

Assessment of Contamination in Ambient Air of Kota City, Rajasthan Due to Fireworks on Diwali (2014)

Sachin Mourya, Kuladeep Pradhan, Nitish Bhardwaj, A.K. Mathur and A K Dwivedi

Department of Civil Engineering Rajasthan Technical University, Kota
E-mail: engg.sachinmaurya@gmail.com

Abstract—In different parts of world people expresses their happiness on different occasions by fireworks, in India now on festival or it any other occasion of joy it become the trends of celebration. These increasing trends of burning Crackers on festival like Diwali, marriage and other occasions now became a serious problem which may pose to human health and other problems in environment like temporary detritions of air quality.

So it is very important now to evaluate the problem by proper monitoring of ambient air in every possible region of India as well as at global level. An attempt to make for assessing the air quality on the occasions of festivals of fireworks known as Diwali in Kota city of Rajasthan. Kota the industrial city of Rajasthan is known for power generation here all four means of power generation (Thermal, Hydra, Atomic, and Gas) plants are settled. The observations were taken before Diwali, on the day of Diwali (Within Period of 24 hours) and after the Diwali. SO_x, NO_x, SPM were measured with help of Air sampler and it was found that Sox, Nox, is in its permissible limit but during Diwali and after Diwali it reaches up to high level which is not observed in normal days. While SPM noticed is sign of danger and observed more than the permissible limit of BIS, CPCB Delhi. The increased amount of particulate matter leads to various air borne disease like asthma, and other chronic diseases. It is evaluate that the Air contains particulate matter during Diwali more than the permissible limit in Kota city of Rajasthan, this increment is only due to fireworks during the Diwali, however at some places it was more in normal days also due to vehicular emissions.

1. INTRODUCTION

Diwali is one of the happiest holidays in India, with significant preparations. People clean their homes and decorate them for the festivities. Girls and women go shopping and create Rangoli and other creative patterns on floors, near doors and walkways. Youth and adults alike help with lighting and preparing for patakhe (fireworks). Diwali is the largest festivals for Hindu religion which falls in the period October-November every year. During the festival days, extensive burning of firecrackers takes place, especially in the evening hours, constituting a significant source of aerosols, black carbon (BC), organics, and trace gases. The widespread use of sparklers was found to be associated with short-term air quality degradation events.

The festival of light seems to be the worst time for people suffering from asthma and other respiratory diseases with the city's air quality deteriorating with each passing year during Diwali. Even the government's campaign against crackers has failed to bring down the pollution levels.

An analysis of levels of various pollutants on Diwali day since years reveals a disturbing trend. Levels of some pollutants, including sulphur dioxide (SO₂) and nitrogen dioxide (NO₂), seem to be on the rise. The levels of particulate matter (PM), which have serious health implications as these tend to get lodged in the lung and can even enter the bloodstream, have been seven to eight times higher than the standard level for several years.

2. STUDY AREA

Kota district lies in south eastern part of the Rajasthan, between 24° 25' and 25° 51' North latitude and 75° 17' and 76° 00' East Longitude. It covers a geographical area of 5198 sq.km and is bounded in the north and north west by Sawai Madhopur, west by Bundi district, west by Chittaurgarh and Baran district in east, south by Mandsoore district of Madhya Pradesh and south east by Jhalawar district 249 meters or 816 feet elevation above the sea level. Total population of the Kota is nearly about 1,5,68,525. The population of the district possess predominantly a rural in character. The population of the district has increased by more than four times in the present century.

3. MATERIAL AND METHODOLOGY

High Volume Samplers are the basic instruments used to monitor Ambient Air Quality. They are in widespread use all over the world to measure air pollution in industrial areas, urban areas, on the shop floor, near monuments and other sensitive areas. The High Volume Sampler is a vital tool for studies relating to impact of industrialisation to the air analysis, and for work related diseases of the respiratory

system to air pollution. In these samplers, air-borne suspended particulates (SPM) are measured by passing air at a high flow-rate of 1.1 to 1.7 cubic meters per minute through a high efficiency filter paper which retains the particles. The instrument measures the volume of air sampled, while the amount of particulates collected is determined by measuring the change in weight of the filter paper as a consequence of the sampling. The passage for air reaching the filter is designed to prevent heavier settle able dust particles from reaching the filter thus measuring the concentration of Suspended Particulate Matter (SPM) in atmospheric air.

In high volume sampler provisions have been made for simultaneous sampling of gaseous pollutants. Here the air is passed through suitable reagents that would absorb specific gases where gaseous pollutants like SO_2 , NO_x , Cl_2 , H_2S , CS_2 , NH_3 , etc. are analysed subsequently by simple wet chemistry method to determine the concentration of specific pollutant. Environtech APM 415 is the "DWARF" version of APM 410. It is lighter, more compact, can be carried in a car dickey and is ideal for field use. It can be used either by mounting it on Roof Tops of van or building or separately outside as necessary. The performance and use of APM 415 is same as that of APM 410.

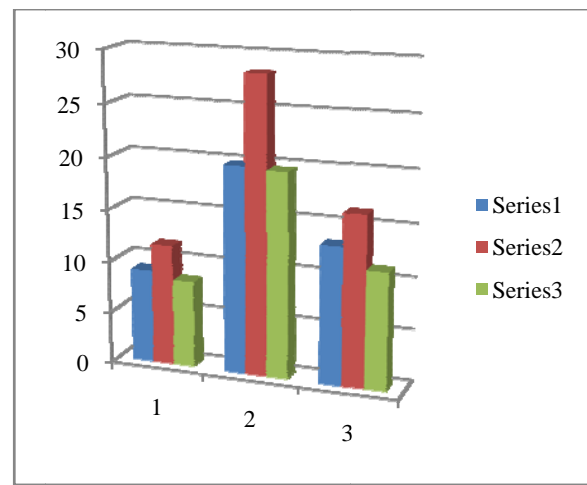
To find out the effect of Diwali 24 hour continuous monitoring at different location in Kota, the sampler was installed one by one at three main sampling locations. Monitoring was done before a week of Diwali on 15-16 October 2014 and during Diwali on 24-25 October 2014 and thereafter 7-8 November 2014 to observe post Diwali experiment. For simplification we named this days as pre days, (15-16 Oct) Diwali days, (24-25 Oct) Post-Diwali (7-8 Nov) or normal days. During the Diwali observation was taken started after 8 pm of evening because the fireworks mainly started after Diwali Poojan in night, so that 48 hours observation on Diwali were taken from 24 October to 25 October, total running time span was 8 hours after that span the sampler was settled to another place for observation. Observations were taken at Dadabari, Gumanpura and Mahaveer nagar area in Education city Kota, SO_x , NO_x and SPM were measured by Air Sampler.

4. RESULT AND DISCUSSION

The observations were measured during the study is represented in figure 1(Value of SO_x), 2(Value of NO_x), 3(value of SPM) respectively. The sampling time in this graph is represented as 1, 2, 3 respectively for before Diwali, during Diwali, after Diwali. While series 1, 2, 3 denotes the sampling locations as Mahaveer Nagar, Gumanpura, and Dadabari.

4.1. SO_x – The value of oxides of Sulphar shown in figure-1, here great variation were observed in kota city during festival of Diwali, as it was under the permissible limit maintained by central pollution control board, Delhi.

The maximum value noticed in Gumanpura area of Kota here it reached up-to 28.3 ug/m^3 on the day of Diwali, big jump observed in other area also during Diwali.



However it is below the limit of 80 ug/m^3 but the trend of increasing value is very harmful to our environment. Dadabari and mahaveer nagar area maximum value found up to 19.8 and 19.6 ug/m^3 little amount of oxide of sulphar may causes various hazardous in the environment leads to various disease.

4.2. Concentration of NO_x - comparison shows in figure-2 that value of NO_x raises up-to a danger mark on the day of Diwali, notice up-to 61.8 ug/m^3 in Gumanpura areas, it is below the limit but this amount is only sufficient to health hazardous. Least value observed in Dadabari area in all observation days. Fig. 1-Value of SO_x in Kota City

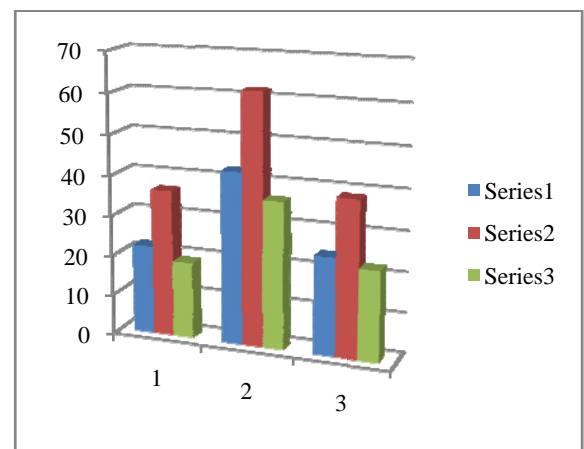


Fig. 2: Value of NO_x

4.3. SPM- Suspended particulate matter is very serious concern and the value crosses the limit settled by CPCB for residential area as shown in figure-3. The maximum value observed in Dadabari area of Kota city, which is only due to fireworks and vehicular emissions also there because it is well connected by main roads of city. The concentration of SPM in

air varies considerably depending upon many factors including proximity to sources of emissions and hourly. Maximum value noticed up to 693.8 microgram per cubic meter in Dadabari, which is three times more than the permissible limit of CPCB, 572 and 489 $\mu\text{g}/\text{m}^3$ observed in Gumanpura and Mahaveer Nagar respectively. This high value observed during Diwali days, values were down after some days as measured after Diwali but it was more than permissible limit. Higher suspended particulate matter in the air of Kota city may cause various health hazards to local people.

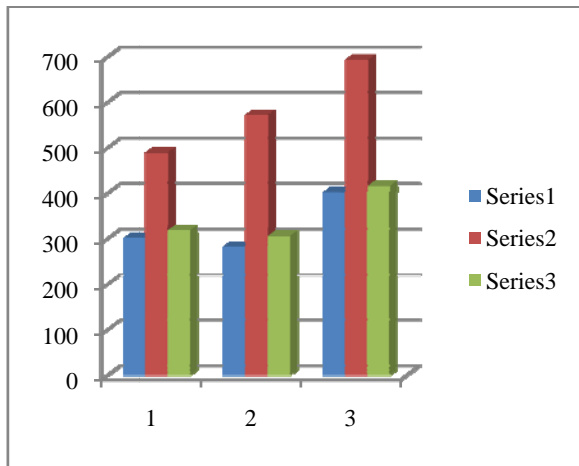


Fig. 3: Value of SPM

5. CONCLUSION

Comparative observation between Diwali days and normal days clearly shows that the burning of crackers and sparklers on Diwali festival are a very strong source of air pollution. Air pollution levels in Kota shot up during Diwali as the quantity of pollutants in Kota reached dangerously high levels. The atmospheric particulate matter increased to 693.8 micrograms per cubic metre that according to health experts is more than three times higher than the permissible limit of 200 micrograms per cubic metre. The figures released after observation, that the particulate matter increased a day after Diwali and noticed at 693.8, 489, 572 $\mu\text{g}/\text{m}^3$ in three areas, the particulate matter remains in the air for few days after bursting crackers. The hazard due to air pollution during Diwali was; however, not limited to particulate matter, the quantity of sulphur oxide (SO_x) reached 28.3 micrograms per cubic meter. It is very harmful to elder people are particularly vulnerable to the ill effects of air pollution. Value of NO_x also reached up-to a

dangerous level in Kota city, as we all know that these oxides of gases are main causes of acid rain or acidification of atmosphere. This resulted in significant health problems for residents of Kota. During the Diwali festivities, people were admitted within hours to the city's Hospital with severe breathing problems. Even during the day more patients were admitted to the hospital's emergency ward with breathing problems after Diwali.

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