

## Ambient Air Quality of Aligarh City (U.P., INDIA) at Diwali

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### Abstract

The present study deals with the impact of bursting crackers & fireworks on the ambient air quality of Diwali festival in Nov 2012. In the present study  $SO_2$ ,  $NO_2$  and SPM were estimated at residential site during the day and night times for pre-Diwali, Diwali day & post-Diwali i.e. from 13-15<sup>th</sup> Nov 2012. On Diwali day, the level of  $SO_2$ ,  $NO_2$  and SPM values were found to be 81.42, 85.86 and 1236.24  $\mu g/m^3$  respectively, which were very high when compared with any normal day (14.61, 41.78 and 341.24  $\mu g/m^3$  respectively). After Diwali day the level of  $SO_2$ ,  $NO_2$  and SPM values were 77.56, 82.17 and 1168.06  $\mu g/m^3$  respectively. On Diwali day and after Diwali day, the values of  $SO_2$ ,  $NO_2$  and SPM were found to be much higher than the standard value of NAAQS. Hence in the present study, crackers and fireworks were found to be the chief sources of air pollution during the Diwali festival. Even though the impact of Diwali is short term, but the short term exposure of these pollutants above the standard values can cause the increase in respiratory problems.

**Keywords:** Air Quality, Diwali, crackers,  $SO_2$ ,  $NO_2$ , SPM, Aligarh.

### 1. Introduction

Ambient air quality Monitoring is the systematic, long-term assessment of pollutant levels by measuring the quantity and types of certain pollutants in the surrounding, outdoor air. Air pollution generates from many sources (including industries, motor vehicles, heating, tobacco smoking and from numerous natural sources) and a variety of pollutants are released from each source. People are generally exposed to various air pollutants simultaneously. The fireworks during the festival of light i.e. Diwali causes a short term variation in ambient air quality. Firecrackers that goes up in air and produces sparkling colorful lights release several kinds of gases and huge amount of suspended particles scientifically known as Respirable Suspended Particulate Matter (RSPM)

Diwali in India is celebrated with lots of fun and enthusiasm, but on this festival the sounds of bursting crackers and the smoke of bursting crackers curtains all over the Indian cities and towns. Fireworks contain chemicals. Burning of fireworks releases pollutants like sulphur dioxide( $SO_2$ ), carbon dioxide( $CO_2$ ), carbon monoxide( $CO$ ), suspended particulates( $PM_{10}$ ) and various metals like cadmium, aluminum, etc. which are associated with serious health hazards. As the world is getting more & more educated & civilized, we're doing more & more meaningless & uncivilized works. Today, using cracker is becoming a fashion. Millions are spent on

this worthless garbage stuff. Bursting crackers is turning to a competition & a status indicator. It is estimated that the annual U.S. carbon dioxide emissions from fireworks is 60,340 tons or the same emissions from 12,000 cars on the road for a year. If one suggests that planting trees is a solution, then, please be informed that it'd take the entire lifetime of 5,000 trees to offset the 60,000 tons of carbon emissions produced in this one day. Not only it pollutes the environment, it also causes many deadly air-borne diseases.

The objective of the present study is to assess the short term variation in the ambient concentration of  $SO_2$ ,  $NO_2$  and SPM with fireworks at the residential site of Aligarh city, U.P. during Diwali festival in 2012 (13-15<sup>th</sup> Nov 2012).

### 2. Material and Methods

To see the impact of bursting of crackers etc. on air quality the 24 hrs continuous ambient air quality monitoring was carried out at Aligarh city, U.P. In the present study ambient air quality was monitored by using 'High Volume Sampler' (Envirotech APM 415-411) for suspended particulate matter and for gaseous pollutants.

#### 2.1. Sulphur Dioxide ( $SO_2$ )

Sulfur dioxide affects human health when it is breathed in. It irritates the nose, throat, and airways to cause coughing, wheezing, shortness of breath, or a tight feeling around the

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chest. The effects of sulfur dioxide are felt very quickly and most people would feel the worst symptoms in 10 or 15 minutes after breathing it in. Those most at risk of developing problems if they are exposed to sulfur dioxide are people with asthma or similar conditions.

Sulphur dioxide was analysed by modified West and Gaeke, (1956) pararosaniline method. A known quantity of air passed through the impinger of high volume sampler. The SO<sub>2</sub> in the ambient air was absorbed in the solution of potassium tetrachloromercurate. A dichlorosulphitomercurate complex was formed, which was made to react with pararosaniline and formaldehyde to form intensely colored pararosaniline methylsulphonic acid. The absorbance of the solution was measured at wavelength of 560nm.

### 2.2. Nitrogen Dioxide (NO<sub>2</sub>)

Small levels of NO<sub>2</sub> can cause nausea, irritated eyes and/or nose, fluid forming in lungs and shortness of breath. Breathing in high levels of NO<sub>2</sub> can lead to burning spasms, swelling of throat, reduced oxygen intake, a larger buildup of fluids in lungs and/or death. NO<sub>x</sub>, plus other ground-level ozone, can cause other major respiratory problems in high levels. Can react with aerosols from aerosols cans and also cause respiratory problems.

NO<sub>2</sub> conc. in the ambient air was monitored by sodium arsenite method (Margeson, 1997). NO<sub>2</sub> was absorbed in absorbing solution of sodium hydroxide and sodium arsenite to form a stable solution of sodium nitrite and was determined at a wavelength of 540nm by reacting the exposed absorbing reagent with phosphoric acid, sulphanilamide and N (1-naphthyl) ethylenediamine dihydrochloride.

### 2.3. Suspended Particulate Matter (SPM)

For Suspended particulate matter, the ambient air was filtered through glass micro fibre filter paper GF/A (20.3 x 25.4). The SPM present in the air thus got deposited on the surface of filter paper. The filter paper was reweighed after sampling, which gives the amount of SPM in the air during that time period and this concentration of the particulate matter in ambient air was then computed on the net mass collected divided by the volume of air sampled

## 3. Results

Trapping of pollutants due to burning of fire crackers under cold conditions during Diwali promotes the formation of smog that stays close to the ground for long time before its dispersion into the atmosphere. The smog is a combination of fog and smoke or other air pollutants. It is created when moisture level is high in the atmosphere. It does not allow the tiny particles of pollutants to dissipate, and instead tiny water droplets carrying fine particles of pollutants and dust remain suspended in the atmosphere. Smog may worsen the condition of patients with lungs, heart and nervous system diseases. The major

pollutants were observed and were compared with that of normal day.

### 3.1. Sulphur Dioxide (SO<sub>2</sub>)

During Diwali day, the SO<sub>2</sub> conc. increased upto approx. 6 times (81.42µg/m<sup>3</sup>) to a typical normal day (14.61µg/m<sup>3</sup>). A day after Diwali, the conc. was observed 77.56µg/m<sup>3</sup>. The conc. of SO<sub>2</sub> was observed maximum at night during Diwali in comparison to day time, which seems to be associated with increased fireworks and crackers during the night. The daily average concentration of SO<sub>2</sub> during winter was below the permissible limits, but was observed above the standard value (80µg/m<sup>3</sup>). A day before Diwali the SO<sub>2</sub> conc. was 28.62µg/m<sup>3</sup> (Fig 1).

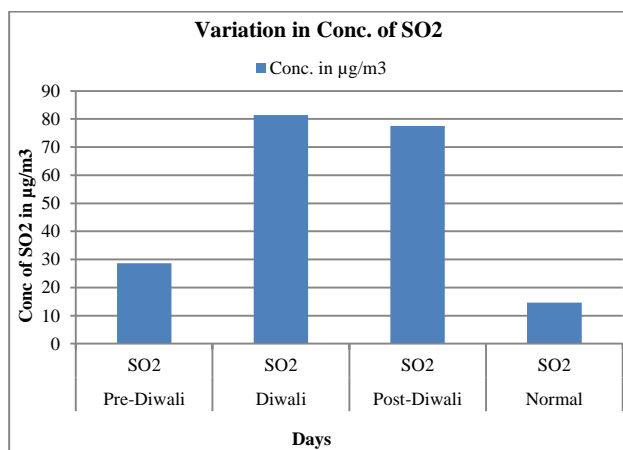


Fig 1: Variation in Conc. of SO<sub>2</sub>

### 3.2. Nitrogen Dioxide (NO<sub>2</sub>)

NO<sub>2</sub> conc. increased upto approximately 2 times (85.86µg/m<sup>3</sup>) on Diwali day and post-Diwali day (82.17µg/m<sup>3</sup>) with its comparison to a normal day (41.78µg/m<sup>3</sup>). The NO<sub>2</sub> conc. was 55.64µg/m<sup>3</sup> on pre-Diwali day (Fig 2). Conc. of NO<sub>2</sub> on Diwali day and after Diwali day was observed above permissible limit (80µg/m<sup>3</sup>). The daily average conc. of NO<sub>2</sub> during winter

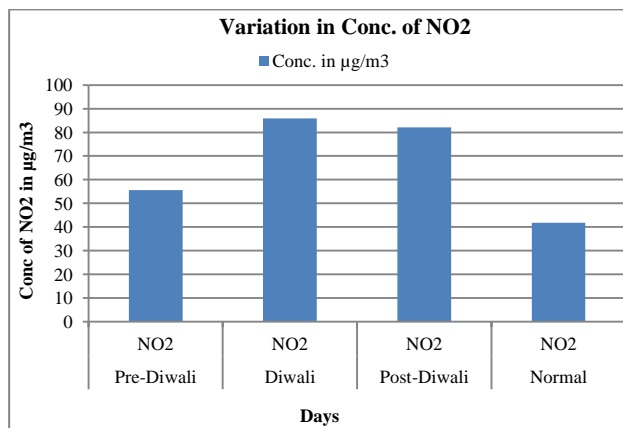


Fig 2: Variation in Conc. of NO<sub>2</sub>

was below the permissible limit. The conc. of SPM was observed  $400\mu\text{g}/\text{m}^3$  on pre-Diwali day;  $1236.24\mu\text{g}/\text{m}^3$  on Diwali day and  $1168.06\mu\text{g}/\text{m}^3$  on post-Diwali day. Conc. of SPM was observed approximately 4 times on Diwali day than on a normal day ( $328.46\mu\text{g}/\text{m}^3$ ). Conc. of SPM exceeded the prescribed standard limits ( $350\mu\text{g}/\text{m}^3$ ) on normal day and on, before and after Diwali day (Fig 3).

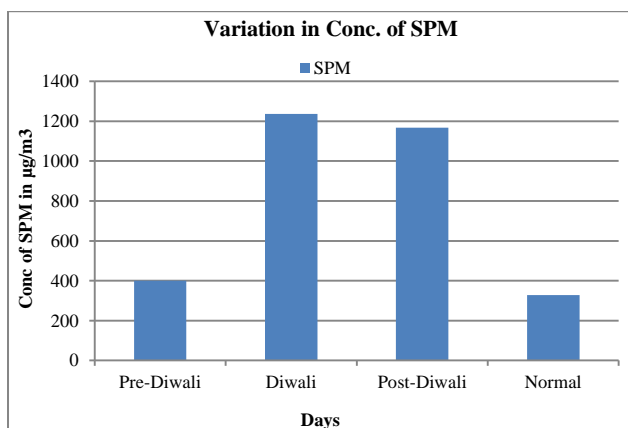


Fig 3: Variation in Conc. of SPM

#### 4. Discussions

For most people lighting of firecrackers is the highlight of Diwali. Brighter the sparkles, louder the noise the greater the thrill. In fact to most of the people, these aesthetic forms of light seem so appropriate and most essential when celebrating the 'Festival of Lights'. Huge amount of crackers and sparkles are burnt mainly on the day of festival, hence high conc. of pollutants was observed on Diwali day along with decrease in temperature was observed during this time. During winter season there is increased atmospheric stability, which in turn allows for

less general circulation and thus more stagnant air masses. It prevents an upward movement of air, hence atmospheric mixing is retarded and pollutants are trapped near the ground. Kulshretha *et al* (2004) and Dwivedi and Seth (2001) reported high levels of different trace elements in ambient air due to fireworks during Diwali festival. Lack of quality control of crackers in India lead to increased level of these pollutants. There is barely any regulatory framework to monitor the quality aspects the crackers. The toxic substances used in the firecrackers release toxic gases that are harmful to the health of all living beings. The levels of these pollutants observed during Diwali were found to be moderately high, which can be associated with serious health impacts. Excess emergency hospital admission has been reported during Diwali festival related to burn hazards and increased asthma. Even though the impact of Diwali is short term, but the short term exposure of these pollutants above the standard values can increase the respiratory problems.

#### References

- Dwivedi, Anand and Seth P.C. (2001). Trace metal concentration in ambient air at selected sites of Mandideep Township, in vicinity of Bhopal (India). *Poll. Res.* 20:125-128.
- Margeson J.H. (1977). Evaluation of sodium arsenate method for measurement of  $\text{NO}_2$  in ambient air. *J. Air Pollution Control Assoc.* 27:553-556.
- Kulshretha, U.C., Rao, T.H., Azhaguvel, S. and Kulshretha M. J. (2004) Emissions and accumulation of metals in the atmosphere due to crackers and sparkles during Diwali festival in India. *Atmospheric environment*, 38, 4421-4425.
- West P. W. and Gaeke G.C. (1956). Fixation of sulphur dioxide as disulfidomercurate (II) and subsequent colorimetric estimation. *Anal. Chem.* 28:1816-18-19.