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Effect on the Air Quality and Noise Levels of Jaipur City in the Event of COVID-19: A Short Review †

Ashutosh Bhardwaj

Photogrammetry and Remote Sensing Department, Indian Institute of Remote Sensing, Dehradun, 248001, India; ashutosh@iirs.gov.in; Tel.: +91-9410319433

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Abstract: Jaipur has seen rapid development in the last two and a half decades being the capital city of Rajasthan and its proximity to the National capital region of India, directly impacting its environment. This systematic review and meta-analysis aimed to evaluate the status of air pollution based on available literature. A review based on the status of air pollution beginning with works of researchers in the 1996-97 period for Jaipur city, till the recent developments through published literature is presented here in the light of abrupt and extreme situations arising due to COVID-19. High Volume Samplers having a respirable dust sampler with dust collector and filter paper were utilized in these studies and it was conducted by dividing the city into various categories such as industrial area, commercial area, residential area, and sensitive area. Sulphur dioxide and nitrogen dioxide were measured by doing gas sampling and passing the gas through absorbing solution of sodium tetrachloromercurate and sodium hydroxide—sodium arsenite solution respectively. Carbon monoxide monitors of type CO-200 were being used to detect the presence of CO and indicate the concentration in ppm. Researchers have found that the recorded mean values of PM2.5 and PM10 were much higher than the specified limit by National Ambient Air Quality Standards (NAAQS). Sound level meters were used for the measurement of noise levels. Currently, daily AQI results are provided through online services based on PM2.5, PM10, NO_2, NH_3, SO_2, CO, and ozone. The AQI on 15th May 2020 is 92, 98, and 100 at 9:00 AM, 11:00 AM, and 2:00 PM representing a satisfactory category. However, AQI was 102 (moderate) at 3:00 PM and 4:00 PM. Jaipur is witnessing a major improvement in the air quality index (AQI) and noise levels during the COVID-19 crisis period due to limited anthropogenic activity since mid-March 2020.

Keywords: air quality index; noise levels; High Volume Sampler; Suspended Particulate Matter; COVID-19

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1. Introduction

Air pollution has been consistently increasing with the rapid pace of urbanization especially in the last two and a half decades in Jaipur. The important primary pollutants are namely, sulphur oxides (SO_x), carbon monoxide (CO), nitrogen oxides (NO, NO_2), lead, hydrocarbons, and allergic agents. Secondary pollutants develop on the reaction of these primary pollutants with one another usually aided by water vapour or sunlight. Some of the important secondary pollutants include sulphuric acid (H_2SO_4), ozone (O_3), formaldehyde, and peroxy-acyl-nitrate (PAN). Besides these, the Noise in the urban environment, which is the unwanted sound causes undesirable physiological and psychological effects in an individual.

A comparative study between 2005–2015 found that every year recorded mean values of particulate matters (PM2.5 and PM10) are very much higher than the specified limit by National Ambient Air Quality Standards (NAAQS) [1]. However, air quality has shown improvement during the lockdown phases in India as well as globally. Mahato et

al. studied the air quality data of seven pollutant parameters (PM10, PM2.5, SO_2, NO_2, CO, O_3, and NH_3) for 34 monitoring stations spread over Delhi based on National Air Quality Index (NAQI) parameters and found considerable improvement in the air quality in pre and during-lockdown phases [2]. Air pollution indices are developed over time in the United States and Canada [3,4], and are now used widely across the environmental agencies across the globe. India witnessed around 43, 31, 10, and 18% decreases in PM2.5, PM10, CO, and NO_2 respectively as observed during the lockdown period compared to previous years over 22 cities [5]. NRSC (National Remote Sensing Centre) in its study found that the mean NO_2 levels over India dip by 17% during the lockdown period with a sharp decrease of 62% in NO_2 levels over New Delhi as compared to 2019. Aerosol levels significantly reduced over the Indo-Gangetic plains region with a reduction of about 24% over the country as compared to the 5-year mean levels. However, an increase in CO levels was noticeable, possibly due to the long lifetime of CO as compared to NO_2 and aerosols [6]. The pollution levels including the noise levels pose a challenge to the community in the vicinity of highly polluted areas and thus require scientific studies. Geospatial technology includes remote sensing (RS), photogrammetry, geographical information systems (GIS), global navigation satellite systems (GNSS), and allied technologies. Geospatial technology has provided visualization and analytical tools to public health professionals and decision-makers by delivering timely regional information on climatic factors and landscape features [7]. Asfa et al. analysed the gaseous pollution scenarios, both before and during lockdown using Sentinel-5P satellite-based data sets along with ground-based AQI measurements for 8 cities having over five-million population in India. An average of 46% reduction in average NO_2 values and a 27% improvement in AQI was observed in these eight cities during the first lockdown phase when compared to the pre-lockdown phase [8].

2. Jaipur Experimental Site

Jaipur is the capital city of Rajasthan state and so has a large number of commercial as well as administrative activities taking place all around the year. Jaipur city (commonly known as the Pink City) is among the most prominent tourist destinations in India and is also the part of the tourist triangle, which includes the capital of India i.e., Delhi, the city of Taj Mahal—Agra and Jaipur. Jaipur city thus has a lot of incoming and outgoing population throughout the year. The region has a semiarid climate.

3. Methods and Results

The methodology involves setting up observation stations in various parts of Jaipur city. The primary data reviewed in the study is based on observation done in 1996-97 for the air pollution due to SO_2, NO_2, CO, Suspended Particulate Matter (SPM) along with the noise levels and the recent data samples, i.e., during COVID-19 situation are from openly accessible web-based platforms. The sampling absorbance was measured using Spectrophotometry. The study was conducted by dividing the Jaipur city into four categories namely: Industrial area (4 nos.), commercial area (28 nos.), residential area (13 nos.), and sensitive areas (4 nos.). In 1997, the SO_2 concentration was found maximum at Gopalpura and Ramgunj, which can be attributed to the heavy traffic movement in these areas. The noise levels are shown in Table 1, for the study carried out in 1997 depicting the highest noise levels in commercial areas. The sensitive areas also show high noise levels due to large less regulated vehicular traffic and being in the central parts of Jaipur [9,10]. Whereas, with the technological development currently the observations are made available for analysis along with the air quality index values on web-based platforms like https://www.oneindia.com/air-quality-index/jaipur (accessed on 15 May 2020). Rajasthan State Pollution Control Board (RSPCB) maintains the stations across Jaipur city at Adarsh Nagar, Police Commissionerate, and Shastri Nagar providing (PM2.5, PM10, NO_2, NH_3, SO_2, CO, and ozone). Most of the studies used respirable dust samplers such as APM 411 or its variants. Johari et al. surveyed 15 locations in Jaipur city during the year 2019 to

study the noise levels using Decibel meters along with methods to decrease its impact. The increased number of vehicles in the city raises the vehicular contribution to the overall pollution and is found as one of the major reasons for noise pollution [11]. However, the COVID-19 first lock-down period witnessed the lowest noise levels due to stalled anthropogenic activities. Kumar et al. studied air pollutants at twelve sites considering residential, industrial, and commercial areas of the Jaipur city. The results found show mostly higher to moderate air pollution based on AQI [12]. The study area is visualized using Cartosat-1 orthoimage. The ambient conditions of Jaipur city have been observed during the fieldwork and visits to Jaipur for studies conducted using geospatial technologies in the pre-COVID-19 times [13–15].

Table 1. Noise levels.

S.No.	Category	Maximum Noise Levels (dB)	Minimum Noise Levels (dB)
1	Industrial area	96	54
2	Commercial area	100	60
3	Residential area	98	50
4	Sensitive areas	97	64

The air quality index on 15th May at Jaipur was 92 at 9:00 AM on oneindia.com webportal and is under the satisfactory category. During the same day i.e., on 15th May, the AQI in Delhi was observed to be moderate. After the heavy rainfall during the 15th August in Jaipur with 176 mm of rain in 24 h, the pollution levels have further gone down. The NAQI depicts "Good" condition most of the time including the afternoon and evening rush hours during the third lock-down (referred to as unlock) phase on consecutive days till 24th August 2020, wherein a lot of activities have resumed although at a lower scale or magnitude.

4. Conclusions

COVID-19 pandemic resulted in a significant slowdown in the anthropogenic activities due to which an improvement in the environment is observed as there is a considerable decrease in air pollution and noise levels since mid-March 2020. The COVID-19 pandemic directly influenced and brought a reduction in the activities of the transport and industrial sector. The newer technologies such as GIS and web-based platforms successfully spread awareness among the community in general raising their concerns to look at the environmental issues due to higher pollution. The present conditions provided the first time a circumstance in the modern era, where the changes in the environmental variables can be evaluated under such a stalemate situation and its positive effect on the environment.

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Conflicts of Interest: The authors declare no conflict of interest.

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