	SEVERE AIR POLLUTION - SAP

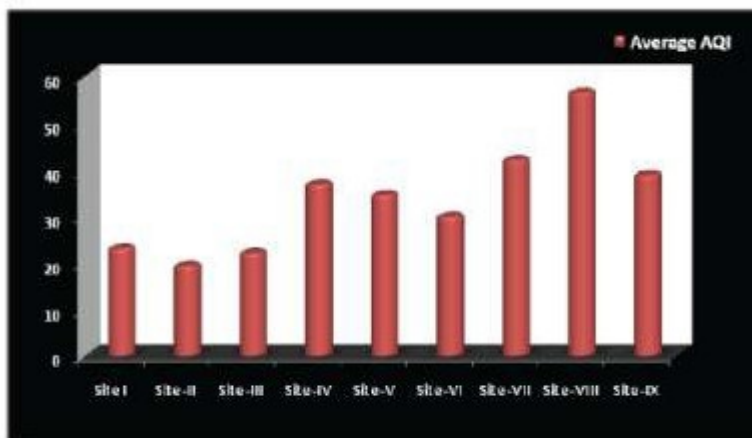


Fig. 2: standard AQI of selected site from July 2020 to June 2021

Cyclic difference of AQI

Table 3 shows the AQI trends in the four seasons (wintry weather, summer, monsoon weather and post-monsoon weather) from July 2020-June 2021.

Table 3
Cyclic difference of AQI of pollutant in dissimilar types of area

site	season			
	wintry weather	Summer	Monsoon	Post-Monsoon
A. Residential Areas				
1. Nehru Nagar	27.65	21.50	17.36	25.48
2. Rajkishore Nagar	22.26	16.04	15.35	26.44
3. Vashali Nagar	24.53	22.24	16.30	27.06
B. Commercial Areas				
4. Gol Bazar	42.40	36.52	32.78	38.73
5. CIMS Hospital Road	41.23	33.47	26.82	41.05
6. Vyapar Vihar	36.98	26.56	25.97	32.51
C. Traffic Crossings				
7. Bus Stand	43.07	38.73	32.51	53.47
8. Railway Road	66.05	56.97	44.12	61.64
9. Tarbahar	47.85	35.02	27.92	47.66

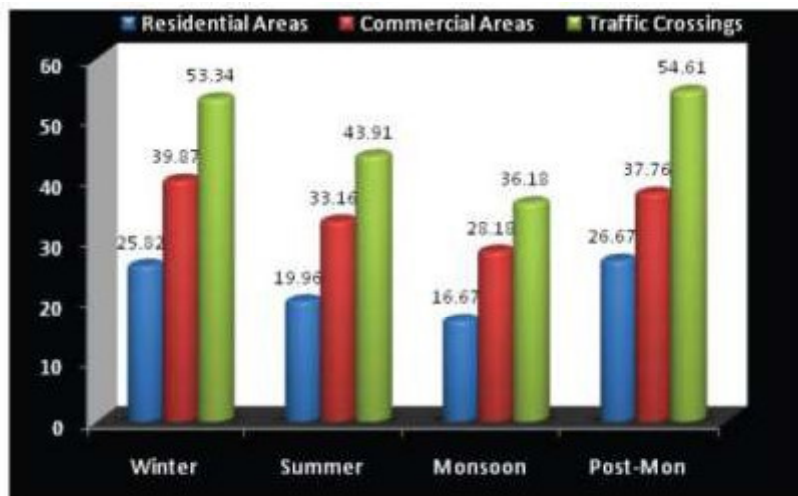


Fig. 3: cyclic middling of AQI in dissimilar area during the study phase.

Every location had the best air quality during storm or monsoon season, while six locations had the worst during the winter and three locations had the worst air quality at all during the post-storm season. Because of the large amounts of precipitation that led to the removal of poisons and subsequent cleaning of the air, the rainstorm season had the finest air quality. Wintertime's notoriously bad air quality may be attributed to calm meteorological conditions and hence less pollution dispersing. Additionally, compared to other seasons, the winter season in this area experienced significantly less precipitation. Additionally, Mohan and Kandya (2007) noted that the greatest seasons are storm season and winter season is the most over the top horrible in regards to air quality.

V CONCLUSION

From the review, it has been closed the convergence of SO₂ also, NO₂ has been seen to be well inside as far as possible though the convergence of together RSPM (PM₁₀) and TSPM have cross the discontinue points the larger part of the period. The noticed AQI values in concentrate on region relate to sparkling or clean space air in neighborhoods to glow or light space air contamination in business regions and modest contamination at solitary of the traffic intersections. Occasionally, finest air qualities have been seen in rainstorm period and most terrible in wintry weather season followed by post-storm.

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