

# Assessment of Air Quality using Air Quality Indices for a Roadway Passing through Commercial Area in Mysuru City

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**Abstract**— Air Quality Indices (AQI) are used for local and regional air quality management in many cities of the world. The present study signifies about the air pollutant concentrations for a roadway passing through commercial area in Mysuru city. Sulphur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>) and particulate matter<sub>10</sub> (PM<sub>10</sub>) were collected over two sampling locations along the roadway. Simultaneously during the sampling period meteorological parameters like temperature, pressure, relative humidity, wind speed, wind direction and rainfall data were also collected and wind roses were plotted. Monthly and seasonal variations of these pollutants have been observed and recorded and AQIs were calculated. It has been observed that the AQI's are high in winter season in comparison to the summer season. In the present study it is noticed that the PM<sub>10</sub> levels at both the locations exceed the prescribed limits as stipulated by CPCB.

**Key words:** CPCB, AQI, APM 460 BL High Volume

## I. INTRODUCTION

Air pollution due to human activities is an abuse to the environment thereby degrading the air quality. Air pollution disrupts the eco-system and the effects will be too

catastrophic for the future generations to overcome and it is one of the major environmental problems associated in major towns and cities. About 60 per cent of air pollution in Indian cities is due to automobile exhaust emission. The worst thing about vehicular pollution is that it cannot be avoided as the emissions are emitted near-ground level where we breathe. The vehicular emission contains more than 450 different organic chemical compounds either in gaseous or in particulate or in the combined forms. Exposure to vehicular pollution directly affects respiratory, nervous and cardiovascular systems of humans, resulting in impaired pulmonary functions, sickness, and even death. The Government of India has enacted Air Act in 1981 (Prevention and Control of Pollution) in order to arrest the deterioration in air quality. Central Pollution Control Board of India recommends limits to primary pollutants for different categories of land use as shown in Table I. US Environmental Protection Agency (EPA) suggests AQIs which highlights the severity of air pollution and risks of adverse health effects, is implemented by many cities. The AQIs are related to the overall status of air pollution via a pre-defined set of clearly identified criteria.

Pollutants	Time Weighted Average	Conc. In Ambient Air	
		Indl,Resi,Rural areas	Sensitive area
Sulphur dioxide (SO <sub>2</sub> ),µg/m <sup>3</sup>	Annual	50	80
	24 Hours	20	80
Nitrogen Dioxide (NO <sub>2</sub> ), µg/m <sup>3</sup>	Annual	40	30
	24 Hours	80	80
PM <sub>10</sub> (<10µm), µg/m <sup>3</sup>	Annual	60	60
	24 Hours	100	100
PM <sub>2.5</sub> (<2.5µm), µg/m <sup>3</sup>	Annual	40	40
	24 Hours	60	60
Lead (Pb),µg/m <sup>3</sup>	Annual	0.5	0.5
	24 Hours	1	1
Carbon Monoxide (CO)mg/m <sup>3</sup>	8 Hours	2	2
	1 Hour	4	4
Arsenic(As),ng/m <sup>3</sup>	Annual	6	6
Nickel (Ni),ng/m <sup>3</sup>	Annual	20	20

Table 1: National Ambient Air Quality Standards (NAAQS)

(Source: CPCB, 2011)

These criteria should be universal and irrespective of the level of pollution. It should be sufficiently flexible to account for different levels of population exposure, variable meteorological and climatic conditions occurring in an area as well as the sensitivity of flora and fauna (Environmental Protection Agency, 1998).

## II. MATERIALS AND METHODOLOGY

### A. Study Area:

Mysuru is the fastest growing tier 2 cities in India with a total vehicle population of around 6.14 lakhs. Mysuru district is a tourist destination, offering several attractions ranging from the royal splendor of Mysuru City and its

fabulous Dasara festival to the exquisite temples, pilgrimage centres and scenic spots. The traffic congestion contributes greater to deteriorating environment in urban communities. In the last few years, about 70% of ambient air quality degradation in Mysuru is affected by transportation activities.

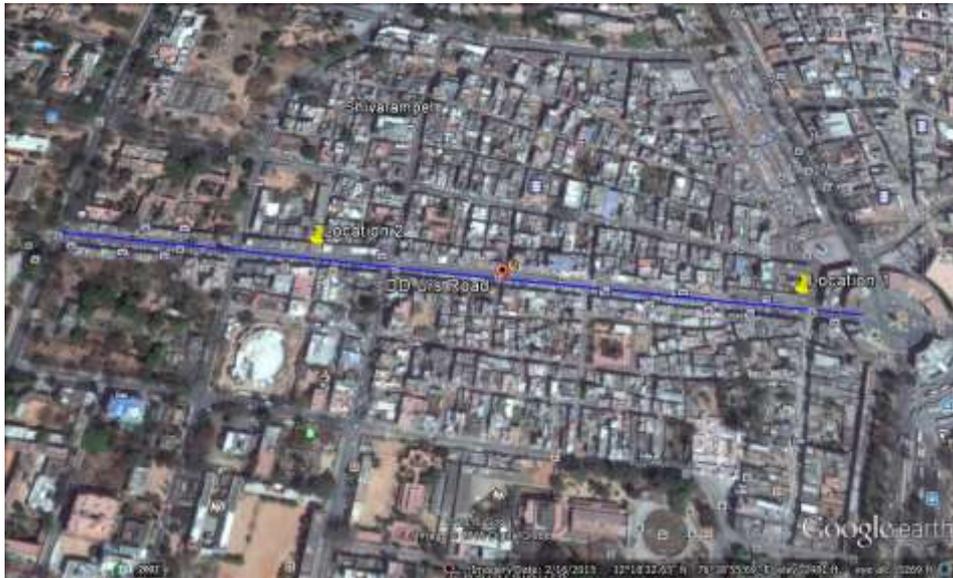


Fig. 1: Sampling Stations of the Study Area

**B. Data Collection Methods:**

Air quality monitoring stations were selected and sampling was conducted twice in a month during January to May 2015 using Envirotech APM 460 BL High Volume Air Sampler. Simultaneously meteorological data collection and traffic monitoring were also carried out.

**C. Air Quality Indices:**

In 1976 the EPA established a uniform AQI, also called the Pollutant Standard Index (PSI), for the use of state and local agencies to assess urban air quality on a voluntary basis. The AQI relates ambient pollutant concentrations to index values on a scale from 0 to 500. Table II shows the AQI ranges, corresponding health affects and associated color codes suggested by EPA (2003).

Index values	Description	Color codes	Meaning
0-50	Good	Green	Satisfactory
51-100	Moderate	Yellow	Acceptable
101-150	Unhealthy for sensitive groups	Orange	Health message for members of sensitive groups.
151-200	Unhealthy	Red	Everyone may begin to experience health effects; more serious health effects for sensitive groups.
201-300	Very unhealthy	Purple	Health warnings of emergency condition
301-500	Hazardous	Maroon	Health alert; everyone may experience more serious health effects.

Table 2: AQI Levels of Health Concern

(Source: EPA, 2003)

In order to study the air quality in Mysuru a typical city roadway, Devraj Urs Road is selected and is one of the major roadways in the city. Fig. 1 show the sampling stations of the study area considered.

Equation (1.1) is used to calculate AQI in the present study.

$$I = \frac{I_{high} - I_{low}}{C_{high} - C_{low}} (C - C_{low}) + I_{low} \quad (1.1)$$

Where: I is the air quality index for the pollutant; C is the pollutant concentration;  $C_{low}$  is the concentration break point  $\leq C$ ;  $C_{high}$  is the concentration break point  $\geq C$ ;  $I_{low}$  is the index break point corresponding to  $C_{low}$ ;  $I_{high}$  is the index break point corresponding to  $C_{high}$ .

**III. RESULTS AND DISCUSSIONS**

**A. Windroses Plots:**

Based on the meteorological data collected, windroses are plotted using WRPLOT view during December 2014 to May 2015, as described in “Fig. 2”.

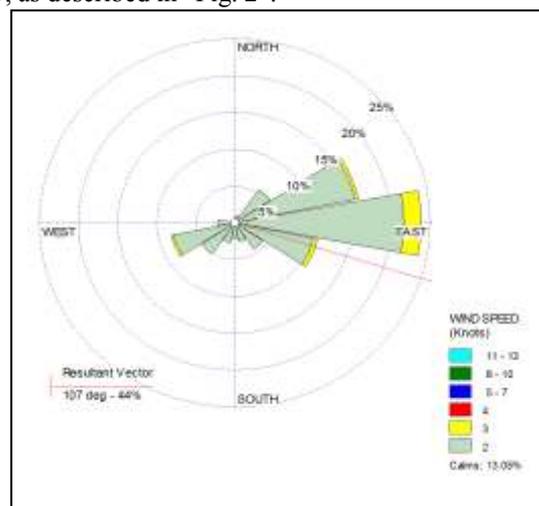


Fig. 2: Average Windrose Plot for Sampling Duration

**B. Air Quality Monitoring Results:**

In present work an attempt has been made to study the seasonal variations of air quality for two seasons viz winter

and summer. It is observed that the concentration of the pollutants is high in winter than in summer season. The values of NO<sub>2</sub> and SO<sub>2</sub> are within the limits as prescribed by NAAQS whereas the value for PM<sub>10</sub> exceeds. "Fig. 3A" and "Fig. 3B," show the concentration of NO<sub>2</sub>, SO<sub>2</sub> and PM<sub>10</sub> observed during winter and summer season at location 1 and 2.

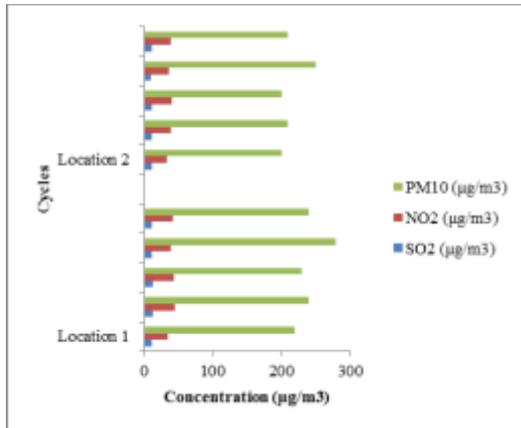


Fig. 3: A. Ambient Air Pollutants Concentration during Winter Season

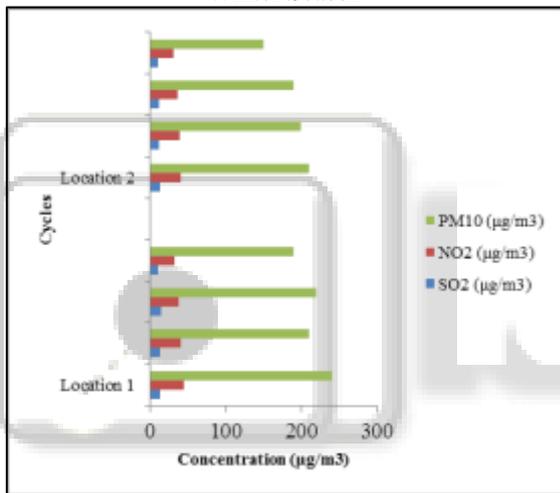


Fig. 3: B. Ambient Air Pollutants Concentration during Summer Season

C. AQI:

AQI is calculated based on the equation (1.1). And the results show that the air pollution levels at both the locations can be characterised as "Good" for NO<sub>2</sub> and SO<sub>2</sub> and "Unhealthy for Sensitive Groups" for both the seasons. The AQI levels are as shown in the "Fig. 4A" and "Fig. 4B".

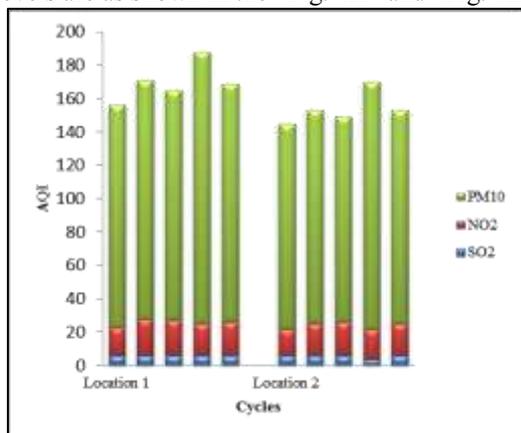


Fig. 4: A. AQI during Winter Season

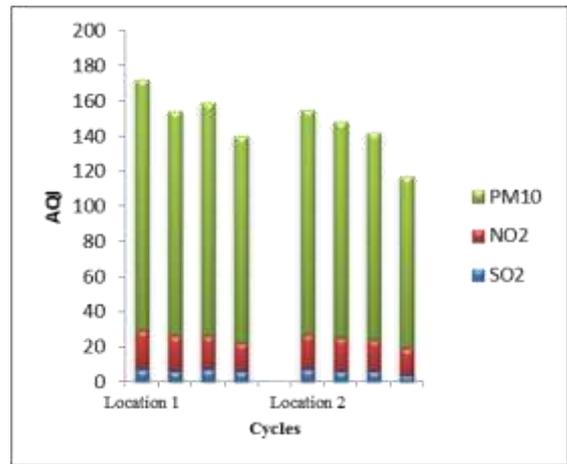


Fig. 4: B. AQI during Winter Season

IV. CONCLUSION

According to the present study the AQI values suggest that the air quality is unhealthy for sensitive groups. To improve the air quality it is suggested to maintain the vehicles in good condition, modify the old vehicles. Usage of good quality fuels lessens the emission of harmful pollutants. Once the destination is reached it is advised not to use the vehicles to nearby places so that the air quality can be improved to some extent.

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