ISSN XXXX XXXX © 2017 IJESC

Research Article Volume 7 Issue No.5

A Comparative Study of Ambient Air Quality of Residential, Commercial and Industrial Area of Gorakhpur

Rohit Kumar Gupta[1] Dr. A.K. Mishra[2]
PG Student (Environmental Engineering) [1], Assistant Professor[2]
Department of Civil Engineering
Madan Mohan Malaviya, University of Technology, Gorakhpur, Uttar Pradesh, India

Abstract:
Urban air quality is a matter of concern because of exposure of large number of people to it. This paper assesses the ambient air quality status in Gorakhpur city. One site under residential area, one industrial area and one commercial area were selected purposively to spotlight an overview of total air quality of this region. The air quality was assessed based on measuring three air pollutants namely Respirable Suspended Particulate matter (RSPM), Oxide of Nitrogen (NO_X) and Sulphur Dioxide (SO_2). The analysis of air quality on this paper is January 2015 to December 2015. The average concentration of SO_2 at all location in each year has remains under the prescribed limit by NAAQS but pollutant like RSPM (PM_{10}) and NO_X level at all location in each year has exceeded the prescribed limit.

Key words: Air Quality, Air Pollutants, Description of Area, Concentration of Pollutant, Health Effects.

I. INTRODUCTION

Environmental pollution is a common problem in both developed and developing countries. Air Pollution is one of the serious problems faced by the people globally, especially in urban areas of developing countries, which is not only rapid growth of population but also industrialization [1]. Air is rendered impure by a) Respiration of man and animals, b) Decomposition of organic matter, c) Combustion of coal, gas, oil etc d) Trade, traffic and manufacturing processes that given off dust, fumes vapors and gases. Urban air pollution is a matter of concern in today's date because of exposure of large number of people to it and their adverse effects on human and environmental heath [2]. In the developing countries, air quality crisis in cities is attributed to vehicular emission which contributes to 40-80% of total air pollution. Three stations mentioned in the table 1 covering round area of Gorakhpur city were selected for ambient air quality assessment. These stations were selected on the basis of activity i.e., residential, commercial and industrial.

II. STUDY AREA DESCRIPTION

The district of Gorakhpur lies between Lat. 26°13′N and 27°29′N and Longitude 83°05′E and 83°56′E. The district occupies the north-eastern corner of the state along with the district of Deoria, and comprises a large stretch of country lying to the north of the river Rapti, the deep stream of which forms its southern boundary with the Azamgarh district. On the west, the boundary marches along Basti and on the east adjoins Deoria and the ChhotiGandakNadi and further south the JharnaNala forms the dividing line. To the north lies Nepal. Gorakhpur has also a lake RamgarhTaal Lake, which is 18 km bigger. It is bigger than Dal Lake of Kashmir which is of 15.5 km RamgarhTaal. It is located on the bank of river Rapti and Rohani, a Ganges tributary originating in Nepal that sometimes causes severe floods. The Rapti is interconnected through many other small rivers following meandering courses across the Gangetic Plain. The district presents characteristics distinct from natural features of the western districts of Uttar Pradesh. The urbanization and industrialization has made rapid changes and expanding residential areas [3]. Three monitoring location representing different activities area i.e., one in residential, one in commercial and one is industrial area were selected for the study.

Table.1. Monitoring Locations for Ambient Air Quality in Gorakhpur City

S. No	Locations	Activities
1	Madan Mohan Malaviya University of Technology (MMMUT)	Residential
2	Jalkal Bhawan	Commercial
3	Gorakhpur Industrial Development Area (GIDA)	Industrial

(Source: UPCB, 2011)

III. METHODOLOGY

For SPM and RPM analysis, the high volume air sampler (HVAS) APM 460 NL was used. The concentration was measured using quantitative analysis with glass fiber filter paper of 20.3×25.4 cm. The sulphur dioxide (SO2) concentration was measured using Potassium Tetrachloromercurate (TMC) as absorbent and titrated with mercuric chloride, 0.066g EDTA and 6g potassium chloride in water and bring to the mark in 1 liter volumetric flask. In this measurement Improved West and Geake

Methods are used. The oxides of nitrogen (NOX) concentration was measured using 4g of sodium hydroxide in distilled water, add 1 g of sodiumarsenite and diluted to 1 liter with distilled water. In this measurement Modified Jacob and Hochheiser Methods are used.

IV. RESULT AND DISCUSSION

Air pollution is a major threat to human health and environment, especially pollution from unscientific disposal sites creates acute health problems to the surroundings habitants [4]. The continue inhalation of particulate matters consists of dust, fumes, mist and smoke cause lung damage and respiratory problems [5]. In this study we have deal with three major pollutants RSPM, SO_2 and NO_X.

IV.I. RSPM Scenario

The concentrations of RSPM in the study area ranged from 61.9-131.9 µg/m³ in MMMUT, 126.3-243.1µg/m³ in Jalkal Bhawan and 167.5-207.6 µg/m³ in GIDA. The concentration level of RSPM has exceeded at all the study sites except control site than the recommended standard (100µg/m³) by NAAQS. The RSPM values were in decreasing order from GIDA> Jalkal Bhawan > MMMUT.

Table.2. Concentration of RSPM in Residential, commercial and industrial area of Gorakhpur city during January 2015 to December 2015

S. No.	Month	RSPM		
		MMMUT	Jalkal Bhawan	GIDA
1	January	63.4	137.5	168.6
2	February	131.9	243.1	237.1
3	March	63.4	137.5	186.6
4	April	121.1	219.4	251.5
5	May	113.9	211.2	243.2
6	June	98.8	198.3	223.2
7	July	61.9	126.3	167.5
8	August	105.3	199.8	229.4
9	September	97.2	177.5	193
10	October	89.8	169.6	188.9
11	November	93.7	174.3	194.4
12	December	109.2	192.5	225.4

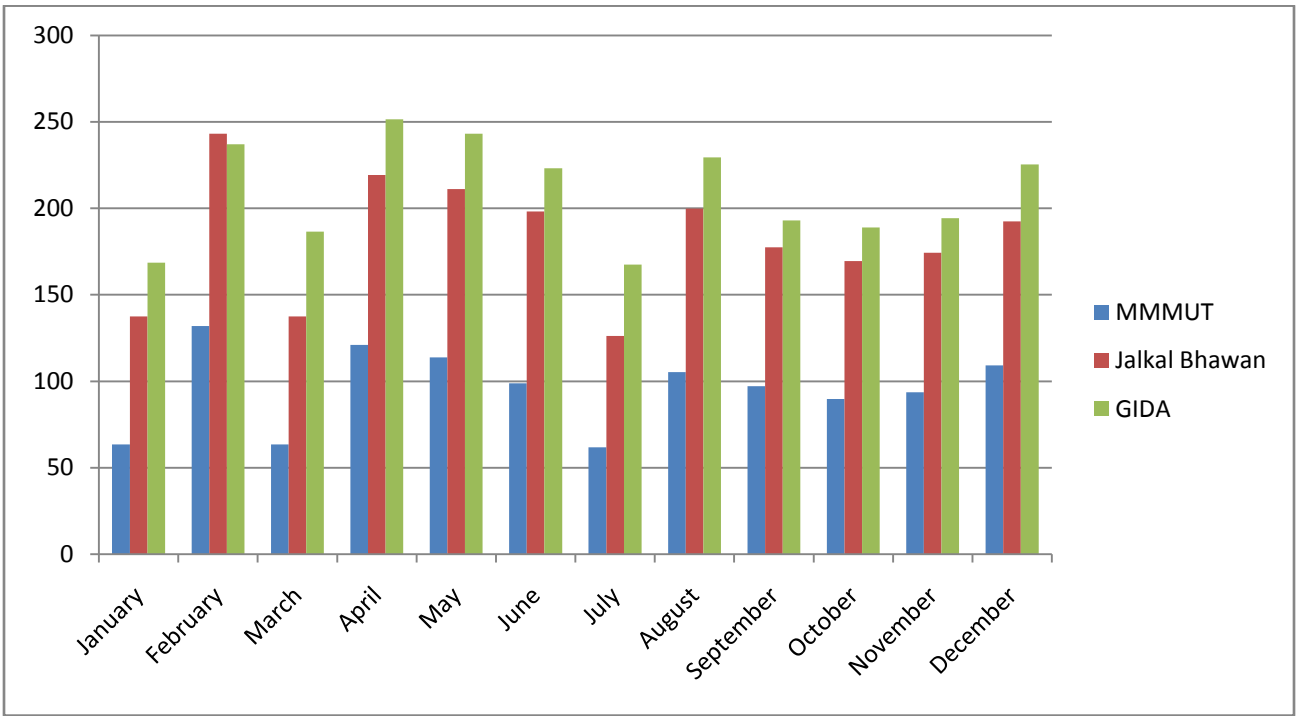

Figure.1. Concentration of RSPM in Residential, commercial and industrial area of Gorakhpur city during January 2015 to December 2015

IV.II. Oxides of Nitrogen (NO_X)

The concentrations of NO_X in the study area ranged from 16.9-27.5µg/m³ in MMMUT, 31.6-49.8µg/m³ in Jalkal Bhawan and 40.8-58.3 µg/m³ in GIDA. The concentration level of NO_X has exceeded at all the study sites except control site than the recommended standard (80µg/m³) by NAAQS. The NO_X values were in decreasing order from GIDA> Jalkal Bhawan > MMMUT.

Table .3. Concentration of NO_X in Residential, commercial and industrial area of Gorakhpur city during January 2015 to December 2015

S. No.	Month	Oxides of Nitrogen		
		MMMUT	Jalkal Bhawan	GIDA
1	January	19.4	33.6	54.9
2	February	27.6	43.3	58.2
3	March	19.4	33.6	54.9
4	April	25.2	49.8	55.2
5	May	22.8	46.1	58.3
6	June	18.4	43.8	53.8
7	July	17.6	31.6	40.8
8	August	17.3	42.5	54.6
9	September	19.3	46.4	53.8
10	October	17.3	43.3	54.6
11	November	16.9	39.5	49.2
12	December	17.5	41.5	51.5

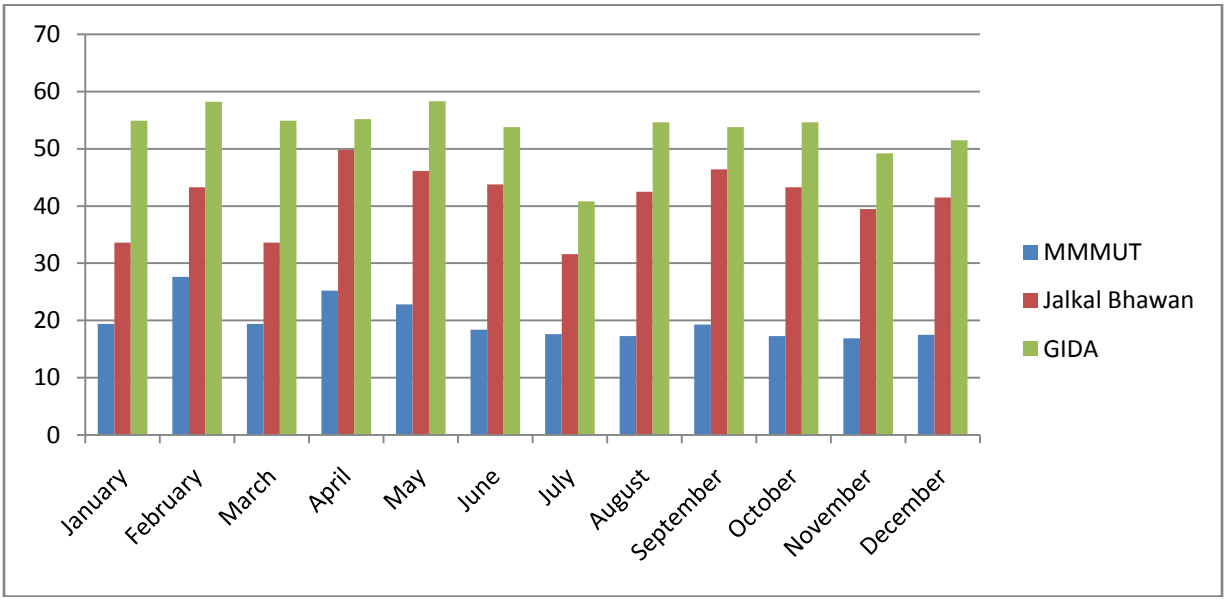

Figure .2. Concentration of NO_X in Residential, commercial and industrial area of Gorakhpur city during January 2015 to December 2015

IV.III. SULPHUR DIOXIDE (SO_2)

The concentrations of SO_2 in the study area ranged from 5.9-13.9µg/m³ in MMMUT, 13.7-23.6µg/m³ in Jalkal Bhawan and 24.5-36.1µg/m³ in GIDA. The concentration level of SO_2 has exceeded at all the study sites except control site than the recommended standard (80µg/m³) by NAAQS. The SO_2 values were in decreasing order from GIDA> Jalkal Bhawan > MMMUT.

Table.4. Concentration of SO_2 in Residential, commercial and industrial area of Gorakhpur city during January 2015 to December 2015

S. No.	Month	Sulphur Dioxide		
		MMMUT	Jalkal Bhawan	GIDA
1	January	9.4	17.8	25.4
2	February	13.9	18.8	36.1
3	March	9.4	17.8	25.4
4	April	11.5	17.4	28.2
5	May	10.5	19.3	27.9
6	June	8.5	19.6	24.7
7	July	8	13.7	24.5
8	August	7.2	21.3	25.4
9	September	7.5	23.6	28.8
10	October	6	21.9	29.3
11	November	5.9	20.1	27.3
12	December	6.8	22.9	29.2

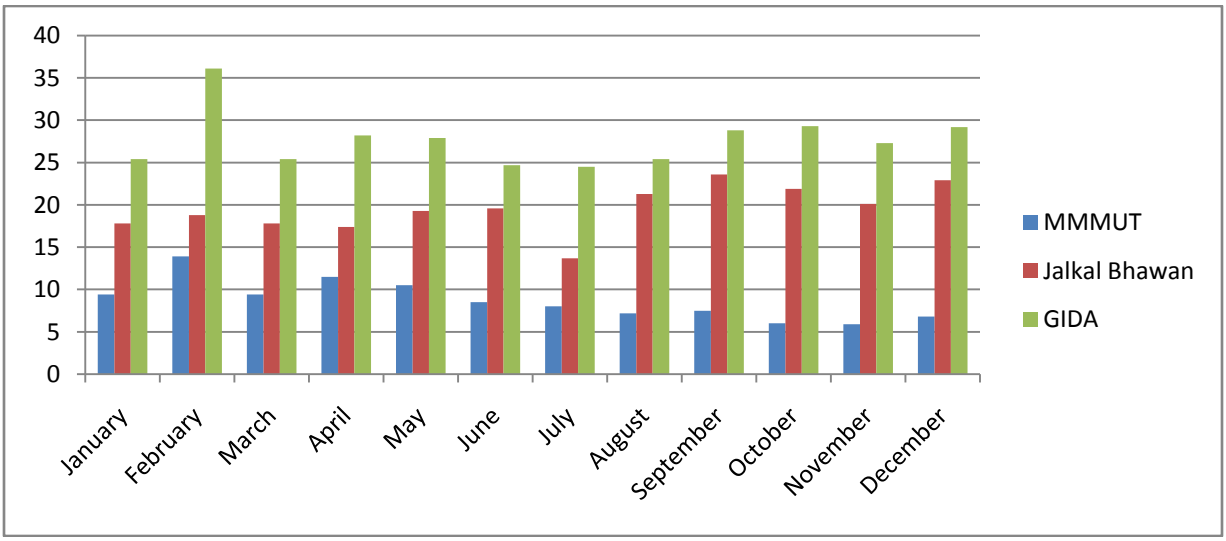

Figure.3. Concentration of SO_2 in Residential, commercial and industrial area of Gorakhpur city during January 2015 to December 2015

V. HEALTH RISK

At elevated levels, all the air pollutants will have adverse effects on human and environment. The accumulation of pollutants in the human body through inhalation of air is an important route [8]. The results of the present study revealed higher levels of SPM and RSPM. The dust released from various sources can produce a spectrum of diseases ranging from a simple cold to deadly diseases like cancer as reported by Bency*et al* [9]. The higher concentration of particulate matter causes acute and chronic respiratory disorders and lung damage in humans [10].Population residing in the vicinity of polluted region by high suspended particulate matter was reported to have ahigher risk of cardiovascular diseases [11]. The high amount of RSPM are either in polluted or moderately polluted category and might be due to the harmful effect of the RSPM dwelling in the area[8]. It is reported that the total daily mortality increased by approximately 1% for every 10µg/m³ increase in PM_{10} concentration. The concentration of NO_X was found to be above the permissible limit in some area (40µg/m³)while the concentration of $SO_2$is found to be below permissible limit (50µg/m³) of NAAQS (MoEF 2009).

VI. CONCLUSION

In the present study analysis of air pollutant such as PM_{10}, SO_2 and NO_X have been done for assessment of ambient air quality for Gorakhpur City and data analysis showed the following – The RSPM levels at all the monitoring location of residential, commercial and industrial area were higher than the NAAQS (60µg/m³).The concentration of gaseous pollutant, SO_2 was found the prescribed NAAQS (50µg/m³) at all the location while NOX was found to be above the permissible limit in GIDA and Jalkal Bhawan (40µg/m³) and shown in above figure. Overall

results indicate that RSPM along with the gaseous pollutant are one of the major causes for deterioration of ambient air quality of the city. Unlimited growth of vehicles, their technological development and release of invisible tailpipe pollutant emission are serious debatable issues even for policy makers. Use of different type of fuels namely petrol, diesel, LPG and CNG make the environment more complex regarding the air quality and their synergistic effect on human health.

VII. RECOMMENDATION

Subsidized public mass transport must be introduced to minimize use of personal vehicles, improvement in the traffic management system. For minimizing the pollution in the surrounding areas, some remedial measure like plantation and green belt can be formed that area for betterment of human life. Traditional methods of power supply should be modernized.

VIII. REFERENCES

[1]. Nagdeve, D. A (2004).: Urban air pollution and its influence in health in India. IIPS Mumbai, ENVIS center, 01(03).

[2]. Barman, S.C Kumar, N and R. Singh (2010): Assessment of urban air pollution and its probable health impact Jouranal of Environment biology 31(60, 931-920.

[3]. UPCB 2010, Action Plan, Abatement of Pollution in Critically Polluted Area of Gorakhpur, UPCB, 2010.

[4]. Visvanathan, C., &Trankler, J. 2003. Municipal solid waste management in Asia: a comparative analysis. In Workshop on Sustainable Landfill Management (pp. 3-5).

[5]. Winder, C. & Neill H. Stacey. 2004. Occupational Toxicology, (Second Edition). 71-114. Taylor and francis, CRC Press. UK.

[6].CPCB (2000), "Parivesh" Annual report for session 1999-2000, from Environmental Information System (ENVIS) from Central Pollution Control Board. From Good Intentions to Proven Interventions: Effectiveness of Actions to Reduce the Health Impacts of Air Pollution. Environmental Health Perspectives, 119: 29-36.

[7].CPCB (2003), "Guidelines for Ambient Air Quality Monitoring" Report Under Central Pollution Control Board, Ministry of Environment & Forests.

[8]. Barman, S. C., Kumar, N., Singh, R., Kisku, G. C., Khan, A. H., Kidwai, M. M., & Murthy, R. C. (2010). Assessment of urban air pollution and it's probable health impact, 31(November), 913–920.

[9]. Bency, K. T., Suresh, V. M., Kumaran, V., Jansy, J., Thakappan, B., Kumar, B., Centre, R. C. (2003). A study on the air pollution related human diseases in thiruvananthapuram city , kerala, 15–17.

[10]. Pulikesia M., Baskaralingama P., Elangob D., Rayuduc V.N., Ramamurthia V., Sivanesana S. (2006): Air quality monitoring in Chennai, India, in the summer of 2005.

[11]. NautiyalJyoti., Garg M.L., Sharma Manoj Kumar, Khan Asif Ali, Thakur Jarnail S. and Kumar Rajesh (2007): Air Pollution and Cardiovascular Health in Mandi-Gobindgarh, Punjab,India - A Pilot Study. Int. J. Environ. Res. Public Health. 4(4), 268-282.