



## ANALYSIS AND COMPARISON OF AQI AND POLLUTANTS – PM<sub>10</sub>, PM<sub>2.5</sub>, CO AND O<sub>3</sub> FOR THE YEARS – 2020 AND 2021 DURING DIWALI SEASON FOR JAIPUR, RAJASTHAN

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*“together we can and we will make a difference”*

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### ABSTRACT

The onset of COVID-19 brought a disastrous change in the lives of people, during which, humans' behavior, not only altered their livelihood but also the Earth's Atmospheric Pollution. This paper is written to show and analyze the difference in Air Quality Index (AQI) on – five days prior the Diwali Day (BDD), on the day of Diwali (DD) and five days after the Diwali day (ADD) for 2020 and 2021 for the city of Jaipur, Rajasthan, taking pollutants- PM<sub>10</sub>, PM<sub>2.5</sub>, CO and O<sub>3</sub>. The results show an increase in air pollution of the city in 2021 as compared to 2020, but O<sub>3</sub> shows a variation in the outcome. The results also link the change in parameters in the two years' data with the psychological behavioral change in public.

**Keywords:** AQI, pollutants, BDD (Before Diwali Days), ADD (After Diwali Days), DD (Diwali Day), COVID-19, Psychological behavioral change.

### INTRODUCTION

As with most experimental research reports, an analytical research paper is a highly technical form with a standard format of presenting information. This paper is presented in – 'Introduction, Methods, Results and Discussions' sections following the traditional IMRaD format. For this research, hourly data of aerosols and pollutants like PM<sub>10</sub>, PM<sub>2.5</sub>, CO and Ozone for 11 days divided in three sections – 5days before, at and 5 days after the Diwali day for both the years 2020 and 2021 were taken and compared, graphs were plotted and conclusions were drawn.

The main reason to carry out this research is to analyze and study the difference in the AQI and other pollutants over the capital city of Rajasthan – Jaipur, during the Diwali season: 9<sup>th</sup> November to 19<sup>th</sup> November in 2020 and 30<sup>th</sup> October to 9<sup>th</sup> November in 2021 when COVID was prevalent in India and draw out conclusions as to why was there a constant decrease in values of pollutants in 2020 during the course of 11 days but no decrease in values in the year 2021 was observed and how the obtained results may be connected to the thought process of public – human psychology, making it an interdisciplinary paper.

The main notation used in this paper is AQI (Air Quality Indices or Air Quality Index) which is most commonly used to indicate the severity of the pollution in air over a certain area ; in this paper – Jaipur, a city in Rajasthan, India. The AQI is the best

method to make local public aware of the air quality and take required measures. Since the past, a number of methods were developed by various scientists, environmentalists and environmental agencies but none of them was universally accepted or approved. Hence each region has its own methods and ways for calculation the AQI. These methods are differentiated mainly on the grounds of pollutants included, the sampling period of these pollutants and air the quality classes and its breakpoints.

This paper was written for the COVID period (2020-2021) when persistent haze events occurred all over India due to the incoming of The Corona Virus. Hence a turbulence of disasters and emotional damage which was experienced by the human race all over the world also affected the study area – Jaipur, India. Therefore, this paper tries to link the results obtained from the research done to the Human Psychology, suggesting that humans lost empathy during 2021, after one year from the onset of COVID-19

### DATA AND METHODOLOGY

#### 2.1 Data sources

Data (including PM<sub>2.5</sub>, PM<sub>10</sub>, CO as well as surface O<sub>3</sub>) were gathered from Jaipur city covering during the lockdown to determine air quality had improved. The concentrations of several pollutants levels from November – 19<sup>th</sup> November for the year 2020 and 30<sup>th</sup> October – 9<sup>th</sup> November for the year 2021 were studied.

The dataset for the current study was obtained from the Central Pollution Control Board (CPCB) portal at <https://app.cpcbcr.com/ccr/#/caaqm-dashboardall/caaqm-landing/caaqm-comparison-data>. In order to gather data, the CPCB has installed a variety of instruments with sensors approved by international meteorological organisations. In general, data resolution takes 15 minutes. The ambient ozone analyser, which operates on the basis of UV photometric/chemoluminescence principle and provides digitally data with a range of 0-500 ppb, was utilised at ground level for the measurement of surface ozone (O<sub>3</sub>). It has a lowest detection limit of 1.0 ppb, and 0.5ppb noise level.

## 2.2 The study area:

In this present study, the air quality data of Shastri Nagar Jaipur obtained from CPCB website. Jaipur historical city is the capital of Rajasthan known as Pink city, famed for its Rajputana culture and magnificent forts. Total area of Jaipur District has 11,117 sq. km with an average population density of 6,500/km. Jaipur is located geographical coordinates 26° 55' 0" N, 75° 49' 0" E at an altitude of 431m above the mean sea level. According to 2011 census, population of Jaipur is 3.1million, which ranks tenth in India in terms of population.

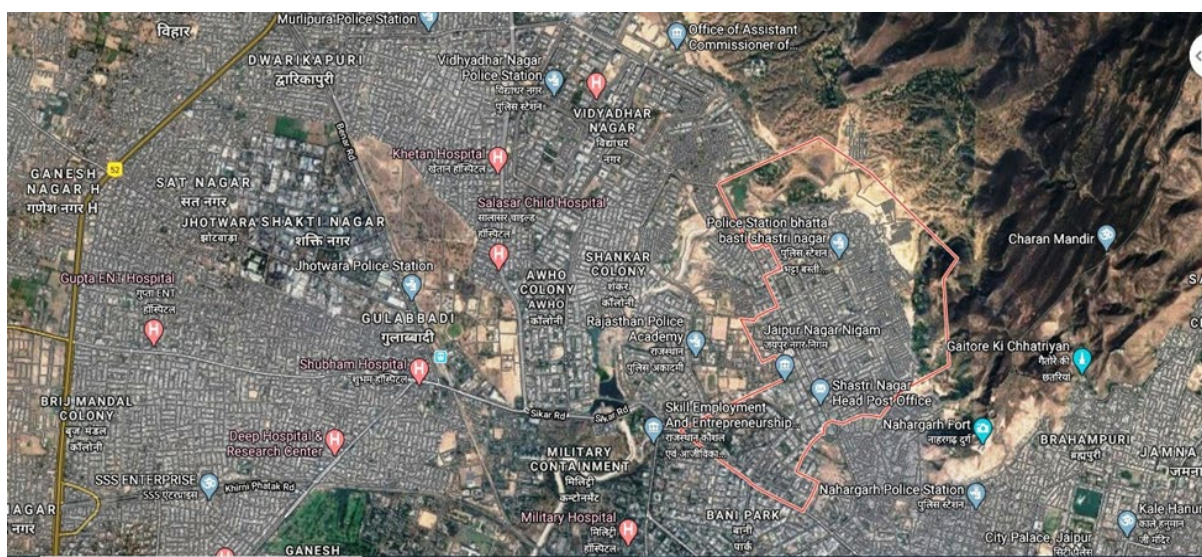


Fig. 1: Locations of air quality monitoring stations at Sastri Nagar Jaipur, Rajasthan (India)

## RESULTS & DISCUSSION

The results obtained from the data analysis done on the values of the parameters – PM<sub>10</sub>, PM<sub>2.5</sub>, CO and O<sub>3</sub> are as follows –

During the analysis it was observed that - there was an increase in values of the air pollutants over the course of 11 days for the year 2021 as compared to 2020 for PM<sub>10</sub>, PM<sub>2.5</sub> and CO resulting in increase in values towards the end i.e., ADD with an increase of 25.5% for PM<sub>10</sub>, 116% for PM<sub>2.5</sub> and 72.15% for CO shown through graphs 1, 2 and 3 (fig. 2, 3 and 4). The values of ozone (O<sub>3</sub>) however does not show an increase in 2021 as expected but rather a decrease of 22.8% in 2021 as observed in graph 4 (Fig 5). The AQI for 2020 gradually decreased over the course of 11 days showing – 42.1% from BDD to DD and – 18% from DD to ADD whereas no decrease was observed in 2021. Rather the AQI increased from BDD to DD with an increment of 116.1% and then slightly

decreased from DD till ADD showing decrement of – 7.14% showing an increment of 103% in AQI of 2021 as compared to AQI of 2020 for ADD, as seen in graph 5 (Fig 6).

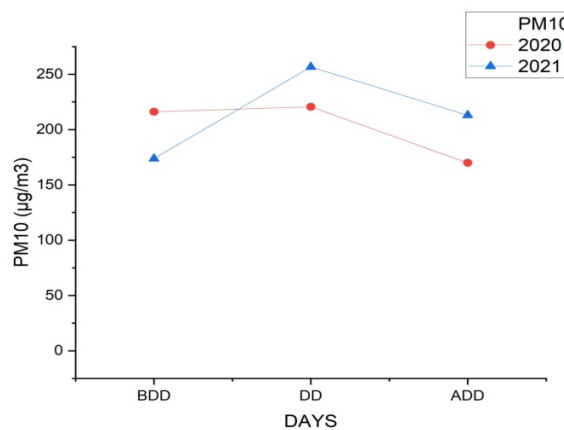
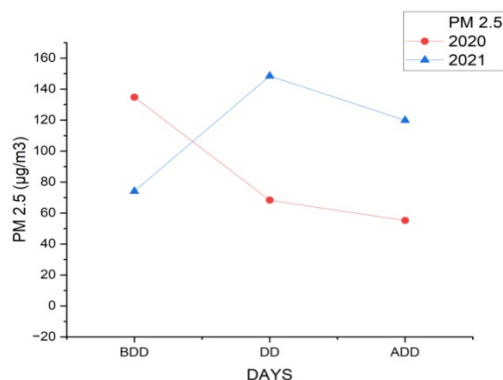
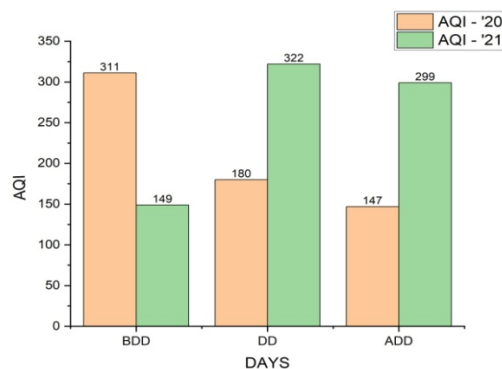


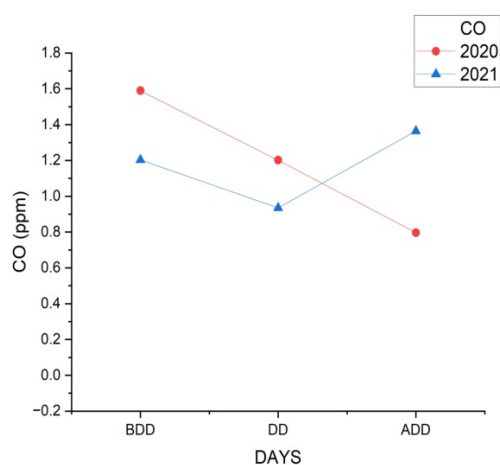
Fig. 2: Mean of 24 hours of PM10 for BDD, DD, ADD in 2020 and 2021.



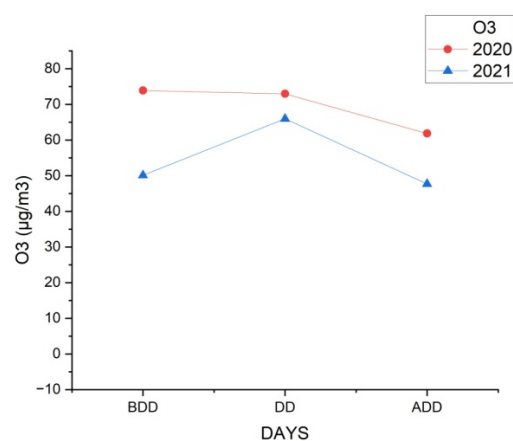
**Fig 3:** Mean of 24 hours of PM<sub>2.5</sub> for BDD, DD, ADD in 2020 and 2021



**Fig.6:** Calculated AQI mean of BDD, DD, ADD for 2020 and 2021.



**Fig 4:** Mean of 24 hours of CO for BDD, DD, ADD in 2020 and 2021



**Fig. 5:** Mean of 24 hours of O<sub>3</sub> for BDD, DD, ADD in 2020 and 2021.

Reasons for the observations can be justified by the fact that in 2020 the National Green Tribunal declared a blanket ban on firecrackers in any district with AQI of 201 or above in order to protect COVID patients from pollution as India was experiencing the first wave of COVID – 19. And as seen in the fig 6, Jaipur had an AQI of more than 300 prior Diwali. Rajasthan state government imposed monetary fines on anyone caught selling or burning crackers. The decrease in the Ozone for 2021 as compared to 2020 can be explained through studies conducted by NASA’s Jet Propulsion Laboratory in Southern California, stating – “ a new study finds that reduced fossil fuel burning due to lockdowns in American and Asian cities caused a global drop in ozone pollution”[1, 5]. According to which local reductions in harmful Ozone were as high as 50%. Hence this research finds out a reduction of Ozone over Jaipur, Rajasthan to be about – 22.86% in 2021 as compared to 2020 during the Diwali season for both the years. Another reason for the outcome can be considered the fear amongst the public. As COVID was a very recent and newly discovered disease with a very high mortality rate, people were afraid of the virus. Many had lost their loved ones to it and so people were sensitive and concerned about the patients suffering from COVID. Therefore, they followed the guidelines sincerely. While in 2021, although the government had still imposed ban on crackers, people still sold and burned firecrackers. It can be explained by the psychological change in humans due to the lockdown. An article – The Psychological and Social Impact of Covid – 19: New Perspective of Well-Being, explaining the same stated – “the COVID – 19 pandemic led to a prolonged exposure to stress” [2,9,



11-14], further stating – “The social distance and the security measures have affected the relationship among people and their perception of empathy toward others” [3-8]. Hence it can be concluded that by 2021 people were psychologically stressed and had comparatively become less empathic towards other humans (especially COVID patients), and thus burned firecrackers despite the ban and didn't care about the effect of the poisonous gasses from the crackers that cause 90% of the pollution, on people suffering from COVID.

### CONCLUSION

To protect COVID patients from pollution, the National Green Tribunal issued a blanket ban on firecrackers in 2020, and the state of Rajasthan fined

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anyone found selling or lighting fireworks. Over the course of 11 days in the year 2021, this led to an increase in the levels of air pollutants, with increases of 25.5% for PM<sub>10</sub>, 116% for PM<sub>2.5</sub>, and 72.15% for CO. Ozone (O<sub>3</sub>) levels drastically dropped during the Diwali season, with a drop of 22.86% in 2021 compared to 2020.

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