Ambient Air Pollution With Respect to Nitrogen Dioxide (NO_2) in Udgir Town Maharashtra, India.

R. B. Allapure

Associate Professor, Dept. of Botany,

Maharashtra Udayagiri Mahavidyalaya, Udgir.

Abstract

Air pollution is a major problem of recent decades, which has a serious toxicological impact on human health and the environment. It is known that the majority of environmental pollutants are emitted through large-scale human activities and mostly vehicular pollution by the different kinds of vehicles.

Nitrogen oxide is a traffic-related pollutant, as it is emitted from automobile motor engines It is an irritant of the respiratory system as it penetrates deep in the lung, inducing respiratory diseases, and produce many adverse effects in humans.

In this paper we studied the ambient air pollution level of NO_2 concentration in Udgir town.

The nitrogen dioxide measured at various heavy traffic sites during 2018 and 2019 in Udgir town showed that NO2 concentration was well below NAAQS (80 µg/m^3 24 hourly). The NO_2 concentrations varied from 38 µg/m^3 to 70 µg/m^3 throughout the 2018-19.

Keywords: Air Pollution, NO_2, Heavy Traffic Sites, Air quality.

Introduction:

One of the formal definitions of air pollution is, 'The presence in the atmosphere of one or more contaminants in such quality and for such duration as is injurious, or tends to be injurious, to human health or welfare, animal or plant life.' It is the contamination of air by the discharge of harmful substances. Air pollution can cause health problems and it can also damage the environment and property. It has caused thinning of the protective ozone layer of the atmosphere, which is leading to climate change.

Keeping these points in view and as there was no systematic study on the air quality of Udgir town, a study was carried out to find out of the present level of air pollutant such as NO_2.

Oxides of nitrogen (NOx) are a class of pollutants formed when fuel is burned at a very high temperature (above 1200 °F), such as in automobiles and power plants. For air pollution purposes, it is composed primarily of nitric oxide (NO), nitrogen dioxide (NO_2) and other oxides of nitrogen. Although there is no air quality standard for NOx, it plays a major role in the formation of ground-level ozone in the atmosphere through a complex series of reactions with volatile organic compounds (VOC's). Nitrogen oxides also contribute to deposition of nitrogen in soil and water through acid rain.

Nitrogen dioxide (NO_2) is a highly toxic, reddish brown gas that is formed through the oxidation of nitric oxide (NO) emitted primarily from the combustion of fuels in stationary or transportation sources. It can cause an odorous, brown haze that irritates the eyes and nose, shuts out sunlight and reduces visibility. NO_2 acts as a precursor to acidic rain and plays a key role in nitrogen loading of forests and ecosystems. NO_2 has been associated with acute effects in sufferers of respiratory disease.

Udgir is a taluka headquarters in Latur district of Maharashtra State extending between 18º 23′ 49″ N latitudes and 77º 5′ 12″ E longitudes. Udgir town shelters a population of more than one lac. It is a commercial center having a large market for agriculture products in the region.

In the present study 24 hour sampling was done with respect to NO2 using high volume sampler (HVS). At each monitoring sites sampling was carried out for 2 days per month for the year 2018 to 2019 to cover all the seasons.

MATERIAL AND GENERAL METHODS:

Ambient air monitoring to assess pollution load

Estimation of Nitrogen Dioxide in Ambient Air

Standard spectrophotometric procedure is adopted to analyze the concentration of NO_2. Nitrogen oxides as nitrogen dioxide are collected by bubbling air through a sodium hydroxide solution to form a stable solution of sodium nitrate. The nitrite ion produced during sampling is determined colorimetrically by reacting the exposed absorbing reagent with phosphoric acid, sulphanilamide and N (1-napthyl) ethylenediamine dihydrochloride.

The method is applicable to collect of 24 hours samples in the field and subsequent analysis in the laboratory .The range of the analysis is 0.01 to 1.5 ug nitrogen dioxide / ml. with 50 ml absorbing reagent and a sampling rate of 20 ml / min for 24 hours, the range of the method is 20 to 740 ug / mtr. Cub (0.01 to 0.4 ppm) nitrogen dioxide.

A concentration of 0.01 µg oxides of nitrogen (as nitrogen dioxide / ml) will produce an absorbance of 0.005 using 1- cum cells sensitivity.

Calculate the concentration of nitrogen dioxide as follows :

Mass of nitrogen dioxide in µg per $m^3 = \frac{(\mu g\ NO_2 / ml) \times 50}{V \times 0.35}$

Where,

50 = volume of absorbing reagent used in sampling; ml;

V = volume of air sampled, mtr. cube

0.35 = overall average efficiency

If desired, concentration of nitrogen dioxide may be calculated as ppm Nitrogen dioxide.

NO_2, ppm = (µg NO_2/m^3) x 5.32 x 10^{-4}

B. Meteorological data:

a. Meteorological data for the study was obtained from Govt. Veterinary College, Udgir for its parameters namely temperature, relative humidity, and rainfall and wind velocity and wind direction.

Result and Discussion

Air Monitoring

The ambient air quality monitoring in respect to NO_2 was done at 04 locations throughout the year (for two year 2018 and 2019). These monitoring sites were classified as

1. Heavy Traffic Sites (HTS- I to HTS- IV)

Mean levels of NO_2 at Heavy Traffic Sites during 2018 and 2019:

The study showed that the nitrogen dioxide measured at HTS-I, the highest concentration was 61 µg/m^3 in April 2018 and 62 µg/m^3 during April 2019 in the Udgir town Table 1&2 .The mean NO_2 concentrations varied from 50 µg/m^3 to 61 µg/m^3 for 2018 and 50 µg/m^3 to 62 µg/m^3 for 2019.
NO_2 concentration throughout the year was well below NAAQS and considerable decreased concentration was recorded during November 2018 and September 2019. Nitrogen Dioxide emission measured at HTS-II showed a range of 50 µg/m^3 to 63 µg/m^3 during 2018 and 51 µg/m^3 to 63 µg/m^3 during 2019. The annual average level of NO_2 observed was 56.41 µg/m^3.

50 µg/m^3 was lowest concentration recorded in the month of August 2018. According to CPCB's NAAQS HTS-II monitoring site was found to be within permissible limit for NO_2 level. The study showed that the nitrogen dioxide measured at HTS-III, the highest concentration was 44 µg/m^3 in January 2018; October and December 2019 in the Udgir town. The mean NO_2 concentrations varied from 38 µg/m^3 to 44 µg/m^3 for 2018 and 2019. NO_2 concentration throughout the year was well below NAAQS and considerable decreased concentration was recorded during May 2018 and April, September 2019.

Nitrogen Dioxide emission measured at HTS-IV showed a range of 59 µg/m^3 to 68 µg/m^3 during 2018 and 59 µg/m^3 to 70 µg/m^3 during 2019. The annual average level of NO_2 observed was 63 µg/m^3. The lowest concentration of nitrogen dioxide was recorded in July 2018 (59 µg/m^3). According to Central Pollution Control Board's National Ambient Air Quality Standards HTS-IV monitoring site was found to be within permissible limit for NO_2 level

Table 1: Mean monthly levels of NO_2 µg/m^3 at four Heavy Traffic Sites of Udgir during 2018

Months	Heavy Traffic Sites			
	HTS I	HTS II	HTS III	HTS IV
Jan.	54	52	44	67
Feb.	53	51	42	62
Mar	59	62	41	60
Apr	61	53	39	61
May	55	54	38	67
Jun	57	55	39	68
Jul	52	61	42	59
Aug	54	50	43	62
Sep	59	63	40	63

Oct	52	60	41	60
Nov	50	57	42	64
Dec	53	59	41	63
Max	61	63	44	68
Min	50	50	38	59
Mean	54.92	56.42	41	63
SD	3.37	4.52	1.76	2.98
SE	0.97	1.31	0.51	0.86

Table 2: Mean monthly levels of NO_2 µg/m^3 at four Heavy Traffic Sites of Udgir during 2019

Months	**Heavy Traffic Sites**			
	HTS I	**HTS II**	**HTS III**	**HTS IV**
Jan.	52	58	41	63
Feb.	52	51	41	62
Mar	60	62	39	67
Apr	62	60	38	60
May	59	61	40	67
Jun	58	63	42	69
Jul	57	57	44	70
Aug	52	51	41	59
Sep	50	53	38	64
Oct	57	59	44	68
Nov	56	55	43	67
Dec	53	51	44	65
Max	62	63	44	70
Min	50	51	38	59
Mean	55.67	56.75	41.25	65.08
SD	3.80	4.45	2.22	3.53
SE	1.10	1.29	0.64	1.02

Conclusion:

The nitrogen dioxide measured at various heavy traffic sites during 2018 and 2019 in Udgir town showed that NO_2 concentration was well below NAAQS (80 µg/m^3 24 hourly).

The highest concentration of nitrogen dioxide was recorded in July 2019 at HTS IV (70 µg/m^3) which is below NAAQS.

NO_2 was more prominent during morning and evening peak traffic hours, however, during the normal traffic flow times, the pollutant values did not exceed the permissible values.

Vehicular air pollution is the result of a combination of bad vehicular conditions, poor fuel quality, poor vehicular maintenance, nonexistent traffic planning very crowded and bumpy roads, congested traffic, violation of traffic rules etc.

There was great influence of climatological factors like wind speed, wind direction, temperature, rainfall and humidity on air pollutants and their dispersion. The most frequent prevailing wind direction was westerly and south westerly with wind speed 4 km. /hour.

References

- Bhatnagar, V.S. (1990): Recent trends in investigation for environmental monitoring. *Indian. J. Environ. Hlth.* 32(4) ; 313-338.
- Becklake, M.R., Goldman, H.L., Bosman, A.R, and Fred, C.C. (1957): Long term exposure to nitrous fumes. Ann. Rev. Tuberc. Pulmonary Diseases. 76 : 398-409.
- Cini, A., Ditty, R., Nagaraj, B.N. and Prasad, V.S. (1997) : Evaluation of Ambient Air Quality Deterioration due to pollution form Road Traffic in Calicut City, *Highway research Bulletin*. Indian Roads Congress. 56, June, 13-29.
- CPCB (1995) : Ambient Air Quality Status and Statistics : 1993-1994, National Air
- Goyal, P. and Singh, M.P. (1990): The long term concentration of sulphurdioxide at Taj Mahal due to Mathura refinery. Atomos. Environ. 248 : 407-411.
- Gyo-Hwang Choo & et.al . (2020) : Analysis of long-term (2005–2018) trends in tropospheric NO_2 percentiles over Northeast Asia. Atmospheric Pollution Research Volume 11, Issue 8, Pages 1429-1440.
- Hickman, A.J. (1982) : The estimation of Air pollution Concentrations from Road Traffic, TRRL Report. pp. 1052.
- Maynard, R.L. and Waller, R. (1999) : Carbon monoxide. Air Pollution and Health Edi. S.T. Holgare, J.M. Samert, H.S. Koren and R.L. Maynard. Academic Press, London, U.K. pp. 749-796.
- R.K. Mishra, A. Shukla, M. Parida, G. PandeyUrban roadside monitoring and prediction of CO, NO2 and SO2 dispersion from on-road vehicles in megacity Delhi Transportation Research Part D: Transport and Environment, 46 (2016), pp. 157-165
- Nadaf A.M. (2000) : Air pollution, noise pollution and transport (automobiles) in Bangalore city. Indian Journal of Transport Management, 24 (8) ; 545-552.
- Ontario (1991): A Guideline to the Ontario Air Quality Index System. ISBN 0-7729-8230-9 Air Resource Branch, Ontario Ministry of the Environment, Toronto, Ont. Canada.

- ORAQI (1970): Oak Ridge Air Quality Index. In Environmental Indices Theory and Practice by Wayne R. Ott Ann Arbor Science Publisher Inc. Mich., USA
- Ramesh, N.B., Srikanth, R. and Madhumohanrao, A (1993): Ambient NOx, SO2 and SPM levels in industrial, residential and commercial areas of Hyderabad city. Pollution Research. 12 (4) ; 239-242.
- WHO (1974): Air quality guidelines for Europe. WHO regional publications, European Series No. 23, Copenhagen, Denmark. pp. 198-205.
- WHO (1999): Environmental Health Criteria and sulphur oxides and suspended particulate matter. Geneva. pp. 75-85.