Environment Conservation Journal 3 (1) 25-29, 2002
(ISSN 0972 – 3099)

Analysis of Some Selected Characteristics of Air Emissions from A Fertilizer Industry

Neha Som Sachdeva and D. R. Khanna

Department of Zoology and Environmental Sciences, Gurukul Kangri University, Hardwar 249404, India

Abstract

To know the quantitative and qualitative aspects of air pollution, it is necessary to anlyze air quality parameters. the main parameters investigated in the present study are ammonia, oxides of nitrogen, sulphur, di oxide, urea ans SPM. In the present study varios samples were collected from air sampling stations and stacks to assess the pollutional load.

Key Words: ***Air quality, Fertilizer plant ,Stacks, NOx, SO_2***

Introduction

Society has become very demanding in terms of quality of life and the material need for the same has increased manifold. This has put a pressure on the industrial growth. The role of population explosion in this context however can not be denied. This increase in population and development activities has brought the inevitable need for industrialization. The rapid expansion of industrial potential from the fifties has started posing serious threat to environment and this has led to the increase in environment pollution and consequently the life become difficult.

Amongst the various types pollution, air pollution is one of the greatest environmental evils. The air we breathe has the life supporting properties. Under ideal conditions, the air we inhale has quantitative and qualitative balance that maintains the well being of man. But when a balance among the air components is disturbed, or in other words, we can say that if it is polluted, it may affect the human health. It has been estimated that a man can live for five weeks without food and five days without water, but can not live for five minutes only without air (Rao and Rao 1995), so human life can not be thought without air.

India's main problem of air pollution arises from the fact that 80% of its industrial production is concentrated in some large industrial centers. This has carried severe environmental pollution problems in isolated pocket with demands of clean air resources. The deterioration of air quality is felt both by the developed and the developing countries alike and the Government and the planners have taken serious steps to stop air pollution very recently. The concentration of air pollution in cities and in industrial areas is very much related to various meteorological conditions such as wind direction, wind velocity and vertical stability of the atmosphere.

In view of the above, it was envisaged to monitor the air quality and analyze some selected characteristics of fertilizer industry air emissions at BABRALA. (U.P.)

Materials and Methods

Samples for various examination were collected from a fertilizer industry, Babrala in the District Badaun of U.P.. For sampling, three different areas were selected.

I. Ambient air quality stations.
II. Stack air quality stations.
III. Bagging plant/work place environment.

I. The main ambient air quality stations from where samples were taken are

Site 1- This site is situated at a distance of about 1.4 km. w-s-w from the prilling tower in town ship.
Site 2- The site is situated at a distance of about 1.2 km. in south from the prilling lower out side the fertilizer complex.
Site 3- This site is situated at a distance of about 0.5 km e-s-e from the prilling tower in the plant area.

II. The main stack air quality stations from where samples were taken are

1. **Ammonia plant reformer stack** : A steel stack with a height of 40 m has been provided for flue gas emissions resulting from burning of fuel natural gas and naphtha.
2. **Service boiler stack:** A steel stack with a height of 40 m has been provided for flue gas emissions generated by burning of natural gas/ naptha.
3. **Heat recovery unit**: There are two-heat recovery units i.e. HRU-1 and HRU-2 for recovery of heat from flue gas resulting from natural gas/naptha based turbine unit. The unit shall be provided with a height of 40 m.
4. **Prilling tower:** The prilling tower has been designed to keep the dust emissions at the minimum by an approximate height of 105 m and improved prilling bucket reduced the generation of dust emissions.
5. **Bagging Plant :** In the fertilizer complex, main work place are bagging plant where dedusting system stack is situated.

III. Monitoring for work place environment quality:

In work place environment, common pollutants are particulate matter (respirable and suspended) and ammonia. In the fertilizer complex, main work place are bagging plant, where dedusting system stack is situated and regularly monitored by stack monitoring kit.

Air quality parameters, which were selected for the study, are ammonia (NH_3), oxides of Nitrogen (NO_x), sulpher di oxide (SO_2), urea and suspended particulate matter (SPM). Standard methods described by Trivedy and Goel 1986 and Manivaskam 1996, were used for the analysis of above stated parameters. The instrument used for the collection of different samples are High volume sampler, Stack monitoring kit and Respirable dust high volume sampler.

Results and Discussion

The values of various parameters of ambient air quality and stack air quality are given in Table 1 and 2 respectively. First we have taken the ambient air quality stations. The level of NH_3 for site 1, site 2 and site 3 was 38.45 μ g/m^3, 37.53 μ g/m^3 and 43.90 μ g/m^3 respectively. According to UPPCB, the standard values of NH_3 for site 1 and site 2 is 50 μ g/m^3 and for site 3 is 80 μ g/m^3. The level of NO_x for site 1, site 2 and site 3 were 25.86 μ g/m^3, 28.89 μ g/m^3 and 46.00 μ g/m^3, respectively. The standard values of NO_x for site- 1 and site- 2 are 60 μ g/m^3 and for site 3 is 80 μ g/m^3.

The level of SPM for site-1, site-2 and site-3 were 112 mg/Nm^3, 124 mg/Nm^3, and 85.34 mg/Nm^3, respectively. The standard values of SPM for site-1 and site-2 is 140 mg/Nm^3 and for site-3 is 360 mg/Nm^3. All the values of NH_3 , NO_x and SPM of ambient air were found under the permissible limits. The level of SO_2 for site-1, site-2 and site-3 were found detectable limit at all the three stations. The standard value of SO_2 for site-1 and Site-2 is 140 mg/Nm^3 and for site –3 is 360 mg/Nm^3.

Table 1. Some Ambient Air quality characteristics

S.No.	Location	NH_3	NO_x mg/m^3	SPM mg/Nm^3	SO_2 μ g/m^3
1.	Site-1	38.45	25.86	112.00	BDL
2.	Site-2	37.53	28.89	124.00	BDL
3.	Site-3	43.90	46.00	85.34	BDL

BDL : Below Detectable Limit.

Table. 2. Some Stacks Air quality Characteristics

S.No.	Location	NH_3 ppm	SO_2 ppm	NO_x ppm	SPM mg/Nm^3	Urea ppm
1.	HRU-1	-	0.278	45.32	2.50	
2.	HRU-2	-	0.398	56.42	4.9	
3.	Service Boiler	-	0.528	51.09	3.01	
4.	Primary Reformer	-	0.342	57.56	3.15	
5.	Prilling tower	32.29	-	-	29.83	28.27
6.	Dedusting stack	30.73	-	-	9.99	21.9

Table 3. Specific Features of stacks

S. No.	Name of source	Stack height (M)	Stack Dia (M)	Stack Temp. (^{o}C)	Stack Gas (Velocity m/sec)	Flow rate (Nm^3/hr.)
1.	Service Boiler	40	2.6	158	6.27	76570
2.	Primary Reformer	40	3.4	176	11.00	238502
3.	HRU-1	40	3.4x3.9	162	6.30	206022
4.	HRU-2	40	3.4x3.9	160	8.89	292062
5.	Prilling tower	106	22.3	51	0.88	1034053

Badrinath *et. al* 1987 estimated atmospheric emissions from one of the proposed fertilizer industry and found comparatively higher values for ammonia, NO_x and SPM which were 22.22 μ g/m^3, 45.98 μ g/m^3 and 220 μ g/m^3, respectively as compared to the present observation. He reported that the installed fertilizer capacity during 1950 was 200 tonnes. The estimated projections for a period of 1980-90 for production of nitrogenous fertilizers were calculated to be 9.88 and 2.56 million tones, respectively. Such an impressive growth also has negative impacts in the form of environmental problems. While in TATA fertilizer industry, it is estimated that the daily production of Urea is 300 tones, which has hardly posed any adverse effect on the quality of air.

Pollution load through industries increases day by day. It depends upon the capacity of production and also on the features of stack, which are given in Table-3.

A number of stacks discharging various emissions to atmosphere have been proposed for various fertilizer industries. In TCL, combustion in boilers, were found to be the main sources of oxides of sulphur that causes sensory and respiratory irritation and also have some adverse health effects. SO_2 inhalation leads to the bronchitis emphysema and other lung diseases. These symptoms increase with the increased atmospheric concentration of SO_2. Lung cancer is known to result due to raised levels of SO_2 in the atmosphere. A 0.25 to 0.50 ppm concentration of SO_2 causes significant broncho-constriction in asthmatics and when present in concentration of 3.00 to 5.00 ppm it can be easily detected by odour.

During the present study, the observed levels of SO_2 were 0.278 ppm and 0.398 ppm for HRU-1 and HRU-2, respectively. For service boiler and primary reformer, the level of SO_2, were found to be 0.528 ppm and 0.342 ppm, respectively. The standard values of SO_2 for HRU-1, HRU -2, service boiler and primary reformer are 100 ppm as prescribed by UPPCB.

In a typical nitrogenous fertilizer industry, nitric acid plant and nitrophosphate plants were found to be the sources of oxides of nitrogen, which cause health effects of corrosion. The health effects of NO_2 vary with the degree of exposure. An exposure of 60 to 100 ppm of NO_2 causes inflammation of lung tissues for 30 to 50 minutes for a period of 5 to 8 weeks. It has been seen that NO_x fades away a number of textile dyes like cotton, rayon, acetate and viscose rayon. It was also found that NO_x level reached to 1 to 2 ppm during combustion of natural gas which is used to heat the dryers. During the present study, the HRU-1 and HRU-2 shown the level of NO_x were 45.32 ppm and 56.42 ppm. For service boiler and primary reformer, the recorded level of NO_x were 51.09 ppm and 57.56 ppm, respectively. The standard values of NO_x for HRU-1, HRU-2, service boiler and primary reformer were 100 ppm. In the various processes of the fertilizer manufacturing, particulate, dust, emissions occur inevitably. In nitrogenous fertilizer plant, material handling, crushing and grinding, size separation, drying, cooling, granulation, prilling are the source of dust which affect environment and health. Particulate pollutants have a capability to penetrate beyond the respiratory passages in to the lungs and damage lung tissues. Particulates accelerate corrosion of metals, which is maximum, in urban and industrial areas. During the analysis of stack viz. HRU-1, HRU-2 service boiler, primary reformer, prilling tower dedusting stack, the SPM levels recorded by 2.50 mg/Nm^3, 4.9 mg/nm^3,-3.01mgt/Nm^3, 3.15 mg/Nm^3, 29.83 mg/Nm^3 and 9.99 mg/nm^3, respectively. The standard values of SPM for all six stacks are 100 ppm. All the values recorded were found with in the permissible limits.

In nitrogenous fertilizer industry, the production of urea was favoured by an excess of ammonia. The off gas from the prilling tower and dedusting stack contain ammonia and urea dust. The level of NH_3 in prilling tower and dedusting stack of TCL were 32.29 ppm and 30.73 ppm where as the standard values of NH_3 for prilling tower and dedusting stack are 50 ml. / m^3.

In TCL the level of urea in prilling tower and dedusting stack were 28.27 ppm and 21.9 ppm, respectively. The standard values of urea for prilling tower and dedusting stack are 50 ml/m^3.

Freeman *et al.* 1966 worked upon ambient air quality of pulp and paper mill and found that flue gas coming out of boilers and chimney of chemical recovery furnace contained SO_2 62.83 ppm, which could affect bronchial state with in 5 months of exposure. Bingham 1978 described a nitrogen fertilizer complex facing air pollution problem where steam generation plant had acquired leasing arrangement and the level of SPM were 320 mg/m^3. He also reported the level of NO_x and NH_3 from the stack, which was 62.33 ppm and 24.1 ppm, respectively. The values recorded during the study work beyond the permissible limits and were found quite high when compared with the present study.

It is concluded from the discussion that none of the pollutants were allowed to violate the limits of stack and ambient air quality even under the adverse meteorological conditions. It is also evident from the results that TCL industry has made good efforts to protect the jeopardizing of air quality.

Conclusion

Air is the most essential component of life and is required for the various activities in the biosphere thus it entails to protect our environment. In this present study, the different parameters of air quality of stacks and ambient air stations were taken for the analysis and found within the permissible limits. By these results, it becomes a very important concept for every industry to check the pollution load and should minimize its after effects by installing proper treatment systems.

References

Alam C.B., Balasubramaniam P. R., Babu R. and Prabhakaran S. 1999. Impact of ambient air quality due to cement making – A case study of the A.C.C.C.T.D., Madukkarui, Coimbatore. ***Pollution Res.* 16 (2), 103-109**.

Badrinath S. K., Kaul S. N., Gadkari S. K. 1987. Fertilizer industries- - An environmental appraisal. ***IJEP,* 7 (3), 201-208**.

Bhatnagar S. P., Saini R. S., Dadhwal P. J. S. and Jajwal S. 1993.Deteriorating air quality in Chandigarh- A study on levels of SPM in the city. ***IJEP* 14 (9), 700-707**.

Bingham E.C. 1978. *Air Pollution Control.* Ann Arbor science publishers.

Freeman D., Panda A. and Dash T. 1997. Ambient air quality around pulp and paper mill. ***Pollution Res.* 15 (4), 399-404**.

Joshi J.P. and Mishra M. 1998. Impact on ambient air quality due to cement making – A case study of the A.C.C.T.D. Madukkarai, coimbortore, ***Pollutiion Res.* 16(2), 103-109**.

Manivaskam N. 1996. *Physico-chemical Examination of Water Sewage and Industrial Effluents.* Pragati prakashsn, Meerut.

Rao H. N. and Rao H.V.N. 1999. *Air pollution.* Tata M.C. Graw. Hill publiching Co. Ltd. New Delhi.

Sharma V. and Sharma J. C. 1995. Ambient air quality monitoring at Bombay university campus. ***IJEP.* 10 (1), 10-16**..

Stern A.C. 1973. *Air Pollutiion* (Vol3) Academic press, New York.

Trivedy R. K. and Goel P.K. 1986. *Chemical and Biological Methods for Water Pollution Studies,* Environmental Publicationos, Aligarh.