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Ambient Air Quality Of Chikkamagalur City

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Abstract

Air pollution is a major public health concern as there is increasing amount of evidence that the quality of air significantly affects our health due to the presence of various toxic pollutants. Any gas could qualify as pollution if it reached a high enough concentration to harm theoretically that means there are dozens of different pollution gases. In practice SO_2, CO_2, CO, NO_2, VOCS, Particulates, Chlorofluorocarbons, Unburned hydrocarbons and Lead and heavy metals causes more concern. There are numerous diseases that caused by air pollution. According to the National Institute of Environmental Health Sciences (NIEHS) long term exposure to air pollutants causes respiratory illnesses, the children's and the elderly are especially vulnerable to the detrimental health effects. Urban air quality is a matter concern because of exposure of large number of people to it. This paper access the ambient air quality status in Chikkamagaluru city.

Chikkamagaluru is a city of Coffee lands and it covers with Forest area, with its supremacy in manufacturing Coffee powder, Ply woods and copper sulphate for Coffee plantation. The air quality being assessed based on measuring four major air pollutants namely suspended particulate matter (SPM), Respirable Suspended particulate matter (RSPM), Oxides of Nitrogen (NO_x) and Sulphur dioxide (SO_2). The air quality assessment in Chikkamagaluru city for three successive years shows increasing trends of air pollution. Even though the SO_2 and NO_2 levels remain under prescribed limit with minor fluctuations with reference to the prescribed limit was given by National Ambient Air Quality Standards (NAAQS). But the average concentration of SPM and RSPM has increased year by year. The study reveals that Chickmagalur has been heavily polluted in all aspects.

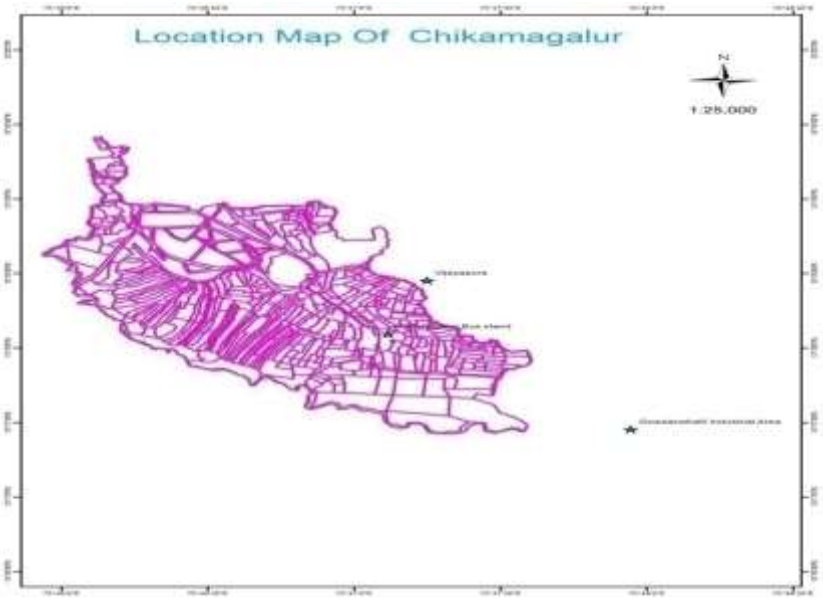
Keywords: Air pollution, Pollutants of air, trends, Average concentration, Spatio-temporal analysis and Urbanization.

1.INTRODUCTION:

Environmental pollution is a common problem in both developed and developing countries. Air pollution is one of serious problems faced by the people globally, especially in urban areas of developing countries, which not only experiences a rapid growth of population but also industrialization which is accompanied by growing number of vehicles [7]. Air pollution consists of gaseous, liquid or solid substances that were present in sufficient concentration and for a sufficient time, under certain conditions tend to interfere with human health

and cause environmental damage. Air pollution is the introduction of particulates, biological molecules or other harmful substances in to Earth's atmosphere, causes diseases, allergies, death to humans, damage other living beings. Every year large quantities of toxic wastes are discharged into the environment from the ever increasing production of goods and from the burning of fossil fuels to generate the energy needed to sustain industrial and domestic activities. SO_2, NO_2 and SPM are regarded as major air pollutants in India [1]. Air is rendered impure by a) respiration of man and animals b) decomposition of organic matter, c) combustion of coal, gas, oil etc d) trade, traffic and manufacturing processes that give off dust, fumes, vapours and gases. Urban air pollution is a matter of concern in the present days, because of exposure of large number of people to it and their adverse effects on human and environmental health [2]. In the developing countries, air quality crisis in cities is attributed to vehicular emission which contributes to 40-80% of total air pollution. The urban population is mainly exposed to high levels of air pollution including metals as well as fine and ultrafine particles [8] from the vehicular emission [9]. Every city has its own characteristics which becomes the pull factor for its growth and development and this developmental progress, if not checked posse's risks to environment and health of the people. Chickmagalur city is famous for its coffee curing and plywood industry and this unique activity of the city is responsible for the depreciated ambient air quality. Industrial operations, construction activities, poor traffic control, uneven roads and extensive automobiles exhausts are additionally helping in its quality drop. It is need of the hour for the awareness of common people especially in the urban area regarding vehicular pollution, industrial pollution etc and human health and its consequence in the short and the long term. In view of the above facts, it needs to monitor the ambient air quality of Chickmagalur city. The level of SPM, RSPM, $S0_2$ and NO_x was measured to check the ambient air quality at three different activity areas of the Chickmagalur city for three successive years.

1.1 STUDY AREA:



The present investigations are carried out to made assessment of Ambient air quality of Chikkamagaluru city The study area is located in between 75º77' to 13º15'North 75º49' to 13º18' East longitude. The selected locations are within in the city limit as shown above, fig.1

1.2 Methodology:

For the present study three successive years data from 2019-2021 have been taken in to consideration. The data obtained from pollution control board Chikkamagaluru. Three stations mentioned in the table were comes in the municipal area of Chikkamagaluru city, selected for ambient air quality assessment. These stations were selected on the basis of quality of air pollution i.e. residential, commercial and industrial. Respirable dust sampler APM 460NL by Environtec is used to collect sample for RSPM and SPM and thermoelectrically cooled gaseous sampling attachment APM 411TE by Environtec is used to collect sample for NOx and SO2, these samples are installed at the height of 10-12km from the ground level and placed on the roof of nearby houses and are about 40-50m away from the traffic area. The sampling was done twice a week. The air samples of 24h were collected in six shifts of 4hrs.

2. Result and Discussion

Chikkamagaluru city is famous for Coffee curing, Plywood, and Copper sulphate industries. There are around 20 big and 45 small units running continuously in the city Premises, which contribute in degrading the ambient air quality to the greater extent. The growing population and changing socio-economic condition of the Chikkamagaluru city in the last few years resulted in increase of Vehicles on the road. Especially, the private automobiles which adversely affects the ambient air quality as well as Human health.
The increasing density of Vehicles increases the consumption of fuel along with the rate of pollution. In Chikkamagaluru city there are 15 filling stations for Petrol and Diesel (table-1), as per the Indian Oil corporations, the consumption of Petrol and Diesel in the city in 2016 till December is 410 Kl and 1000 Kl respectively, While LPG consumption is 110Kl.

Table-1: Petrol pumps in Chickmagalur city

SL. No	Agency	Number of Outlets
01	Indian oil corporation (IOC)	8
02	Bharath Petroleum Corporation Ltd.(BPCL)	9
03	Hindustan Petroleum Corporation Ltd.(HPCL)	10
04	Liquid petroleum gas station(LPG)	5
Total		32

Source: Indian oil corporation (IOC), Chikkamagaluru city.

Table-2: Consumption of Fuel (in KL) in Chickmagalur city.

SL. No	Agency	Petrol			Diesel			LPG		
		2019	2021	% change	2019	2021	% change	2019	2021	% change
01	IOC	180	270	33.34	280	430	34.88			
02	BPCL	85	150	43.33	180	290	37.93			
03	HPCL	170	290	41.37	190	270	29.62			
04	LPG	-	-	-	-	-	-	70	130	46.15
City consumption		435	710	38.73	650	990	34.34	70	130	46.15

Monitoring locations: Three monitoring locations representing different activities areas like One in Residential area, one in Commercial area and one in industrial area were selected for the study.

Table-3: Monitoring Locations for Ambient Air Quality in Chickmagalur City.

SL. No	Locations	Activities
01	Vijayapura	Residential
02	KSRTC Bus Stand	Commercial
03	Gowdanahalli	Industrial

Table-4	**Concentration (µg/m^3)**								
Time	Station: - Vijayapura residential area for **SO_2**								
	02-03/11/19	04-05/11/19	06 - 07/11/19	21-22/10/20	23-24/10/20	24-25/10/20	11-12/11/21	13-14/11/21	15-16/11/21
10AM -2 PM	5.6	5	5.6	5	5.6	5.3	5	5.4	5.2
2PM-6 PM	6.3	5.6	6.3	5.9	6.5	6.3	6.5	6.7	6.7
6PM-10 PM	6.5	6.3	6.5	6.5	7.1	6.8	7.1	7.3	7.2
10PM-2AM	7.1	6.5	7.1	7.1	7.5	7.1	7.5	7.6	7.75
2 AM - 6AM	7.5	4.6	7.5	5.3	5.3	5.6	6.3	6.4	6.4

6AM - 10PM	5.9	4.4	5.9	4.7	5	5	6.3	6.5	6.4
Station: -Vijayapura residential area for **NO_2**									
	29-30/10/19	02-03/11/19	04-05/11/19	21-22/10/20	23-24/10/20	25-26/10/20	05-06/11/21	10-11/11/21	12-13/11/21
10AM -2 PM	17.5	19.3	19	18.2	18.4	18.5	17.9	17.9	17.7
2PM-6 PM	18.3	20.4	20.5	20	19.3	20.6	20	20.4	20.2
6PM-10 PM	19.4	21.5	21.7	21.3	21.5	21.6	21.7	22.1	21.9
10PM-2AM	20.8	22.5	23.4	22.5	23.1	23.5	22.7	22.9	23.1
2 AM - 6AM	17.3	23.1	21.1	17.9	18.2	18.3	18	19	20.5
6AM - 10PM	16.9	18.4	18.6	17.7	18	18.1	17.5	19.2	19.8
Station: -KSRTC Bus Stand Commercial area for **SO_2**									
	05-06/10/19	07-08/10/19	09 - 10/10/19	11-12/11/20	13-14/11/20	15-16/11/20	11-12/09/21	13-14/09/21	15-16/09/21
10AM -2 PM	5.3	5.1	5.4	5.3	5.8	5.7	5.2	5.6	5.3
2PM-6 PM	6.5	5.6	6.7	6.1	6.7	6.3	6.5	6.8	7.0
6PM-10 PM	6.8	6.3	6.9	6.3	7.3	7.1	7.3	7.6	7.5
10PM-2AM	7.2	6.8	7.1	7.1	7.8	7.3	7.8	8.0	8.2
2 AM - 6AM	7.7	4.8	7.5	5.5	5.7	5.9	6.3	6.6	6.5
6AM - 10PM	5.9	4.6	6.0	4.9	5.2	5.3	6	6.5	6.3

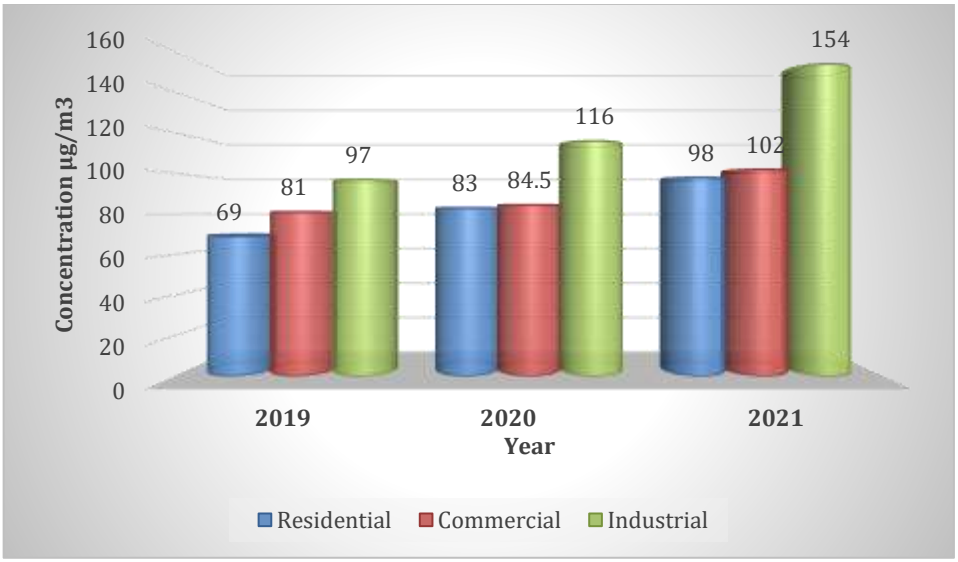
Source: Pollution Control board Chikkamagaluru.

Station: -KSRTC Bus Stand Commercial area for **NO_2**									
	29-30/09/19	02-03/10/19	04-05/10/19	29-30/10/20	02-03/11/20	04-05/11/20	11-12/11/21	13-14/11/21	15-16/11/21
10AM -2 PM	18.1	19.3	19.2	19.1	19	18.2	18.6	18.8	19
2PM-6 PM	18.7	21	20.5	21	19.8	22	21	21.8	22
6PM-10 PM	20.4	22.5	21.3	23.3	22.1	24	23	22.8	23.3
10PM-2AM	21.8	23	23.7	22.8	26.1	23.4	24.1	23.4	24
2 AM - 6AM	18	23	22	19.8	20	19.4	19	19.2	20.6
6AM - 10PM	17.1	19.6	18.8	18	17.5	18.6	18	18.6	19.2
Station:- Gowdana hally Industrial area for **SO_2**									
	02-03/10/19	03-04/10/19	05 - 06/10/19	11-12/10/20	13-14/10/20	15-16/10/20	11-12/10/21	13-14/10/21	15-16/10/21

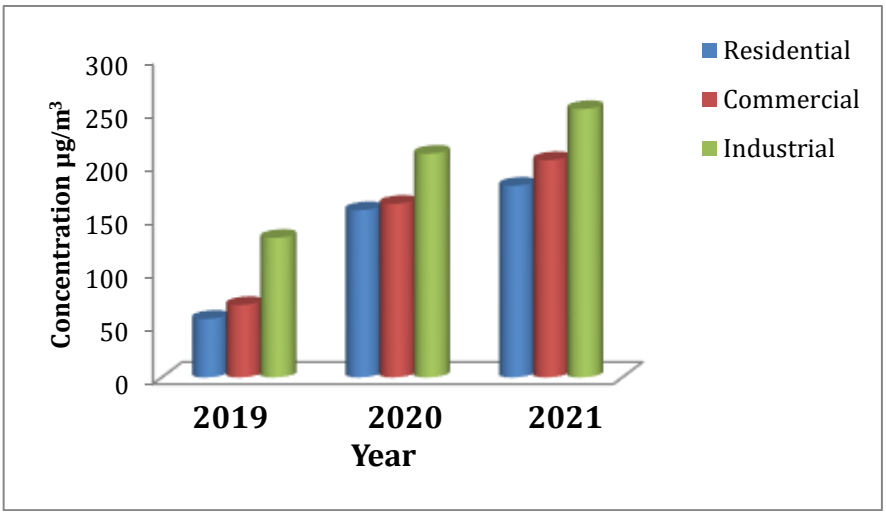
10AM -2 PM	5.1	5	5.7	5.4	5.6	5.3	5	5.2	5.4
2PM-6 PM	6.2	6	6.2	6	6.7	6.5	6.5	6.9	7.2
6PM-10 PM	6.6	6.7	6.5	6.5	7	6.9	7.5	7.2	7.7
10PM-2AM	7	6.8	6.6	7	7.3	7.8	8	8.4	8.2
2 AM - 6AM	7.2	5.8	6.5	6	5.2	5.6	7.1	7.2	7
6AM - 10PM	6	5.6	6.2	5.2	5.8	6	6.3	6.6	6.2
Station:- Gowdana hally Industrial area for **NO_2**									
	29-30/11/19	02-03/12/19	04-05/12/19	06-07/10/20	08-09/10/20	10-11/10/20	02-03/11/21	04-05/11/21	06-07/11/21
10AM -2 PM	19	18.7	19.2	19.1	19	18.2	19	18.6	18.4
2PM-6 PM	19.5	21.4	21	21	19.8	22	20.4	21	22.6
6PM-10 PM	22.3	23	23.4	23.3	22.1	24	22.8	23	23.9
10PM-2AM	23.8	23.5	24	22.8	26.1	23.4	23.6	24.7	25
2 AM - 6AM	19.7	21	22.2	19.8	20	19.4	19.2	19.8	21
6AM - 10PM	18	18.6	19.1	18	17.5	18.6	18	18.6	19.1

Spatial variation of ambient air Quality Status of Chikkamagluru city (2019 to 2021)

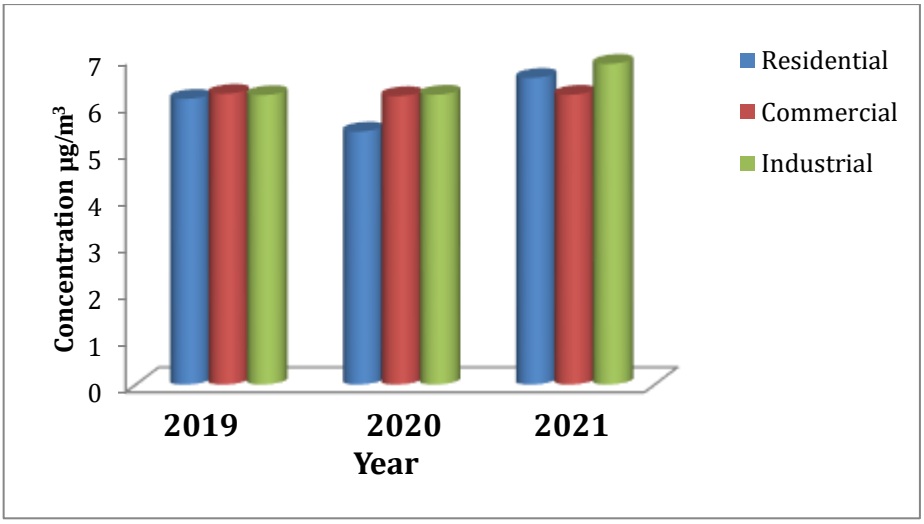
2.1 Respirable Suspended Particulate Matter (RSPM): There has been an increasing trend seen in the Residential, Commercial as well as in the Industrial areas compared to the previous years with minor fluctuations. The values at all the locations exceed the prescribed limit of NAAQS. While Industrial area showed the highest increase in values over the last years. The lowest average annual concentration of RSPM is observed in Residential area in 2019 is around 69µg/m^3 at Vijayapura and highest in 2021 is 154µg/m^3 at Gowdanahally. In Commercial area the highest average annual RSPM concentration is observed in 2021 is 116 µg/m^3 and lowest in 2021 which is 83µg/m^3 (fig.2)



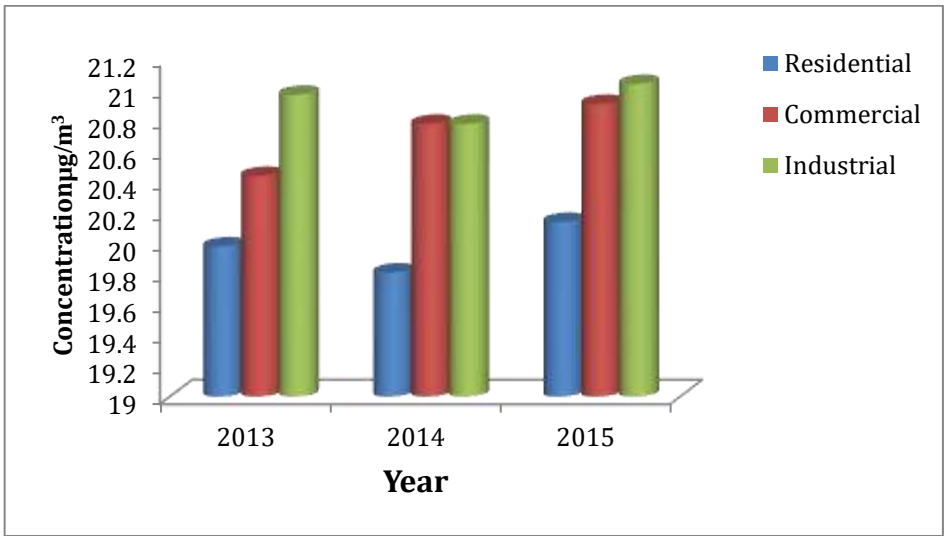
2.2 Fine Particulate Matter (SPM): At all the stations higher values were found compared to the previous year. But the Commercial and the Industrial areas showed fluctuations with the previous years. All the values at industrial area are nearest to the NAAQS (360 µg/m^3). The average SPM concentration in Residential area is found highest in 2021 is 131µg/m^3 and lowest in 2019 is 55µg/m^3. In Commercial area the average SPM level noted highest in 2015 is 210µg/m^3 and lowest in 2019 is 157µg/m^3. In Industrial area also highest value observed in 2021 and lowest in 20 is 252µg/m^3 and 180µg/m^3 respectively as in (fig.3)



2.3 Sulphur Dioxide (SO_2): The lower Concentration of SO_2 was found in Residential area as compared to the others, it is increased with small values as compared to the previous years. Commercial as well as the Industrial area too showed the same changes respect to the previous years. The average lowest value Concentration of SO_2 is found in Commercial area in 2020 is 5.42 µg/m^3 and highest value is found in Industrial area in 2021 is 6.87µg/m^3. In overall view at all the stations showed a small increasing trend over the time with minor fluctuations. All the values were found to be lower than the NAAQS (30µg/m^3) as shown in (fig.4).



2.4 Oxides of Nitrogen (NO_2): All the locations showed increasing trend when compared to the previous year values. Concentration of NO_2 showed the highest value at Industrial site followed by the Commercial and Residential areas. The lowest value of NO_2 concentration was found in Residential area in 2020 is 19.81µg/m^3 and highest value is found in Industrial area in 2021 is 21.04µg/m^3 as shown in (fig.5).



All the values of the current study is lower than the NAAQS (60µg/m^3). The entire analysis of spatial concentration of air pollutants shows that the highest concentration of air pollutants was observed in Industrial area and lowest in residential area. The RSPM and SPM levels found to be greater than that predicted by NAAQS at all the locations of the study area.SO_2 concentration shows decrease in their levels and well below the prescribed limit, whereas NO_2 shows increase in their concentrations at all the stations in the successive years, but the values are within the limit of NAAQS.

3. HEALTH EFFECT'S

The Results of the present study revealed that higher level of particulate matter (PM_{10}) at all the monitoring locations are responsible for several cardiovascular and respiratory diseases such as asthma, bronchitis, reproductive development, Chronic obstructive pulmonary disorder (COPD), increased risk of preterm birth and even mortality and morbidity rate. The effect of PM depends on the mass and number concentration, shape and size and the composition and concentration of other inorganic and organic pollutants associated with it. In the present study, the concentration of $S0_2$ and NO_2 were found to be below the permissible limits (30µg/m^3 and 60µg/m^3) of NAAQS. Several reports reveal that gaseous pollutants are related with respiratory diseases and reproductive and developmental effect even at low concentrations. Vehicular traffic and NO_2 are associated with significantly higher risk of lung cancer.

CONCLUSIONS

In the present study analysis of air pollutants such as PM_{10}, PM2.5, SO2, NOx have been done for assessment of ambient air quality of Chikkamagaluru City and data analysis showed the following the RSPM (PM_{10}) level and Fine Particles ($PM_{2.5}$) level at all the monitoring locations of residential, commercial areas were higher than the NAAQS (50µg/m^3 and 70µg/m^3).The concentration of gaseous pollutants $S0_2$ and NO_2 were below the prescribed NAAQS (60 µg/m^3) at all the locations.

Overall results indicate that RSPM and SPM along with the gaseous pollutants are one of the major causes for deterioration of ambient air quality of the city. Un limited growth of number of vehicles, their technological development and release of invisible tailpipe pollutants emission are serious debatable issues even for the policy makers. Use of different types of fuels namely petrol, diesel and LPG make the environment more Complex regarding the air quality and their synergistic effects on the human health. Overall continuous accumulation of different types of pollutants and their exposure to human beings needs emergency attention of the policy maker, researchers and regulatory agencies. The present study suggests that it is necessary to monitor the air quality as Well as the health effects at regular intervals at strategic locations which will help the planners for sustainable development of the city.

REFERENCES:

1. Agarwal,M. And J.Singh: Impact of coal power plant emission on the foliar elemental concentrations in plants in a low rainfall tropical region. Environ. Monit, Assess, 60,261-282(2000).
2. Barman, S.C., Kumar.N and R.Singh: Assessment of urban air pollution and its probable health impact. Journal of environmental Biolog,31(6),931-920(2010).
3. Caselles ,J.,C.Colliga and P.Zornoza: Evaluation of trace elements pollution from vehicle emissions in petunia plants. Water Air Soil Pollut, 136,1-9(2010).
4. Curtis,L.W.Rea,P,Smith-Willis,E.Fenyves and Y. Pan: Adverse health effects of outdoor air pollutants,Environ.Intern.32,815-830(2006).
5. Jayaraman,G.N: Air quality and respiratory health in Delhi. Environ. Monit. Assess, DIO 10.1007/s 10661-007-9651-0(2007).
6. Kaushik, C.P.,K. Ravindra and K.Yadav: Assessment of ambient air quality in urban centers of Haryana(India) in relation to different anthropogenic activities and health risk.Environ.Monith.Assess.,122,27-40 (2002).
7. Nagdeve,D.A: Urban air pollution and its influence on health in India. IIPS Mumbai, ENVIS center,01(03),(2004).
8. Nolte,C.G.,J.J, Schauer,G.R. Cass and G.R. Simoneit : Trimethylsilyl derivatives of organic compounds on source samples and in atmosphere i.e fine particulate matter. Environ.Sci. Technol,36,4273-4281(2002).
9. Sharma, k., R.Singh, S.C. Barman, D.Mishra, R.Kumar, M.P.S.Negi, S.K. Mandal, G.C.Kisku, A.H.Khan, M.M. Kidwai and S.K.Bhargava: Comparison of trace metals concentration in PM of different locations of Lucknow ncity.Bullet.environ.Contam.Toxicol.,77, 419-426 (2006).
10. Alberini, A, M Cropper, et al., (1997), "Valuing Health Effects of Air pollution in Developing Countries: the Taiwan Experience," Journal of Environmental Economics and Management, (34): 107-26.
11. Alberini, A and A Krupnick (1997), "Air Pollution and Acute Respiratory Illness: Evidence from Taiwan and Los Angeles," American Journal Agriculture Economics, (79.7): 1620-1624.
12. Alberini, A and A Krupnick (2000), "Cost of Illness and Willingness to Pay Estimates of the Benefits of Improved Air Quality: Evidence from Taiwan," Land Economics, (76): 37-53.
13. Amemiya, Takeshi (1984), "Tobit Models: A Survey," Journal of Econometrics, (24):3-6.
14. Apte, J.S., Pant, P. (2019). Toward cleaner air for a billion Indians. PNAS 116, 10614–10616.
15. Brauer, M., Guttikunda, S.K., Nishad, K.A., Dey, S., Tripathi, S.N., Weagle, C., Martin, R.V. (2019).
16. Brauer, M., Guttikunda, S.K., Nishad, K.A., Dey, S., Tripathi, S.N., Weagle, C., Martin, R.V. (2019).
17. Examination of monitoring approaches for ambient air pollution: A case study for India. Atmos. Environ. 216, 116940.
18. Chen, Y., Wild, O., Conibear, L., Ran, L., He, J., Wang, L., Wang, Y. (2020). Local characteristics of and exposure to fine particulate matter (PM2.5) in four Indian megacities. Atmos. Environ. 5, 100052. https://doi.org/10.1016/j.aeaoa.2019.100052 Chin, M. (2012).
19. Dirtier air from a weaker monsoon. Nat. Geosci. 5, 449–450. https://doi.org/10.1 038/ngeo1513 Chowdhury, S., Dey, S. (2016). Cause-specific premature death from ambient PM2.5 exposure in India: Estimate adjusted for baseline mortality. Environ. Int. 91, 283–290. 20. Chowdhury, S., Dey, S., Di Girolamo, L., Smith, K.R., Pillarisetti, A., Lyapustin, A. (2019). Tracking ambient PM2.5 build-up in Delhi national capital region during the dry season over 15 years using a high-resolution (1 km) satellite aerosol dataset. Atmos. Environ. 204, 142–150.