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Effect of Ban of Firecrackers in 2017 on $PM_{2.5}$ and CO Concentrations in Lucknow City

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Abstract

Diwali is a standout amongst the most significant celebrations commended all over India which falls in the period late October to early November consistently. It is related with burning of firecrackers that prompts debasement of air quality that goes on for quite a while. Fireworks on burning discharges enormous measure of trace gases, for example, NOx, CO, SO_2 and O_3 and immense amount of aerosols and particulate matter. The present investigation centers around the impact of ban of fireworks which was forced in 2017, on PM2.5 and CO levels, to estimate the Diwali impact on air quality in Lucknow City. A decrease of 30.95% was seen in particulate matter post diwali in 2017 because of increase in awareness campaigns among public and increased cost of firecrackers after its boycott. However the average concentration levels of the gaseous pollutant CO did not demonstrate any noteworthy change which demonstrates that CO not an outflow of firecrackers.

Keywords: *Diwali, firecrackers, Air Pollutant, Lucknow*

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1. Introduction

Air contamination levels in megacities have been a growing reason for worry as of late because of expanded dimensions of anthropogenic pollutants and their related well being risks. To this regard, little air quality degradation scenes have gained increased consideration from research networks in past few years as they pose some serious medical problems because of their long haul negative impact on air quality. Diwali which is likewise called the celebration of Lights is a standout amongst the most significant celebrations of the Hindu people group and is widely commended all over India consistently with the bursting of crackers as the most prominent activity. As indicated by the Gregorian schedule, Diwali celebration more often happens in late October/early November and is praised for three days all over India. Gigantic measures of firecrackers are burned mainly during the evening time of the festival (Diwali day) and also on the day before and after Diwali (considered as pre-Diwali and post-Diwali day).

Firecrackers contain compound, for example, arsenic, sulfur, manganese, sodium oxalate, and aluminum and iron residue powder, potassium per chlorate, strontium nitrate, barium nitrate, and charcoal. Consuming of these fireworks discharges contaminations, for example, sulfur dioxide (SO2), carbon dioxide (CO2), carbon monoxide (CO), suspended particles (counting particles underneath 10 µm in measurement, i.e., PM10), and a few metals, for example, aluminum, manganese, and cadmium, which are related with genuine wellbeing risks.

It is contended that air quality deteriorates after Diwali, by virtue of fireworks that get scorched during the celebration. The connection between firecrackers and air Pollution has been built up in different locales by different authors. This brought about calls for forbidding the sale of firecrackers, and in 2017, the Supreme Court of India ordered such a ban.

The subject of what amount air Pollution decreased in view of cracker ban is significant , restriction on the clearance of fireworks impose noteworthy expenses as reduced occupations of individuals in that specific trade. Contingent on the meteorological conditions during Diwali period, particulate issue and gases lessens the perceivability in air to a bigger degree, enduring up to numerous hours. Numerous scientists have revealed detoriation in air quality due to diwali celebrations over various pieces of India

There are numerous contaminations noticeable all around, the most exceedingly awful among these is particulate matter, or PM2.5, a blend of solid and fluid droplets drifting noticeable all around whose diameter is under 2.5 micrometers. PM2.5 particles are delivered from a wide range of burning, including engine vehicles and power plants and some mechanical procedures. Of the toxins, PM2.5 particles are considered the most unsafe as they can enter profound into the respiratory tract, achieving the lungs. This can cause transient health impacts, for example, eye, nose, throat and lung disturbance, hacking, wheezing, runny nose and shortness of breath, and in the long haul can influence lung work and decline ailments, for example, asthma and coronary illness. We, in this manner,

concentrate to the proportion of PM2.5. The unit of estimation of PM2.5 is µg/m3.

The present study intends to evaluate the air quality status during the Diwali celebration over Lucknow, the capital of U.P., one of the vigorously populated significant urban communities and its correlation with earlier year's air quality information during a similar period. For this study, average daily concentration of PM2.5 and CO one day before Diwali, on diwali and a day after Diwali was considered and compared to describe the role of Diwali firecracker emission on the Air quality of Lucknow during the celebration time frame. This investigation will give helpful data about the progressions that have happened in urban air nature of the capital city of U.P. over ongoing three years (2016, 2017 and 2018).

2. Datasets and Methodology

Every one of the information gathered at the checking website CPCB utilized in this investigation are freely accessible on the web, and no particular authorizations are required to get to these locales. CPCB has a few observing stations in Lucknow: 1) Central School 2) Lalbagh 3) Nishatganj 4) Talkatora region which is contiguous a industrial area, while we chose Lalbagh that furnished us with the most reliable dataset. We bring craw PM2.5 and CO values from Lalbagh air pollution in Lucknow. This is as a few drop boxes where one needs to choose the name of the city, and station, the ideal timeframe just as the pointers for which information is required. We utilize hourly information from the area referenced above for a timeframe before , during and after Diwali over late three years 2016, 2017 and 2018. It ought to be noticed that values are absent from specific segments of the data. These missing perceptions are barred from our examination. We erase 1% tail of the perceptions to expel extreme values.

The one hour interval data obtained from continuous measurement of analyzers were averaged hourly and temporal graphs were plotted from 01 hrs to 24 hrs IST to assess the air quality during Diwali period from 2016 to 2018.

3. Results and Discussion

3.1 PM2.5

Year	Pre Diwali	Diwali	Post Diwali
2016	224.4125	270.3888	489.405
2017	149.5223	185.3475	141.5395
2018	196.9774	267.5254	406.95875

Table 1- Representation of the average daily concentration of $PM_{2.5}$

Table 1 shows the average daily concentration of PM2.5 in 2016, 2017 and 2018. In the period between 2016 and 2018, Diwali occurred on the following dates: Oct 30 2016, Oct 19 2017, Nov 7 2018. The concentration of PM2.5

increased post Diwali over Diwali day in 2016 and 2018 but in 2017 the PM2.5 average daily concentration reduced from 185.3475 μg/m^3 to 141.5395 μg/m^3 when the ban on firecrackers was introduced. A decrease of of 30.95% was observed in particulate matter concentration post diwali in 2017. This shows that the rule was followed by the people of Lucknow.

Fig 1 shows variation of Pre Diwali days, Diwali days and post Diwali days for year 2016, 2017 and 2018. During pre Diwali days ie. On 29th Oct 2016, 18th Oct 2017 and 6th Nov 2018 the mean level of PM2.5 was less over the Diwali days. Similarly on Diwali days, the level of PM2.5 was less over post-Diwali days for all three years. This shows that bursting of crackers is responsible for the increasing trend of particulate levels as the other sources such as traffic and industrial activities were at the minimal contribution levels during the period on account of Diwali holidays.

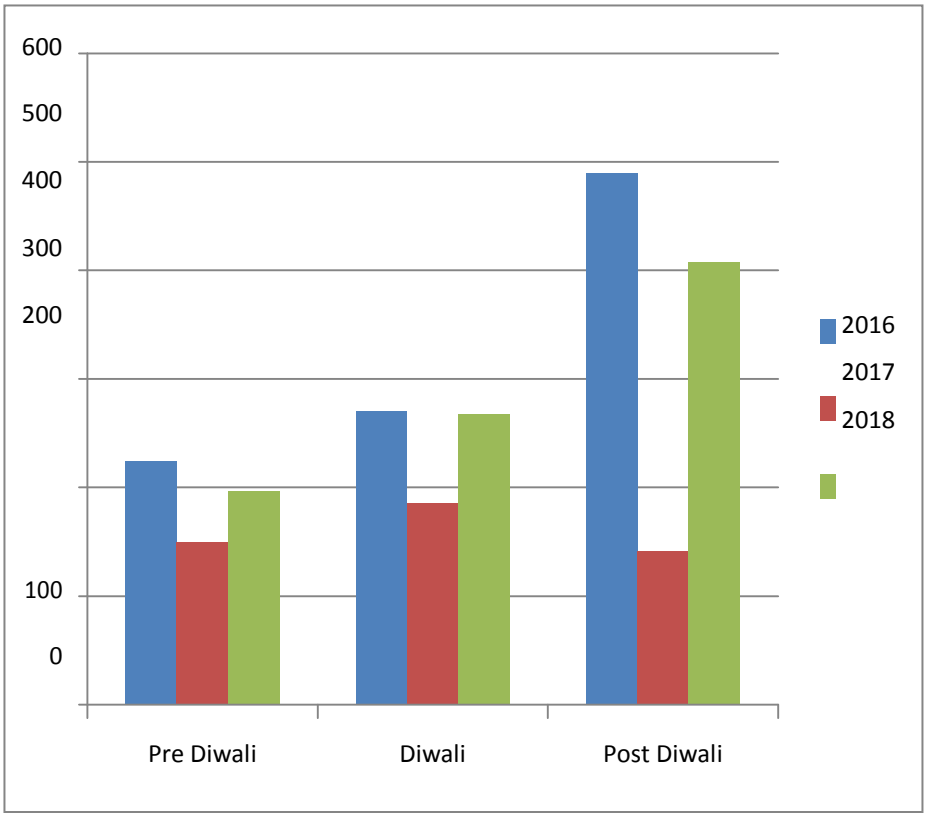

Fig. 1

Further, on Diwali nights the PM2.5 concentration was maximum for all three years over Diwali days levels (Fig. 2).

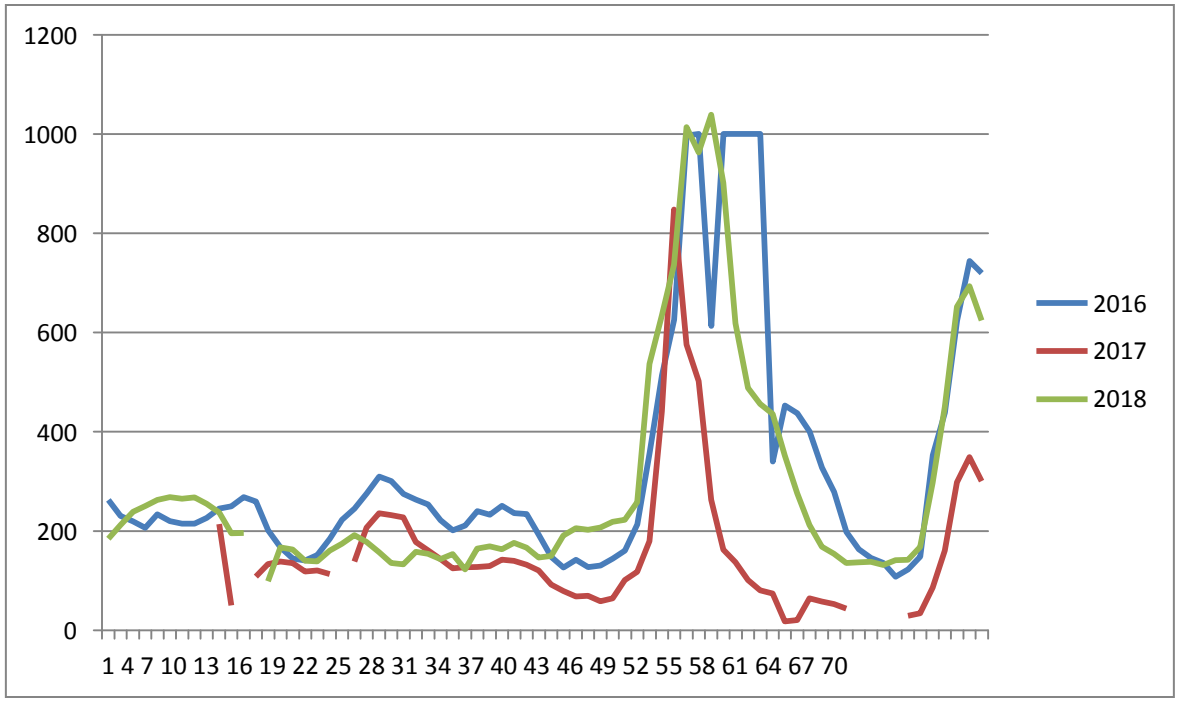

Fig. 2

3.2 CO

Year	Pre Diwali	Diwali	Post Diwali
2016	1659.237	1223.197	1847.849
2017	1087.065	1266.038	1423.455
2018	1035.417	1500.417	2204.167

Table 2

From Table 2 it can be observed that even after the ban on fire crackers in 2017 the concentration of CO increased from 1087.06 $\mu g/m^3$ on pre Diwali day to 1266.038 $\mu g/m^3$ on Diwali day. Further, it reached 1423.455 $\mu g/m^3$ post Diwali. It can be concluded that effect of ban on crackers in 2017 had no effect on CO levels and it kept increasing because of vehicular emissions since crackers do not produce significant amount of CO.

Fig. 3 shows that for Pre Diwali days of 2016, 2017 and 2018 the CO concentration is showing a decreasing trend whereas on Diwali days it is showing increasing trend followed by no specific trend for post Diwali days.

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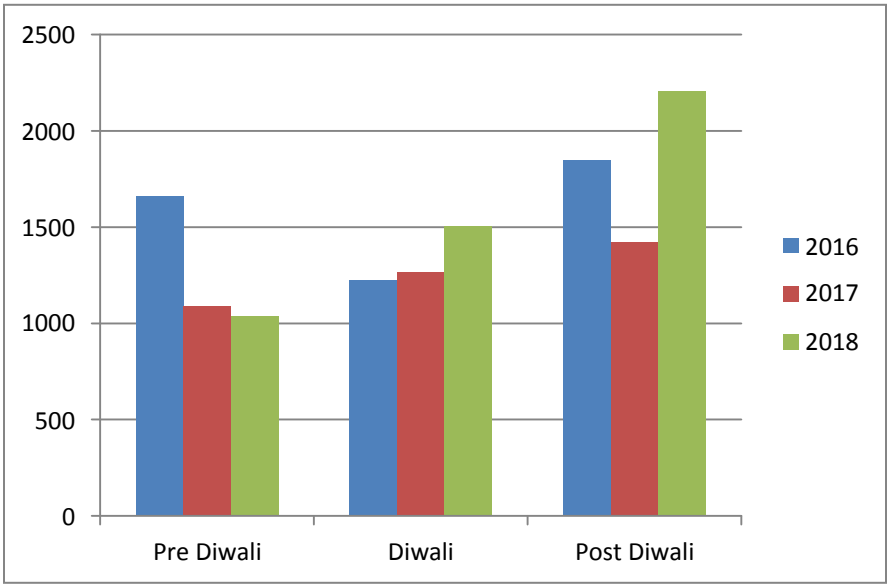

Fig. 3

However, from Fig. 4 it can be seen that the level of CO showed deceasing trend post Diwal night followed by a increasing trend in the mornings for all the years . It can be concluded that because of festive puja people preferred to stay at their homes so the use of vehicles decreased that time leading to the decrease in vehicular emission.

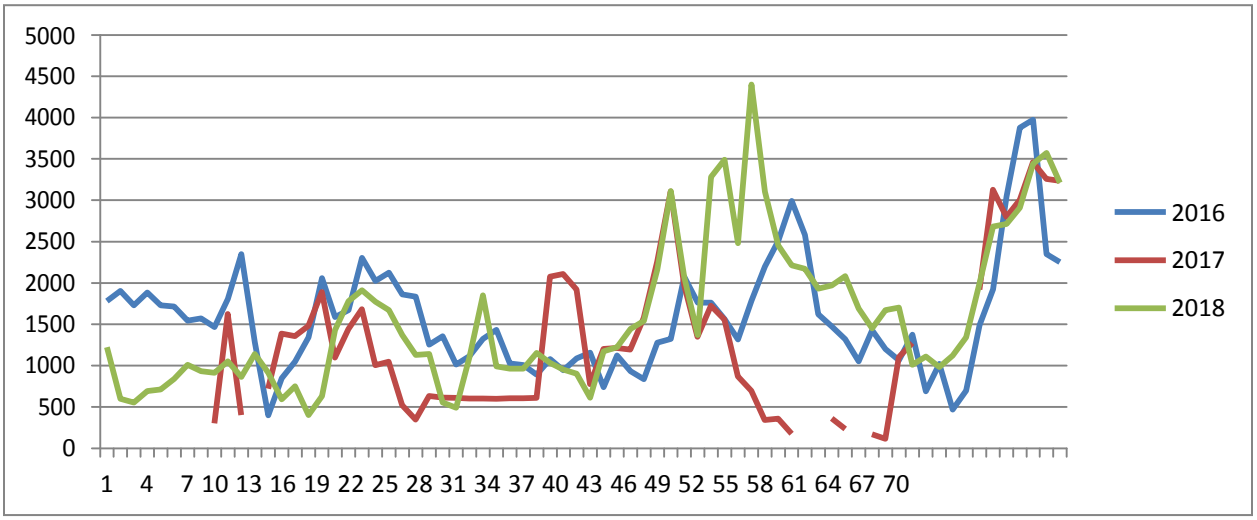

Fig. 4

4. Conclusion

These results indicate that fireworks during the Diwali festival affected the ambient air quality of Lucknow more in in 2016 and 2018 as compared to the year 2017 . The implementation of ban on fire crackers in Diwali 2017 caused decrease in concentration of PM2.5 when compared to the previous year PM2.5 concentration level for the same period.

However, CO concentrations kept increasing for the year 2017 even after the ban. Also,for previous years there is no specific trend during Diwali days which predicted that firecrackers do not emit significant CO. Also, post diwali, there is an increase in CO concentration for all three years from where it can be concluded that naturally the use of vehicles post Diwali holidays will increase and therefore the CO emission will also increase.

References

[1] Nasir U. P. & Brahmaiah D. (2014) Impact of fireworks on ambient air quality: a case study. International Journal of Environmental Science and Technology Date: 05 Feb 2014.

[2] SUNIL KUMAR PESHIN, PRIYANKA SINHA and AMIT BISHT Impact of Diwali firework emissions onair quality of New Delhi, India during 2013-2015 dated 15 June 2016

[3] Assessment of Ambient Air Quality during Pre-Diwali, Diwali and Post-Diwali Festival, November 2018 Environmental Monitoring Division CSIR-Indian Institute of Toxicology Research Lucknow, UP

[4] Ghei D, Sane R (2018) Estimates of air pollution in Delhi from the burning of firecrackers during the festival of Diwali. PLoS ONE 13(8): e0200371