

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 7, Issue 12, December 2018

# Assessment of AQI Measurement in Different Areas of Davangere City and its Effect on Human Health

Kole Prashant Prakash<sup>1</sup>, Dr. G Manavendra<sup>2</sup>, Mr. Deviprasad N Mirashi<sup>3</sup>

P.G. Student, Department of Mechanical Engineering, Bapuji Institute of Engineering and Technology,  
Davangere, India<sup>1</sup>

Associate Professor, Department of Mechanical Engineering, Bapuji Institute of Engineering and Technology,  
Davangere, India<sup>2</sup>

Assistant Professor, Department of Mechanical Engineering, Bapuji Institute of Engineering and Technology,  
Davangere, India<sup>3</sup>

**ABSTRACT:** Present study is to assess ambient air quality in Residential, Industrial, Traffic, and Gardening area of Davangere city. Six sampling locations are selected. A pollutants are PM<sub>2.5</sub>, SO<sub>2</sub> and NO<sub>2</sub> measured during April and May 2018. Criteria of pollutants measured in sampling locations were found well within NAAQ standards. In this study air quality condition in davangere city is moderate at BIET Boys Hostel and MCC B Block. The air quality condition is unhealthy at Karur Industrial area, Jayadeva circle, Big bazaar and Gandhi circle. Increasing population and vehicular density shows that reduction of greenery and lung spaces; it's affecting air quality in city. It concluded that city requires regular inspection of ambient air quality due to chances of increase in pollutants level in future. The health effects of PM<sub>2.5</sub>, SO<sub>2</sub> and NO<sub>2</sub> have been presented.

**KEYWORDS:** PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>2</sub> and Health effects.

### I. INTRODUCTION

The term "air pollution" describes that, substances that are artificially introduced into the air. Air pollution leads from gases and airborne particles which, in excess, are harmful to human health, building and the ecosystems[1]. Contamination of air is a considerable major issue with respect to ecosystem and their environment. That impacts on human health and other activities of plants and animals, also that leads to deterioration of materials and reduces the quality of visibility and that may cause to bad odors. Contaminants are emitted naturally by volcanoes, forest fires etc, but the impact of natural emission of contaminants is very less compared to emissions from manmade sources, major contributors for manmade sources are stationary sources like power plants and industries and mobiles sources like fuel burning by vehicular motion. Environmental pollution, which is commonly thought to be the result of human activity; in general and industrial revolution in particular, is preceded by man himself [2]. The natural processes such as volcanic eruption, forest fire, dust storms etc., are the sources of major pollutants. The magnitude of the problem of environmental pollution increased immensely with industrialization and urbanization[3]. The human contribution to pollution through industries and automobiles has suppressed nature's contribution by thousand folds[4]. The pollution load has reached an alarming level in highly industrialized countries, which leads to reduction in scavenging action of the atmosphere. Industrialization is not only a symbol of prosperity, but also a major source of pollution. Due to industrialization associated with urbanization, many country's transportation is playing a vital role in modernization of human race and has contributed much to air pollution by the way of automobile exhaust, emitting obnoxious gaseous pollutants such as CO/CO<sub>2</sub>, hydrocarbonsetc. Industrial accidents can cause huge input of air pollutants into the

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 7, Issue 12, December 2018

atmosphere and this emission may lead to the permanent degradation of the natural environment. As the air moves from one place to another, in turn the air pollutants are being carried to great distance and hence the air pollution is an international issue rather than local problem.

## II. RELATED WORK

- **AkhilNath .G et al.**, Carried out ambient air quality studies in Kerala state, India. The kerala state pollution board has mainly selected four stations for ambient air quality monitoring in three districts. In Thrissur district they selected Poonakunnam, in Malappuram selected Kakkanchery and Kozhikode selected Nallam and KSRTC were selected for Ambient Air Quality (AAQ) monitoring in Kerala state. The selected sites were places of maximum population, heavy traffic, and commercial areas. The data collected between years 2005-2010 for ambient air quality of the above said station. There is increasing trend in the concentration of pollutants and the KSRTC stand, Kozhikode seems to be having higher API value of about 82.
- **Jay S. Patel et al.**, [6] The air pollutants data were collected for a year 2016 at 4 locations in Delhi from Central Pollution Control Board. The air pollutants analyzed are Particulate matter ( $PM_{2.5}$ ), Nitrogen dioxide ( $NO_2$ ) and Sulphur dioxide ( $SO_2$ ). The locations selected are Dwarka, R.K Puram, Panjabi Baugh, and AnandVihar. The AQI were calculated using IND-AQI procedure. It has been observed that AQI's values of all four locations falls under very poor category. It affects the health and mental status of urban dwellers. It was found that AQI values were very high during winter season and low during monsoon season.
- **Lokeshappa et al.**, Carried out ambient air quality studies Bangalore city and determining the air quality index in the Residential, Industrial and Sensitive areas of the 13 selected locations of the Bangalore city. Sulphur dioxide ( $SO_2$ ), oxides of nitrogen ( $NO_x$ ) and R.S.P.M were collected over six sites in Bangalore. The R.S.P.M levels at all selected sites exceeds the prescribed limits as stipulated by Central Pollution Control Board (CPCB) New Delhi. A part from this the  $SO_2$  and  $NO_x$  levels in industrial areas remain under prescribed limits of CPCB. The data of air pollutants were collected from twelve sites in residential, industrial and commercial areas of the city for a period of 24 hours in winter season of the year, 2009-2010.
- **MarilenaKampa et al.**, Hazards chemical by natural or anthropogenic activities may cause adverse effect on human health and environment air pollution such as carbon monoxide, sulphur dioxide, nitrogen oxides, volatile organic compounds, ozone, heavy metals and respirable particulate matter which occurs due to combustion of fossil fuels. Air pollution causes acute as well as chronic effect on human health which affects number of different system and organ. It has wide range affecting from minor upper respiratory irritation to chronic respiratory and heart or asthmatic attack.
- **Leigh A. Beamish et al.**, Impacts of air pollution on health have recently received much attention. Exposure of air pollutants has been link to lung and cardiovascular disease an increase in hospital admission and mortality. Inflammatory bowel disease has suggested that factors could contribute to disease pathogenesis. Exposure of the bowl to air pollutant occurs via mucociliary clearance of PM from the lungs as whereas ingestion via food and water source. The effects of air pollutant have direct effect on epithelial cells, systemic inflammation and immune activation and modulation of intestinal micro biota.

## III. METHODOLOGY

### 3.1 Study Area

For the present study Davangere city is considered. Davangere is the sixth largest city in the state of Karnataka and is well-known for holy city of educational institutions. It is also known as the Manchester of Karnataka. It is located at 264 km from Bangalore. Its lies at 79°59'27" E longitude and 14°28' N latitude (602.5 m above the MSL). However, these days, due to rapid commercialization and urbanization, the level of pollution has increased rapidly.

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 7, Issue 12, December 2018

### 3.2 Sampling station

6 sampling stations are selected for the monitoring, PM<sub>2.5</sub>, SO<sub>2</sub> and NO<sub>2</sub>. Davangere city map was divided in to north, south, east and west direction taking in to account and concentrating mainly on the basis of population based on these five locations were selected as follows:

Table 1: Location of Survey areas

Sl no	Areas	Name of sampling station
1	Industrial Area	Karur Industrial Area near DC office
2	Traffic Area	Jayadeva circle, Gandhi circle
3	Residential Area	BIET Boys Hostel
4	Commercial area	Big Bazaar near Harihara Road
5	Garden area	Water Head tank, MCC B Block

### 3.3 Parameters considered

The parameters considered for the study oxides of sulphur, oxides of nitrogen and particulate matter<sub>2.5</sub> (PM<sub>2.5</sub>) to calculate the Air Quality Index. The samples are collected by above parameters based on 24 hours and oxides of nitrogen, oxides of sulphur are collected 24 hours on 8 hour basis. The samples are collected in months of April and May

### 3.4 Air Quality Index

AQI is the number which is utilized to report the everyday air quality. This number is used by the government organization to convey to general society how contaminated the air right now. The following computation was used to drive the air quality index of the sites under consideration:

$$AQI = \frac{1}{3} \times (PM_{2.5} / SPM_{2.5} + SO_2 / SSO_2 + NO_2 / SNO_2) \times 100$$

Where,

PM<sub>2.5</sub>- individual values of particulate matter<sub>2.5</sub>

SO<sub>2</sub> - individual values of sulphur dioxide

NO<sub>2</sub> – individual values of nitrogen dioxide

SPM<sub>2.5</sub>, SSO<sub>2</sub> and SNO<sub>2</sub> – standards of ambient air quality of oxides of sulphur, oxides of nitrogen and particulate matter<sub>2.5</sub>

Table 2 : AQI standards[2]

Sl.no	AQI values (AQI value in this range)	Levels of health concern (Air quality condition)
1	0-50	Good
2	51-100	Moderate
3	101-150	Unhealthy for sensitive group
4	151-200	Unhealthy
5	201-300	Very unhealthy
6	301-500	Hazardous

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 7, Issue 12, December 2018

## IV. EXPERIMENTAL RESULTS

### 4.1 Variation of PM<sub>2.5</sub>, SO<sub>2</sub> and NO<sub>2</sub> in ambient air in selected sampling locations of Different areas of Davangere city

The pollutants concentration shows an increasing trend from the month of April to May due to the climate change, increase in vehicular emission and other activities. The trends in the level of pollutants such as PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>2</sub> monitored during the sampling period a represented in Fig 1 to Fig 3

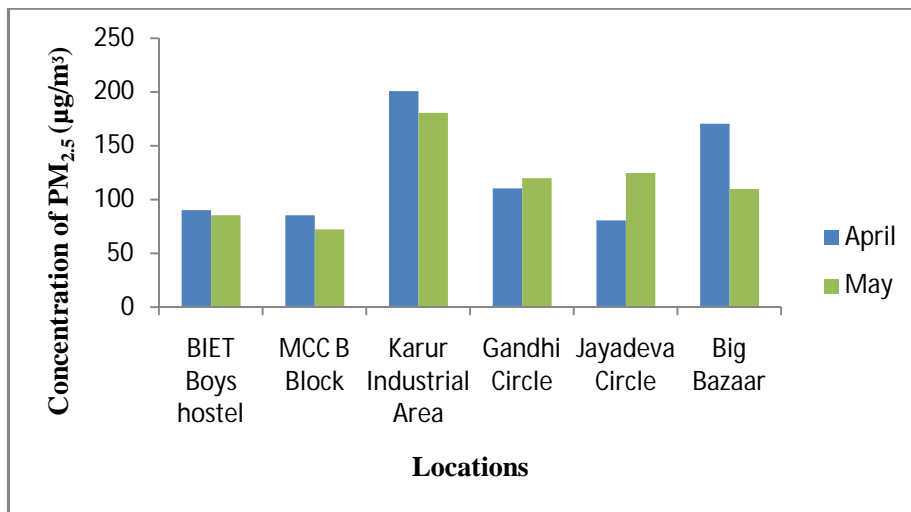


Fig 1: Concentration of PM<sub>2.5</sub> (µg/m<sup>3</sup>) during the two months at six sampling locations

The present study indicates the air quality status of Residential areas of Davangere City at six sampling locations. The concentrations of SPM during the sampling period at six sampling locations are shown in the Fig. 1. The graph shows that particulate matter (PM<sub>2.5</sub>) concentration in the study area varied between 72.5 µg/m<sup>3</sup> to 180.5 µg/m<sup>3</sup>. The particulate matter concentration in the Karur Industrial Area is more when compared to other locations may be due to vehicular emission.

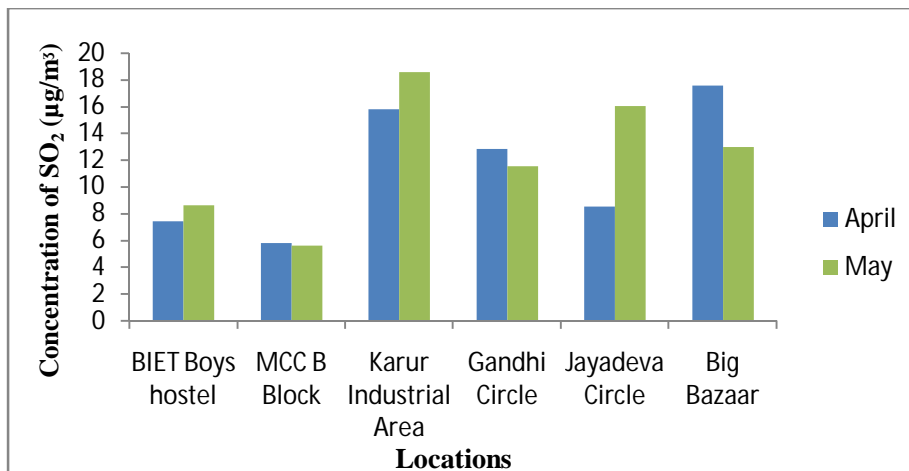


Fig 2: Concentration of SO<sub>2</sub> (µg/m<sup>3</sup>) during the two months at six sampling location

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 7, Issue 12, December 2018

The concentrations of SO<sub>2</sub> during the sampling period at six sampling locations are shown in the fig .2. The graph shows that Sulphur dioxide (SO<sub>2</sub>) concentration in the study area varied between 5.62 µg/m<sup>3</sup> to 18.56 µg/m<sup>3</sup>. The Sulphur dioxide concentration in the Karur Industrial Area is more when compared to other locations may be due to vehicular emission and commercial activities.

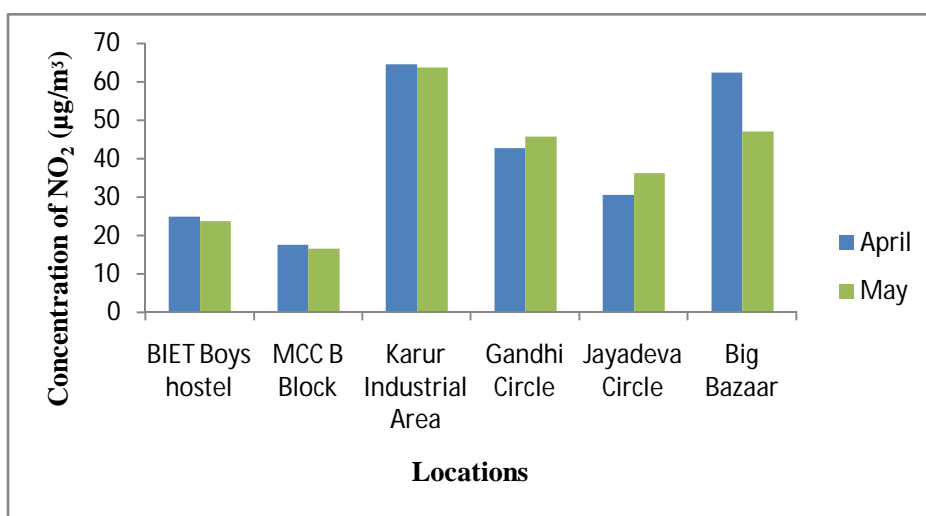


Fig 3: Concentration of NO<sub>2</sub> (µg/m<sup>3</sup>) during the two months at six sampling location

The concentrations of NO<sub>2</sub> during the sampling period at six sampling locations are shown in the Fig .3. The graph shows that nitrogen dioxide (NO<sub>2</sub>) concentration in the study area varied between 16.70 µg/m<sup>3</sup> to 64.33 µg/m<sup>3</sup>. The nitrogen dioxide concentration in the Karur Industrial Area is more when compared to other locations may be due to vehicular emission. It is surrounded by commercial streets, bus stands and also with railway station.

### 4.1.1 Air quality index for study area and to compare it with standard limits of National Ambient Air Quality Index (NAAQS)

Table 3: AQI in study areas

Sl. No	Areas	Name of sampling station	AQI value	Air quality condition
1	Industrial Area	Karur Industrial area	173.24	Unhealthy
2	Traffic Area	Jayadeva Circle	140.33	Unhealthy
3	Commercial Area	Big Bazaar	129.76	Unhealthy for sensitive groups
4	Residential Area	BIET Boys Hostel	95.086	Moderate
5	Garden Area	MCC B block	78.34	Moderate
6	Provisional Area	Gandhi Circle	138.09	Unhealthy

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 7, Issue 12, December 2018

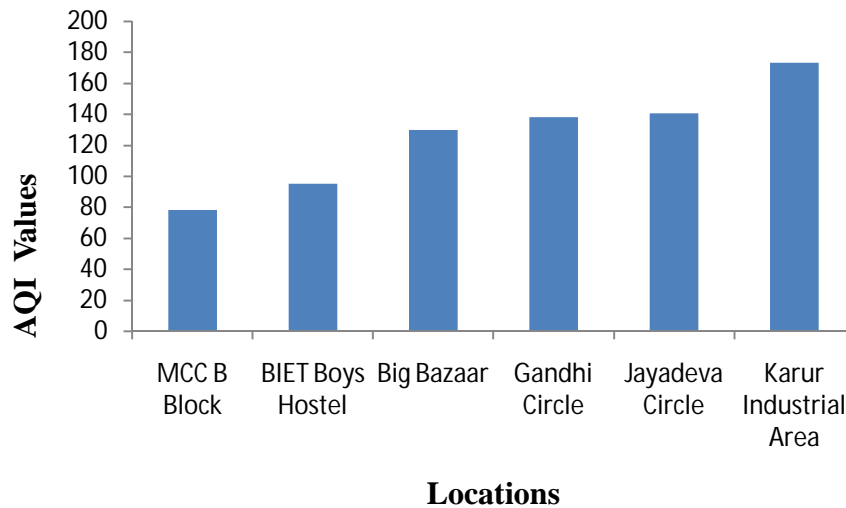


Fig 4: AQI Value verses six sampling locations

The Fig 4.represents air quality in davangere city is moderate at BIET Boys Hostel and MCC B Block. The air condition is unhealthy at Karur Industrial area, Jayadeva circle, Big bazaar and Gandhi circle.

## 4.2 Health effects

### 4.2.1 Particulate matter 2.5

Increased awareness of health problems related to air pollution arising from urbanization and industrialization has, especially during the last two centuries, gradually created a demand for more efficient emission controls, especially in the developed world, and thus there has been a notable decrease in both the emissions and ambient concentrations of many air pollutants. Recently, problems caused by atmospheric particulate matter in urban air have received greater attention. Various health effects attributable to PM have been documented. The most conclusive evidence has been provided by cohort and time series studies that have linked elevated concentrations of PM to increased morbidity and mortality.

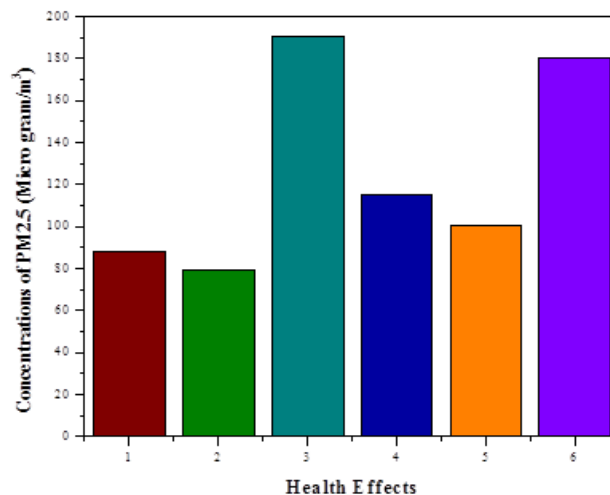


Fig 5: Concentration of PM<sub>2.5</sub> (µg/m<sup>3</sup>) with health effects

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 7, Issue 12, December 2018

The Fig 5 shows that the different health effects of PM<sub>2.5</sub> at different concentration. Health effects are mentioned below

- 1- Increases in respiratory and cardiac disease
- 2- Increases the number and severity of asthma attacks, bronchitis and other lung diseases
- 3- Increase in respiratory diseases such as pneumonia, chronic obstructive pulmonary disease (COPD), and asthma, Risk of Lung Cancer Mortality
- 4- Increase in hospital admissions of children with respiratory disease, Lung Cancer Mortality
- 5- Increase of lower respiratory illness among children, Lung Cancer Incidence
- 6- Increase the likelihood of respiratory symptoms and aggravation of lung disease, chronic obstructive pulmonary disease (COPD), and asthma, Risk of Lung Cancer Mortality

### 3.2.2 Sulphur dioxide

Sulphur dioxide is a colorless gas released from burning of coal, high Sulfur coal and diesel fuel. SO<sub>2</sub> and particulates together forms a major portion of the pollutant load in many cities. It can cause irritation, reduction of visibility and some respiratory diseases. Healthy person experience bronchoconstriction at 1.6 ppm of SO<sub>2</sub>, for a very few minutes exposure at 8-12 ppm level throat irritation occurs. At 20 ppm, immediate cough and eye irritation results. Even for exposure of SO<sub>2</sub> at 400-500 ppm is dangerous for life. Sulfur dioxide (SO<sub>2</sub>) harms human health by reacting with the moisture in the nose, nasal cavity and throat and this is the way in which it destroys the nerves in the respiratory system. When the concentration of SO<sub>2</sub> is higher than the prescribed standards of World Health Organization (WHO), it effects especially those suffering from asthma, bronchitis, lung and cardiac problems. SO<sub>2</sub> can be dangerous to the respiratory system and the functions of the lungs and can also leads to irritation of eyes.

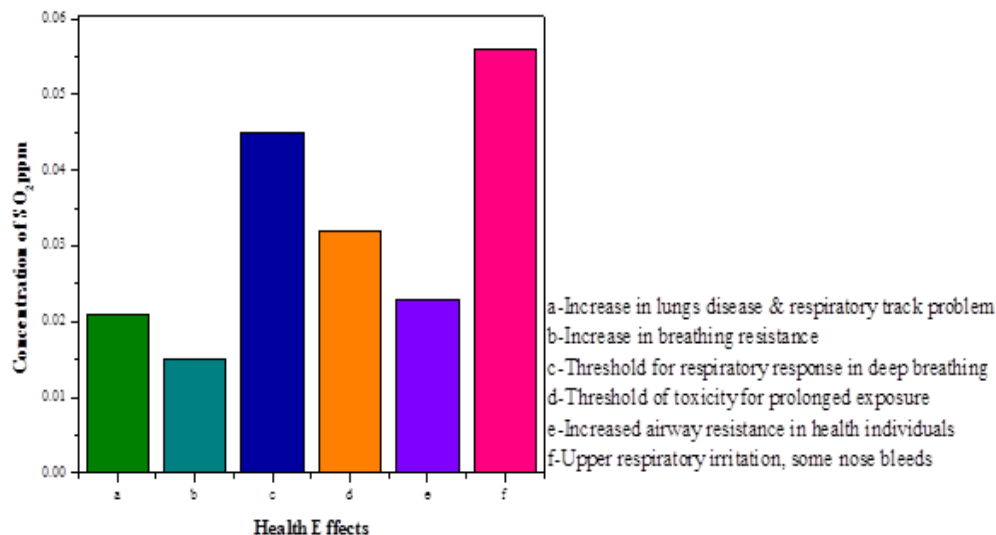


Fig 6: Concentration of SO<sub>2</sub> (ppm) with health effects

The Fig 6 shows that the different health effects of SO<sub>2</sub> at different concentration, different colour indicates the different health effects.

### 4.2.3 Nitrogen dioxide

Nitrogen dioxide is an important atmospheric trace gas, not only because of its health effects but also because it absorbs visible solar radiation and contributes to impaired atmospheric visibility as an absorber of visible radiation it could have a potential direct role in global climate change if its concentrations were to become high enough. It is, along with nitric oxide (NO), a chief regulator of the oxidizing capacity of the free troposphere by controlling the build-up and fate of radical species, including hydroxyl radical



## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 7, Issue 12, December 2018

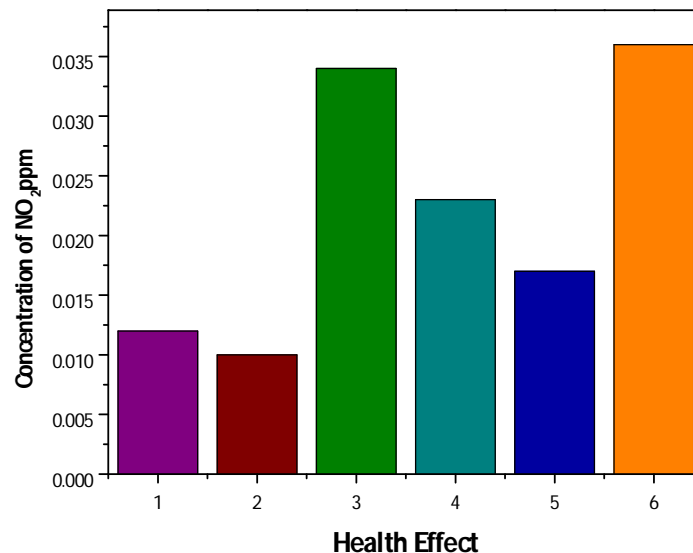


Fig 7: Concentration of NO<sub>2</sub> (ppm) with health effects

The Fig 7 shows that the different health effects of NO<sub>2</sub> at different concentration. Health effects are mentioned below

- 1- No change in specific airway resistance
- 2- No significant effects on specific airway resistance
- 3- Decrease in FEV<sub>1</sub>, FVC, and PEF<sub>R</sub>; increase in SR<sub>aw</sub>; no change in cold air response
- 4- No effects on spirometry or specific airway resistance; variable increase in methacholine reactivity
- 5- No effects on function or reactivity to cold air
- 6- No effects on bronchitis alone; possible decrease in quasistatic compliance

Note: FEV<sub>1</sub> = forced expiratory volume in 1 second; SR<sub>aw</sub> = specific airway resistance; FVC = forced vital capacity; PEF<sub>R</sub> = peak expiratory flow

### V. CONCLUSION

In this study air quality condition in Davangere city is moderate at BIET Boys Hostel and MCC B Block. The air quality condition is unhealthy at Karur Industrial area, Jayadeva circle, Big bazaar and Gandhi circle. The growing population in Davangere city shows an increasing trend leading to change in the existing land use pattern, increase in the vehicular density and reduction of greenery and lung spaces affecting the air quality in the city. There is so many health effects by air pollution. It causes cancer, eye irritation, lung diseases, respiratory diseases etc.

### REFERENCES

- [1] M. Kampa, "Human health effect of air pollution", (ELSEVIER), PP: 362-367, 2008
- [2] D. P. Nagarajappa, "Monitoring of SPM, SO<sub>2</sub>, NO<sub>2</sub> and Air Quality Index in Selected Areas of Davangere City During Summer Season", (GRD) volume-2, ISSN:2455-510, 2017.
- [3] Gowtam. Sarella, "Ambient Air Quality Analysis Using Air Quality Index A Case Study of Vapi", (IJIRST), volume-1, ISSN:233349-6010, 2015
- [4] Anitha K. G., "Assessment of Air Quality Index of Davangere City- A Case Study", (IJETR), volume-3, ISSN:2321-0869, 2015
- [5] Akhil Nath, G., "Air Quality Study of Selected Areas in Kerala State", (IRJET), volume-4, ISSN:2395-0072, 2017
- [6] Jay. S. Patel, "Ambient Air Quality Assessment Using Air Quality Index Of Delhi", (ICRISET), volume-3, ISSN:2349-6010, 2017
- [7] Lokeshappa, "Air Quality Indexing for Selected Areas in Bangalore City, Karnataka State India", (IJST), volume-3 (2014), ISSN:23198753, 2015
- [8] Leigh a. Beamish, "Air Pollution: An Environmental Factor Contributing to Intestinal Disease", (ELSEVIER), volume-5, PP: 279-286, 2011s