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Interpolation Assessment of Ambient Air Quality of Bikaner City

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ABSTRACT
In developing countries like India, air pollution has become a major threat and regular air quality monitoring is prime need for strategy makers to reduce. In the present study an attempt has been made to develop a GIS model which will help conveniently obtain ambient air quality status from eights sampling sites of Bikaner city from March, 2019 to February, 2020. Seasonal and annual ambient air quality assessment has been carried out using interpolation evaluation. Variations in the concentration particulate matter ($PM_{10}$and $PM_{2.5}$) and gaseous pollutants (SO_2 and NO_2) has been shown through interpolated map using IDW technique of Geographical Information System. Findings of the study revealed that PM_{10} and $PM_{2.5}$ are the major contributor to the deterioration of air quality in Bikaner city. Spatial pattern and contour plots exhibit that the concentrations of the particulate matter are higher in winter and summer in comparison to the monsoon, while NO_2 and SO_2 concentrations were well below than the NAAQ standards. Ambient air database collected during the study will help to formulate control strategies for reducing air pollution and can be used to improve environmental and human health.
Key words: Air pollutants, Geographical Information System, IDW, NAAQS

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INTRODUCTION:

Release or occurrence of any pollutants (foreign material or gases) into the atmosphere, which may be harmful to human health and other living being known as air pollution. This situation in the urban area is particularly grim and is getting worse very fast during recent years. Rapidly growth in industrialization, urbanization, population, vehicular numbers have intensified environmental health risks and air pollution, especially in developing countries like as India, China, USA, Russia following by other Asian and European countries. Air pollutants can be various types including particulate matter (PM_{10}, $PM_{2.5}$) and aerosol (asbestos, dust, fly ash and soot), gaseous pollutants such as oxides of sulphur (SO_2), oxides of nitrogen (NO_2), carbon monoxide (CO), ozone, peroxyacetyl nitrate (PAN) and other oxidants which are responsible for poor air quality [1]. The air pollution occurs mainly from anthropogenic activities including burning of fossil fuels, incineration of the various industrial, municipal, and private wastes and emission from industries and vehicles. Recent studies show that various metropolitan cities have major role in exposure of criteria pollutants following carbon monoxide (70%), hydrocarbons (50%), oxides (40%) and SPM (30%) [2]. The World Bank has revealed that estimated cost of health damage due to poor ambient air quality to be $5.7 trillion, equivalent to 4.8% of global GDP [3]. Many cities of India in term of poor air quality have been in the list of top polluted cities around the world, National capital Delhi was most polluted city in 2016 and later on Ghaziabad replaced it and ranked first in the among top 20 polluted cities of the world [4] but in 2020 arising out of COVID-19 over the last few months across the globe and consequences have been seen as improvement in ambient air quality due to imposed restriction on human activities and transportation are obvious causes [5]. The COVID-19 infection caused by Novel Corona virus SARS-CoV-2, which is suspected to initiated in Wuhan city, China in the end of 2019 (6) and due to its rapid transmission rate World Health Organization declared it as global pandemic on March, 11 (7). Although effects of corona virus have been reported on human health but it helped to cure environmental health. Restriction on anthropogenic activities, public transport, suspension of commercial/business/educational activities and industries has improved the ambient air quality and decline in concentration of particulate matter, SO_X, NO_X, and other criteria pollutants and AQI was reported during the lockdown in many cities of India following Delhi, Ghaziabad, Gwalior, Varanasi, Kolkata, Jodhpur etc. [8].

Recently, Wang *et al*. (2020a, b) analysed particulate matter data in a number of Chinese cities, Beijing, Shanghai, Guangzhou, and Wuhan during COVID-19, and found a pronounced decline in ambient air

pollution attributed to the reduction of vehicular emission. Muhammad *et al*. (2020) found 20–30% reduction in concentration of NO_X and SO_X in China, Spain, France, Italy, and the USA due to lockdown. Kumari and Toashniwal (2020) revealed that COVID-19 has significantly helped to improve environmental health across the globe and India as well resulting reduction the concentration of PM10, $PM_{2.5}$, NO_2 and SO_2 by 55%, 49%, 60% and 19%, and 44%, 37%, 78% and 39% for Delhi and Mumbai. Similarly, many comprehensive studies shown that COVID-19 pandemic has influenced the ambient air quality and contributed in decline the concentration of major pollutants in ambient air by restricting human activities since complete lockdown imposed nationwide [9-11].Air pollution has both short-term and long-term hazardous impacts on human health, flora and fauna. The State of Global Air, 2020 revealed that 1.67 million annual deaths from stroke, heart attack, diabetes, lung cancer, chronic lung diseases and neonatal diseases due to Long-term exposure to outdoor air pollution in India in 2019. Short-term exposure to poor air quality can lead to wheezing, shortness of breath, cough, respiratory disease, asthma, and high rates of morbidity. The long-term effects caused by air pollution are chronic asthma, pulmonary insufficiency, cardiovascular diseases, and cardiovascular mortality.
Geographical Information System (GIS) is an efficient geospatial tool that simulates, capture, store, manipulate, derive, and analyse various types of geographical data and represent graphical view for easy understanding. Interpolation method is more suitable when it is not possible to monitoring at all selected locations it can predict the unsampled data from the study area. Interpolation aims to predict values of un-sampled location based on the sampled data over whole area, which can be show through maps or images. Interpolation technique is one of the most successful geospatial tools in modelling spatial changes of environmental system [13].
In order to develop and implement an effective air quality management plan, it is pre requisite to obtain reliable information on ambient air pollution level. Sampling and monitoring of air pollutants, generally known as air quality monitoring, is an integral component of any air pollution control programme running by CPCB and known as NAMP (National Air Monitoring Program) across the nation. The ultimate purpose of monitoring is not merely to collect data but also to provide the necessary information required by scientists, policy makes and planners so the general objective of this study is to assess the ambient air quality status of Bikaner city which is being deteriorated since last few of urbanisation, rapidly growth in vehicles, increasing industries, mining activities and improper traffic and urban planning [14].

MATERIAL AND METHODS

STUDY AREA: Bikaner district is fast developing city of Rajasthan located in the north-western part of Rajasthan and encompassed between north latitudes 27°11’ to 29°03’ and east longitudes 71°52’ to 74°15’ covering geographical area of 30247.90 km^2. The population of city is about 772,000 (2020) and Approximately 80%% people reside in urban area. The district experiences arid type of climate. Unlike many other cities with arid climate, Bikaner has long and very hot summers, mild and relatively short winters, dust storms and a monsoon season. The climate in Bikaner is characterized by significant variations in temperature having two seasons monsoon (June to September) and winter (October-February). In the summer season temperatures lie in the range of 28-45°C (82.4-119.3°F) and in the winter, it is cold with temperatures lying in the range of 5-23.2°C (941.0-73.8°F). Annual rainfall is in the range of 260-440 mm (10-17 in). The city is dominated by various small, medium and large-scale food and woollen industries, two wheelers, fertilizers, textiles, ceramics, food industries, chemical, Food aids, Plaster textiles etc.

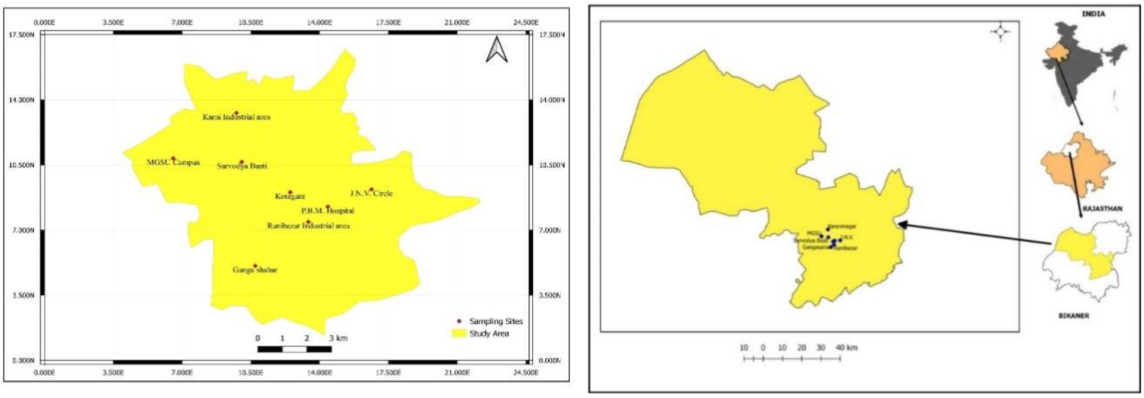


Figure 1: Sampling sites and study area (Bikaner City)

AIR SAMPLING: The main concern of the study was to measure the ambient air quality monitoring including PM_{10}, $PM_{2.5}$, SO_2 and NO_2 at different sampling sites in Bikaner city which were selected on the basis of differential anthropogenic activities and characteristics includes residential (R), sensitive (S), commercial (C) and industrial (I) areas which have observed considerable growth in commercial and industrial sector since last few years. The Sampling was carried out in all the three seasons i.e. winter, summer and Monsoon at 24, 4 hourly basis from March, 2019 to February, 2020. The selected Parameters were analysed by following methods $PM_{2.5}$ and PM_{10} (Gravimetric Method), SO_2 (EPA assessment modified West and Gaeke Method) and NO_2 (Arsenate modified Jacob and Hocchheiser Method) according CPCB guideline which gave a fair idea of pollution load carrier by the air in all the seasons [14,15]. High Volume air sampler (Model: RDS APM 460 NL with Gaseous sampling attachment APM 411 TE, Make: Envirotech India Pvt. Ltd) was used to collect the samples by running the equipment for a period of 24 hours.

Standard Methods for Analysis of Selected Parameter:

Particulars	PM_{10}	$PM_{2.5}$	SO_X	NO_X
Sampling Equipment	Respirable Dust Sampler APM 460	Respirable Dust Sampler APM 460	RDS with Gaseous Sampling Attachment	RDS with Gaseous Sampling Attachment
Analytical Method	Gravimetric Method (PM_{10})	Gravimetric Method ($PM_{2.5}$)	Spectrophotometry (Imporved West and Gaeke Method)	Spectrophotometry (Modified Jacob and Hochheiser Method)
Collection Media	Glass Fiber Filter Paper	Glass Fiber Filter Paper	TCM Tetrachloromercurate	NaOH + Sodium Arsinate
Flow Rate	1.0-1.3 m^3/min	1.0-1.3 m^3/min	0.5 L/min	0.5 L/min
Time Frequency	8 Hourly	8 Hourly	4 Hourly	4 Hourly

Inverse Distance Weighted Method:

The spatial data was created within a Geographical Information System for the study area. The district boundary map of Bikaner city and sampling sites boundary are created in QGIS 3.18. Interpolation predicts the values for cells in a raster from a limited number of sample data points. It can be used to predict unknown values for any geographic point data (17). The Inverse distance weighted (IDW) interpolation is used to determine the cell values using a linearly weighted combination of a set of sample points. Compared with other methods, the IDW method is simpler to programme and does not require pre-modeling or subjective assumptions in selecting a semi variogram model (18). IDW using QGIS 'Inverse Distance Weighted (IDW)' is a local interpolator that estimates the value at un-sampled location using a combination of samples weighted by an inverse function of distance from the point of interest to the sampled points. The samples near to the un-sampled location have more influence than the further. The greater the weighting coefficient, the less the effect points will have if they are far from the unknown point during the interpolation process. As the coefficient increases, the value of the unknown point approaches the value of the nearest observational point. A power factor (k) is used to control the weights. If we increase the value of power factor that increases the influence of nearby points. IDW is a local exact interpolation technique. The general equation for IDW method is,

$$Zo = \sum Zi.\ 1\ dj/\ ksi{=}1 \sum 1\ dj$$

Where,

Zo = estimated value at un-sampled point o

Zi = Z value at control point i

dj = distance between sample point i and point o

s = the number of sample points used in estimation

k = Power factor

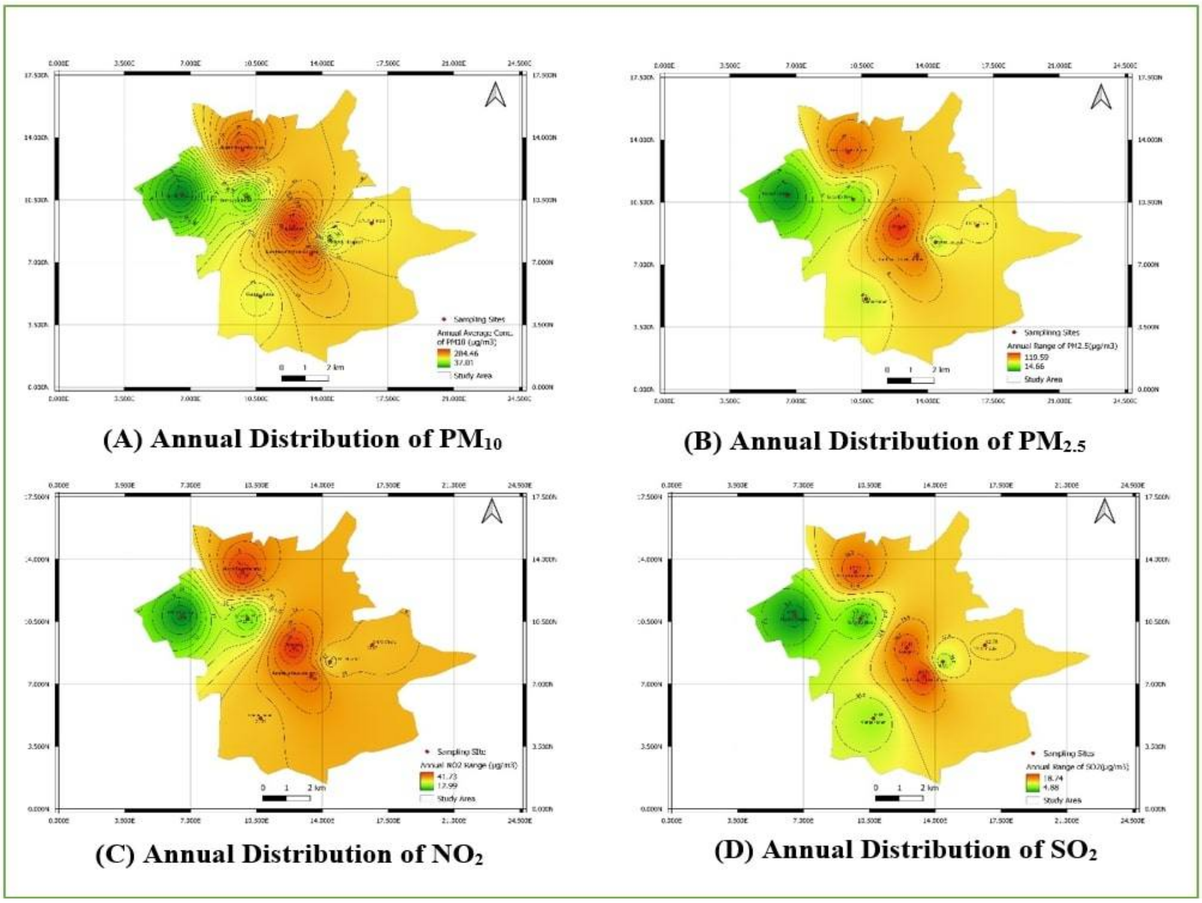


Figure 2: Annual average concentration (µg/m3) of PM_{10}, $PM_{2.5}$, NO_2 and SO_2

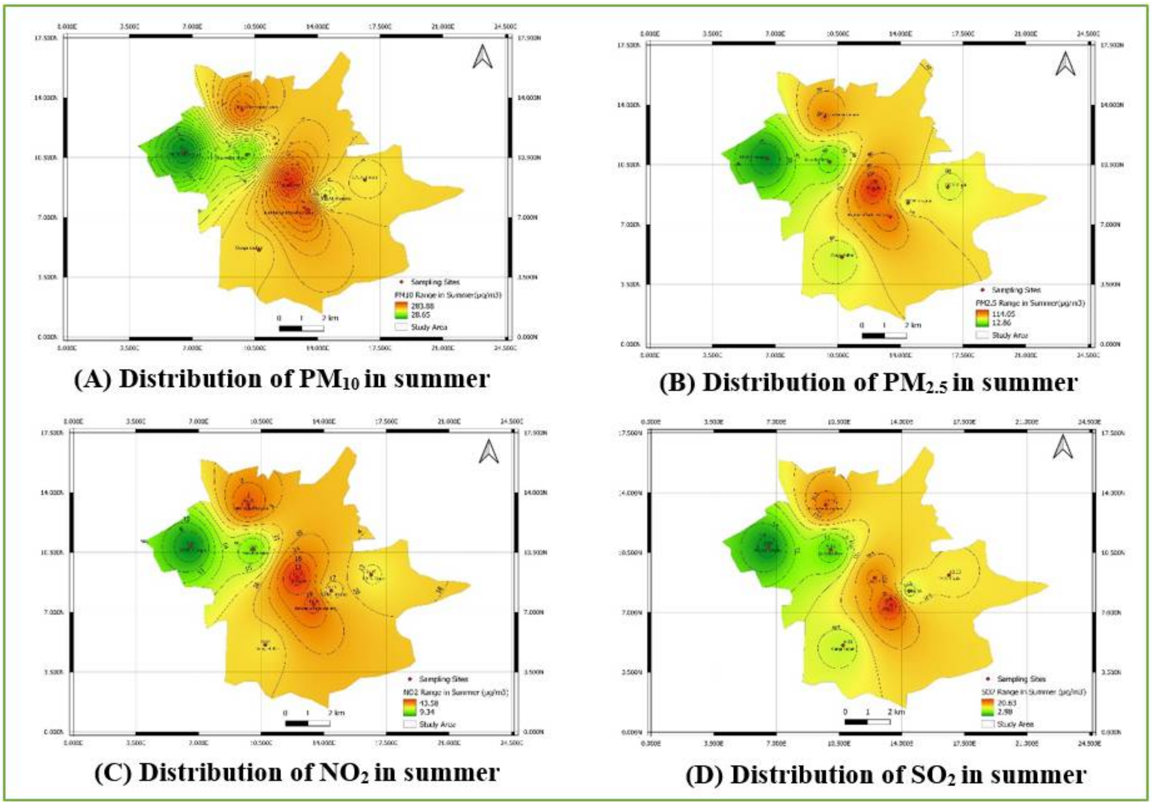
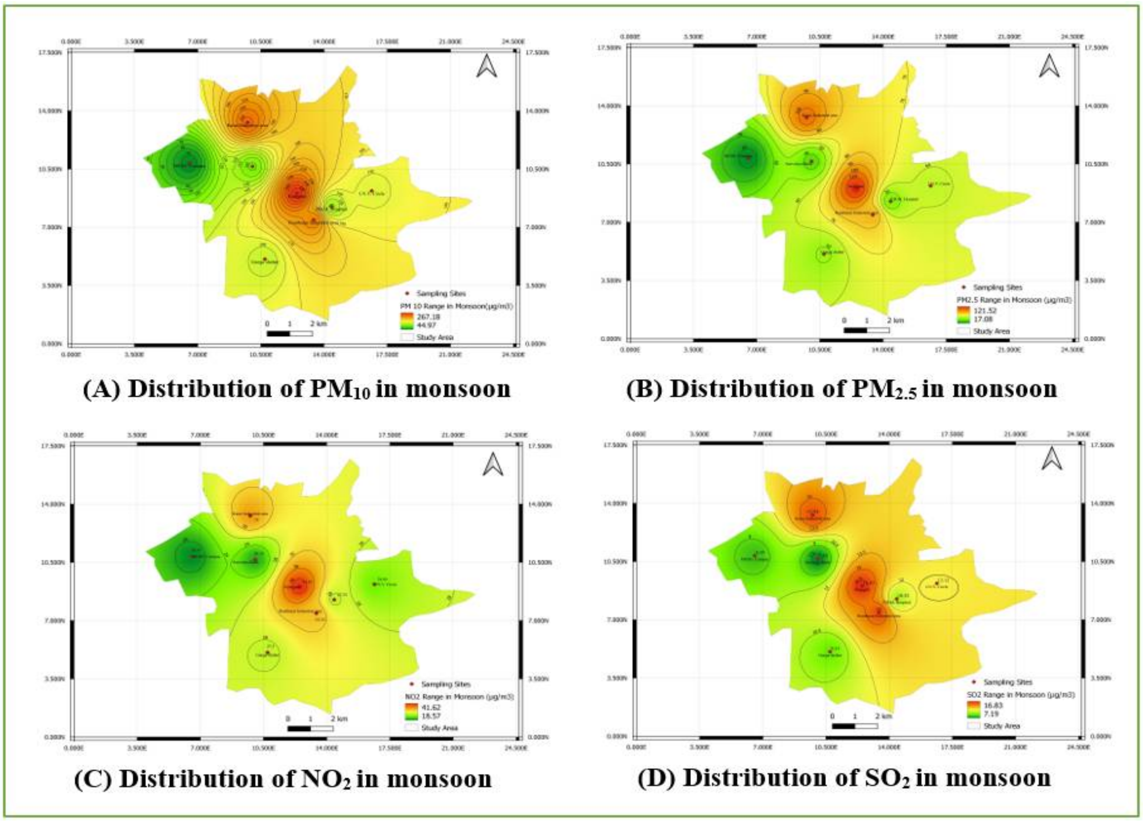


Figure 3. Average concentration (µg/m3) of PM_{10}, $PM_{2.5}$, NO_2 and SO_2 in summer season



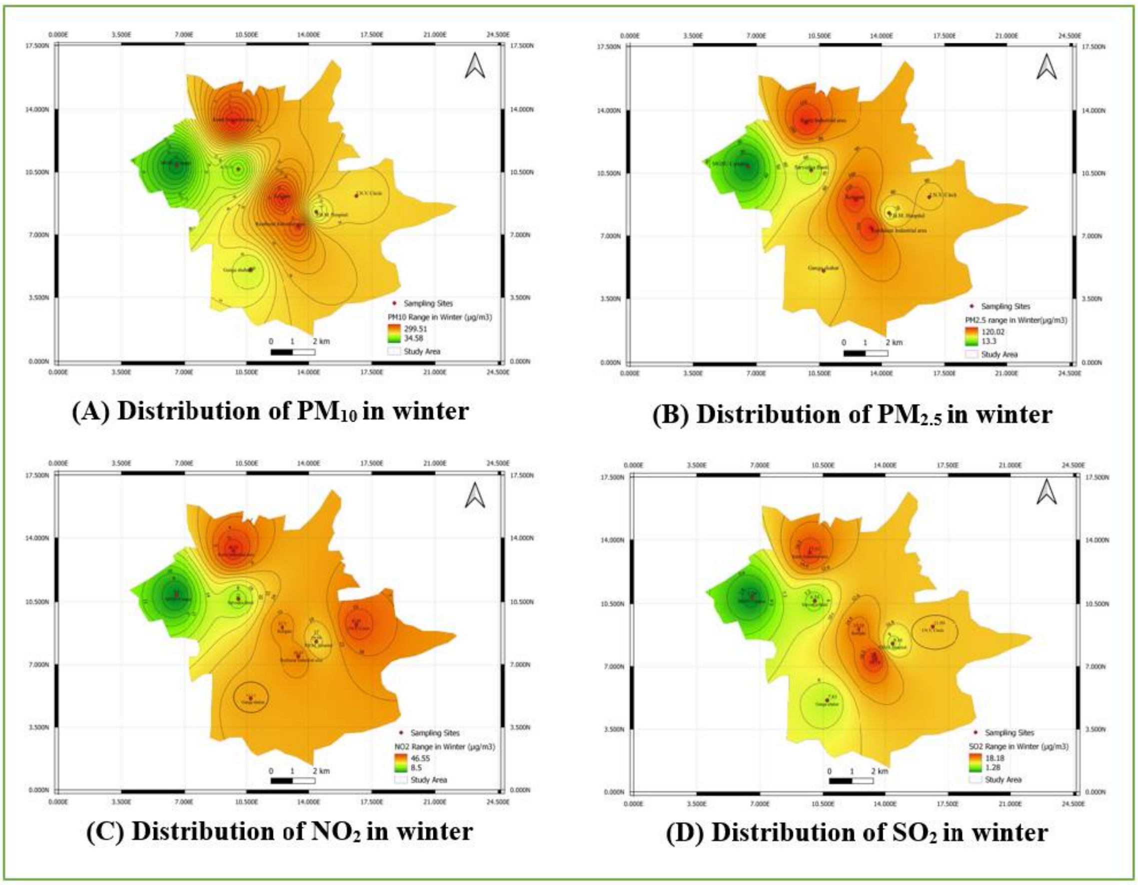
(A) Distribution of PM_{10} in monsoon

(B) Distribution of $PM_{2.5}$ in monsoon

(C) Distribution of NO_2 in monsoon

(D) Distribution of SO_2 in monsoon

Figure 4. Average concentration (µg/m3) of PM_{10}, $PM_{2.5}$, NO_2 and SO_2 in monsoon season



(A) Distribution of PM_{10} in winter

(B) Distribution of $PM_{2.5}$ in winter

(C) Distribution of NO_2 in winter

(D) Distribution of SO_2 in winter

Figure 5. Average concentration (µg/m3) of PM_{10}, $PM_{2.5}$, NO_2 and SO_2 in winter season

RESULT AND DISCUSSION

seasonal and annual variation in concentration of particulate matter (PM_{10} and $PM_{2.5}$) and Gaseous pollutants (NO_2 and SO_2) were assessed at eight selected sampling sites of Bikaner city. On the basis of monitored data of selected pollutants concentration at various locations, it is observed that the annual average concentration of gaseous pollutants (NO_2 and SO_2) has recorded well below while concentration of particulate matter (PM_{10} and $PM_{2.5}$) has consistently exceeded the permissible limits by NAAQS the sampling sites for the year 2019-20. Annual and seasonal average values of the ambient air quality parameters have been considered in present study are shown in Fig. 2. The maximum annual average concentrations of NO_2 and SO_2 are found to be 41.74 and 18.74 μg/m^3 at Kotegate sampling site and Ranibazar Industrial area sampling site amongst the eight sampling sites, SO_2 level is well below than the prescribed limits by NAAQS but annual concentration of NO_2 found very close to permissible limit (40 μg/m^3) at Kotegate (41.74μg/m^3) and Ranibazar industrial area (37.59μg/m^3). Similarly, annual average concentrations of PM_{10} and $PM_{2.5}$ followed the trend and maximum annual concentration of PM_{10} and $PM_{2.5}$ found 398.47 μg/m^3 and 179.20μg/m^3 at Kotegate followed by 368.14μg/m^3 and 166.42 μg/m^{3}at Karaninagar industrial area, 358.28 μg/m^{3}and 150.62μg/m^3 at Ranibazar industrial area.

Gaseous pollutants (SO_2 and NO_2) were found below the standards limits at all the centers except NO_2 level at Kotegate (41.74μg/m^3) and Ranibazar industrial area (37.59μg/m^3). The levels of SO_2 during the study were well below the permissible limit at all sampling sites. A relative fall in concentration of SO_2 has been observed in some developed cities in after arrival of BS6 vehicles engine, promotion of low sulfur content fuel, due to strict emission control and industrial restructuring. Consequently, the high SO_2 concentrations in earlier decades have been replaced by annual average concentration of about 20-40 μg/m^3 in most cities of the developing countries, and the daily average values rarely exceed 125 μg/m^3 (). The levels of SO_2 observed in the present study are in conformity with the above observation. Outcome of the study elucidate that seasonal annual average of PM10 and PM10 values were higher than prescribed limit (150/500 lg/m^3) set by NAAQS during the present study at commercial zone, industrial zone and residential, while shows lower concentration trend at MGSU campus sampling sites. The seasonal annual average of PM_{10} and $PM_{2.5}$ concentration crossed the reference levels of 100/200 lg/m^3 at remaining seven sampling sites categorized under residential/commercial/industrial category except MGSU campus site of sensitive zone, may be due to its location out of the city near and the Nal village area. Several comprehensive studies (19,20) also reported that the concentration of gaseous pollutants (SO_2 and NO_2) was found within the stipulated limits as per NAAQS while the concentration of particulate pollutants (PM_{10} and $PM_{2.5}$) have crossed the prescribed limits. It was observed during the study that higher concentration of particulate matter was recorded at kotegate sampling site followed by Karaninagar industrial area and Ranibazar industrial area sampling sites. The excessive amount of the PM_{10} and $PM_{2.5}$ may be correlated with the poor traffic management, narrow roads in the interior part of the old city, overcrowding of cattle in urban area, illegal parking of vehicles etc. The higher concentration of particulate matter near the Kotgate site may be correlated with the railway crossing at the main road, heavily transportation which generate the range of particulate matter through the dust from plying of diesel vehicles, dust produced from brakes, clutch plates, tires and indirectly through the re-suspension of particulates on road surfaces through vehicles– generate turbulence [22,23]. The problem became more severe due to industrial exhaust other anthropogenic activities at Ranibazar industrial area and Karaninagar industrial area. It was found that meteorological parameters like temperature, humidity, wind speed and wind direction significantly influenced the concentration of the pollutants. Seasonal distributions of the air pollutants. It is elucidated that concentration of particulate matter in winter and summer was higher compared with monsoon. The concentration of pollutants elevated in winter and summer due to industrial emission, apart from industrial emission, open biomass burning, mining exhaust, vehicular emission, construction etc across the study area play a significant role in enhance the concentration of pollutants.

Seasonal Interpolation Analysis:

The concentration of ambient air quality dataset collected from various sampling sites with coordinates was used in QGIS3.18 for interpolation using IDW technique. The results of use of IDW interpolation analysis are in figure 3,4 and 5, which are showing contour plots of seasonal average (summer, monsoon and winter) for PM_{10}, $PM_{2.5}$, NO_2 and SO_2, respectively. Distribution of seasonal variation in the concentration of pollutants can be see though the interpolation map and it is elucidated that concentration of gaseous and particulate matter pollutants are higher compared with summer and monsoon at every sampling site except MGSU campus. Figure 3 (A), (B), (C) and (D) are contour plots of average PM_{10}, $PM_{2.5}$, NO_2 and SO_2during summer season in present study period. NO_2 and SO_2 concentrations are as low as 09.34 and 2.98 μg/m^3 at MGSU campus site. The highest concentrations of NO_2 and SO_2 are at Kotegate (43.59μg/m^3) and Ranibazar industrial area (20.63μg/m^3) respectively. PM_{10}

and $PM_{2.5}$ also followed the trend and maximum concentration found at Kotegate site (283.95µg/m^3 and114.08µg/m^3).Six of among eight sampling sites during the study experienced higher concentration of particulate matter in due to severe dust storm in May month which accelerated the PM value, whereas lower concentration of PM_{10} and $PM_{2.5}$ was reported at MGSU campus (28.64µg/m^3 and 12.86µg/m3) followed by Sarvodyabasti (89.58µg/m^3 and 34.09µg/m3), were well below the slandered range by NAAQS, decline in concentration of particulate matter in these sampling site may be due to due to less vehicular emission, industrial pollution and good plantation. Figure 4 (A), (B), C and (D) exhibit contour plots of average concentration during monsoon season. This is less for all pollutants, though PM_{10} and $PM_{2.5}$ are 267.20µg/m^3 and 121.56µg/m^3 (Kotegate) followed by 232.88µg/m^3 and 103.81µg/m^3 (Karaninagar industrial area) are still higher than the permissible limit of ambient air quality standards. Lower concentration of pollutants in monsoon has been observed and this may be due to precipitation and higher wind speed, high rainfall washout the pollutants and show lower pollution levels in that period. Interpolation representation of PM_{10}, $PM_{2.5}$, NO_2 and SO_2 during winter season are shown in Figs. 5 (A), (B), (C) and (D). It is observed through the contour plot that NO_2 level was recorded higher at some sites such as Karaninagar Industrial area (46.55) and Kotegate (43.85µg/m^3), while SO_2 level was found under the permissible limit. Spatial patterns indicate that PM_{10} and $PM_{2.5}$ may be transported from Karaninagar industrial area to Kotegate and from Kotegate to Ranibazar industrial area. Interpolatted map represents good correlation between air pollutants and local meteorological (wind speed, temperature and relative humidity) conditions of study area. The results of the present study are fairly supported by the earlier findings other researchers [23-25].

CONCLUSION

Inverse Distance Weighting (IDW) interpolation technique of QGIS3.18 was used for assessment of gaseous (NO_2 and SO_2) and particulate matter (PM_{10} and $PM_{2.5}$) pollutants in the ambient air of Bikaner city. The study was carried out for air quality assessment to understand the variability in the concentration of these criteria air pollutant across the city. The analyses have been performed during three seasons (summer, monsoon and winter) at eight sampling sites, categorised on the basis of traffic load, characteristics and anthropogenic activities. Spatial pattern and contour plot of winter and summer exhibited similar pattern for PM_{10} and $PM_{2.5}$ pollutants while in monsoon it behaved different as well due to lower concentration in monsoon, So it can be conclude on the basis of monitored data and contour plot that concentration of particulate matter were higher in winter compared with summer and monsoon this trend may be due to low wind speed and condense condition which helps pollutants to suspend in ambient air for longer time period. Temporal distributions of the air pollutants demonstrated that Kotegate site was most polluted by PM_{10} and $PM_{2.5}$, while MGSU campus and Sarvodyabasti site were remarked as the best air quality among eight sites during the study. The study also demonstrates that IDW technique of GIS appears to be an appropriate navigation tool for assessment the spatial pattern of air pollution and its association with weather conditions along with visualization and statistical analysis. The spatial variability's in concentration of air pollutants provides scientific database for its mitigation and control. This site wise information of air pollution concentration would be useful for urban policy makers and administrative to effectively manage air quality for health and environmental purposes. It was found that harmful emission into the air is a symbol for environmental force that seriously affects human health, natural life and agriculture; thus, leading to major loss on the nation's economy. Therefore, strict traffic management, proper planning for controlling illegal parking, proper maintenance of vehicles, proper implementation of Air (Prevention and Control of Pollution) Act, 1981 are the need of the time to mitigate the air pollution in the urban area of Bikaner.

REFERENCES:

1. Abbasi, S.A. (2014). Environmental Pollution and its control.
2. Narayana, P. (2007). Environmental Pollution, Principles, Analysis and Control.
3. World Bank (2020). Report on air pollution, 1-14.
4. Green peace India. Green Peace Environment Trust (GPET); Tamil Nadu, India (2017). Airpocalypse: Assessment of Air Pollution in Indian Cities.
5. Gautam, S. and Trivedi, U. (2020). Global implications of bio-aerosol in pandemic. Environ Dev Sustain, 22, 3861–3865.
6. World Health Organization (2020). Coronavirus Disease 2019 (COVID-19) Situation Report – 51.
7. World Health Organization (2020). Novel Coronavirus (2019-nCoV): situation report, 3.
8. Greenpeace India. Green Peace Environment Trust (GPET); Tamil Nadu, India (2020). Airpocalypse IV: Assessment of Air Pollution in Indian Cities & National Ambient Air Quality Monitoring Programme (NAMP).
9. Arora, S., Bhaukhandi, K.D. and Mishra, P.K. (2020). Coronavirus lockdown helped the environment to bounce back. Sci. Total Environ. ;742 /j.scitotenv, 742, 540-573.

10. Mahato, S., and Ghosh, K. G. (2020). Short-term exposure to ambient air quality of the most polluted Indian cities due to lockdown amid SARS-CoV-2. *Environmental Research*, *188*, 109835.
11. Sharma, S., Zhang, M., Gao, J., Zhang, H., and Kota, S. H. (2020). Effect of restricted emissions during COVID-19 on air quality in India. *Science of the Total Environment*, *728*, 138878.
12. Goodchild, (1993). GIS and Environmental Modeling, Oxford University Press.
13. Charan, P.D. and Sahel, H. (2014). Study of respirable dust in ambient air of Bikaner city and its impact on human health. Applied Journal of Hygiene, Volume 3(1), 11-14.
14. Guidelines for the Measurement of Ambient Air Pollutants Volume-I, (2013), CPCB, New Delhi.
15. West, P. W. and Gaeke, G. C. (1956). Fixation of SOx as a sulfatomecurate (II) and subsequent colorimetric estimation. Analyst Chem. 1956, 28: 1816-1819.
16. Watson, D.F. and Philip, G.M. (1985). A Refinement of Inverse Distance Weighted Interpolation. Geo-Processing, 2, 315-327.
17. Janssen, S., Dumont, G.,Fierens, F.and Mensink, C. (2008). Spatial interpolation of air pollution measurements using CORINE land cover data. Atmospheric Environment 42(20), 4884-903.
18. Chauhan, G.S., Musa, A.A. Mustapha, T., Kushwaha, Y. and Ameta, D. (2020). Appraisal of Rajasthan Ambient Air Quality During Covid 19 Pandemic Lockdown.Journal of Xidian University, 14(5), 5797-5807.
19. Deep, A., Pandey, C.P. and Nandan, H.(2019). Evaluation of ambient air quality in Dehradun city during 2011–2014. J Earth Syst Sci 128, 96.https://doi.org/10.1007/s12040-019-1092-y.
20. Watkins, L.H. (1991). Air pollution fromroad vehicles. Transport and Road Research Laboratory, London, U.K..
21. Sandhu, P.S., Patel, U. and Gupta, A.B., (2004). Exposure to airborne particles and their physical characterization in ambient environment of Jaipur city. Nat. Environ. Pollut. Technol., 3 (4), 509–514.
22. Kumar, A., Patil, R. S., Dikshit, A.K. and Kumar, R. (2016). Air Quality Assessment Using Interpolation Technique.Environment Asia, 9(2),140-149.
23. Choudhary, M.P. and Gupta, H. (2016), Assessing ambient air quality of Kota city, Rajasthan in terms of air quality index. International journal of modern trends in engineering and research, 213-221: 2349-9745.
24. Dadhich, A.P., Goyal, R and Dadhich, P. N. (2018). Assessment of spatio-temporal variations in air quality of Jaipur city, Rajasthan, India. The Egyptian Journal of Remote Sensing and Space Science, 21(2), 173-181.
25. Muhammad, S., Long, X., and Salman, M. (2020). COVID-19 pandemic and environmental pollution: A blessing in disguise?. *Science of the total environment*, *728*, 138820.
26. Paital, B. (2020). Nurture to nature via COVID-19, a self-regenerating environmental strategy of environment in global context. *Science of the Total Environment*, 1390888.
27. Kumari, P.andToshniwal, D. (2020). Impact of lockdown measures during COVID-19 on air quality– A case study of India. International Journal of Environmental Health Research, 29(6).1-9
28. Wang, P., Chen, K., Zhu, S., Wang, P., and Zhang, H. (2020). Severe air pollution events not avoided by reduced anthropogenic activities during COVID-19 outbreak. *Resources, Conservation and Recycling*, *158*, 104814.
29. Wang, Q., and Su, M. (2020). A preliminary assessment of the impact of COVID-19 on environment–A case study of China. *Science of the total environment*, *728*, 138915.

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