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Comparative statistical studies of air pollution index of Agra and Kolkata city

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Abstract

The presence of one or more air pollutants contaminants in such quantity and duration which may prove the injurious to human health, plants and animal life. The property is unreasonably interfere with comfort and enjoyment of life, property and conduct of the business is termed as air pollution. Present investigation mainly deals with the comparative statistical studies of air pollution index of Agra and Kolkata city.

Keywords: Air pollution, comparative studies, Agra and Kolkata

Introduction

Plants, animals and living organisms have to be entirely depends upon environment for sustaining their life. All living being are directly and indirectly affected by environment. The environmental pollution is the unfavorable alternation of our surrounding through direct or indirect effects of changes in energy patterns radiation level, chemical and physical constitution and abundance of living organisms. The present investigation mainly deals with the study of air pollution index in Agra and Kolkata city. The constant mean model, locally constant mean model and water forecast procedure are applied on air pollution data of NO_2 , SO_2 and SPM from 1996-2000. The air pollution means ^[1-5] are present in the outdoor atmosphere of one or more contaminants such as dust, fumes, gas, mist, odour smoke and vapour are present in quantities. The characteristics of these pollutants regarding the durations such as to be injurious to human, plant, animal life or property or which unreasonably interfere with the comfortable enjoyment of life and property.

Materials and Methods

Clear and dry air contains 78.09% nitrogen and 20.94% oxygen by volume. The remaining 0.79% is composed of a gaseous mixture of CO_2 , He, Ar, Kr, Nitrous oxide and xenon as well as very small amounts of some other organic and inorganic gases whose amount in the atmosphere vary with time and places. Various amounts of air pollution contaminants ^[6-10] continuously enter the atmosphere through both natural and man-made process that exists upon the earth. The portion of those substances which interacts with the environment to cause the toxicity, disease, aesthetic, distress, physiological effects, or environmental decay has been labelled by man as a "pollutant". Air pollution contaminants ^[11-17] are either natural or may be the results of various activity of man like industrial operation. Air pollutants are identified as follows:

- (i) Natural contaminants pollutants are as follows:
Natural fog, Pollen grain, Bacteria and Product of volume eruption.
- (ii) Aerosols pollutants are as follows:
Dust, smoke, mists, fog and fumes.
- (iii) Gaseous and vapours pollutants.

Other important contaminants are as follows:

- a) Sulphur compounds: SO_2 , SO_3 , H_2S etc.
- b) Nitrogen compounds: NO , NO_2 , NH_3 etc.

- c) Oxygen compounds: O₃, CO, CO₂ etc.
- d) Halogen compounds: HF, HCl, etc.
- e) Organic compounds: Aldehyde, Hydrocarbon and Radioactivity.

Results and Discussion

Air pollution study of Agra city

Perhaps, no other historical monuments has evoked as much awareness and administration of tourists and travelers, alike as the magnificent TajMahal, fondly called people as the ultimate requiem of love, from the great Mughal Emperor Shah Jahan to his beloved wife. Agra is a historical city and situated on bank of River Yamuna in Uttar Pradesh (India). It is situated in the North Central part (27° 10' N, 78° 05 E, 169 m.) above the mean sea level of India. It is semi arid region bounded by the desert of Rajasthan on two third of its peripheries. It was founded by Sikandar Lodhi. So over whelming is exquisite beauty presence of this marble mausoleum that centuries later today even the very land whose it has been located Agra has been important as the city of Taj. The latter part of Indian history outline the origins of Agra to 1475 A.D., when the region of Raja Badal Singh. Later in 1526 A.D. the Mughal Emperor Babar took upon himself the task for rendering Agra, a unique character and beauty of its own. TajMahal, Sheer Poetry in marble and Majesty Magnificance, unrevaled. The TajMahal is one and only one of its kind across the World.

Findings

No pollution monitoring ^[18-22] is being done at the TajMahal as to the quantum of polluting gases and Suspended Particulate Matter (SPM) affecting the monuments. The UPPCB (Uttar Pradesh Pollution Control Board), air monitoring station inside the TajMahal is closed. Neither of the two station have continuous electricity as per the January 1998, aerations of this Hon'ble Supreme Court to the UPSEB. In November 1996 the Mahajan Committee reported had found the same situation and in the year 2000, it is no different. The Hon'ble Supreme Court order of March 24, 1998, is being openly violated by permitting petrol, diesel vehicles around the TajMahal.

Important Decision of the Hon'ble Supreme Court in the Public Interest Litigation

Taj Pollution Matter M.C. Mehta versus VOI Ors. WPC No. 13381/1984: The source of air pollution in Agra region were particularly Iron Foundries, brick kilns, refractory units and automobiles. The petitioner also alleged that distance sources of pollution were the Mathura refinery and Firozabad bangles and glass Industries. It was also stated that the SO₂ emitted by the Mathura refinery and the industries located in Agra and

Firozabad when combined with moisture in the atmosphere forms sulphuric acid and causes 'Acid rain' which has a corroding effect on the gleaming white marble.

Constitution of Mahajan Committee

The Mahajan Committee was constituted by the order of Hon'ble Supreme Court on 05.02.1996. The Hon'ble Supreme Court on 30.08.1996 directed the Mahajan Committee to inspect the progress of the green belt developed around the TajMahal every three months and submit progress report in the court for the period of next three years. Earlier, on the basis of the report submitted by the NEERI regarding development of the green belt around the TajMahal, The Hon'ble Supreme Court on 30.08.1996 and 30.12.1996 directed the Ministry of Environment and Forests, Government of India for monitoring maintenance of the trees planted in the green belt. On the direction of the Hon'ble Supreme Court on 13.09.2000, the Central Pollution Control Board inspected the Foundry Nagar Industrial Area, Agra and the premises of the TajMahal and submitted its report with its recommendation. The city of Taj (Agra) has the sever problem of air pollution ^[23]. The main air pollutants are as: CO₂, SPM, oxides of Nitrogen (NO₂), Sulphur dioxide (SO₂), Carbon monoxide (CO), etc.

(1) TajGanj: A sensitive area where TajMahal is situated. The area is surrounded a green belt extending for a radial distance of 1 k.m. Several small scale industries are also located within the region. Every day, in a peak season about 2500 visitors come, mostly by vehicles to see TajMahal.

(2) DayalBagh: A suburban area located in the north of the city, has low residential density and no industrial activity.

(3) St. John's Crossing: Major business and commercial center of the city. The traffic density is maximum about 30,000 vehicles per day.

(4) Manas Nagar: A residential area, has no industrial activity and low traffic density.

(5) Sadar Bazar: Market area, a number of goods vehicles come here for loading and unloading the goods and a number of diesel generator sets operate during power failure.

(6) Foundry Nagar: In industrial area; situated on the eastern periphery of the TajMahal.

The Central Pollution Control Board (CPCB) monitor the level of the air pollutants like SO₂, NO₂, SPM contaminant at the following six sites are shown in Table-1 and ambient air quality standards are given in Table-2.

Table 1: Average concentration of SO₂, NO₂ and SPM ($\mu\text{ gm}^{-3}$) at different sites in Agra City

Station (sites)	Average concentration ($\mu\text{ gm}^{-3}$)		
	SO ₂	NO ₂	SPM
(1) Taj Ganj (Sensitive)	18	15	519
(2) Dayal Bagh (Suburban)	14	12	616
(3) St. John's crossing (Commercial)	21	19	751
(4) Manas Nagar (Residential)	15	14	653
(5) Sadar Bazar (Commercial)	16	14	656
(6) Foundry Nagar (Industrial)	22	20	742

Table 2: National ambient air quality standards prescribes by Government of India

Pollutants	Time weighted average	Concentration ($\mu\text{ gm}^{-3}$) of Pollutants in ambient air quality		
		Industrial	Residential or Rural	Sensitive
SO ₂	Annual average	80	60	15
	24 hours	120	80	30
NO ₂	Annual average	80	60	15
	24 hours	120	80	30
SPM	Annual average	360	140	70
	24 hours	500	200	100

Air Pollution Study of Kolkata City

Kolkata is one of the large cities in India known to have sever air pollution problems with respect to Suspended Particulate Matter, oxides of Nitrogen, Sulphur dioxide, Carbon monoxide and lead. The primary source of these pollutants is vehicular emission vulnerability analysis reveals that at road

level, the traffic intersection at Howrah Bridge approach is the most polluted. Kolkata is a capital city of West Bengal, has an area of 187.33 square kilometers and is divided into 141 wards. In 1998, the ambient air quality monitoring for SPM, NO₂ and SO₂. Concentration of air pollution index of different pollutants at road level in Kolkata city are given in Table-3.

Table 3: Value of air pollution index of Kolkata city

Pollutant/Station	Average National Ambient Air Quality Standard	
SPM ($\mu\text{ gm}^{-3}$)	Average	N.A.A.S
(i) BBD Bag	685.1	500
(ii) Howrah	1662.1	500
(iii) Taratola	1490.2	500
(iv) Gariahat	977.1	200
(v) Shyam Bazar	889.3	200
(vi) Hazra	817.0	200
NO ₂ ($\mu\text{ g/m}^3$)	Average	N.A.A.S
(i) BBD Bag	251.5	120
(ii) Howrah	251.3	120
(iii) Taratola	272.1	120
(iv) Gariahat	223.3	80
(v) Shyam Bazar	209.9	80
(vi) Hazra	196.9	80
SO ₂ ($\mu\text{ gm}^{-3}$)	Average	N.A.A.S
(i) BBD Bag	68.9	120
(ii) Howrah	126.6	120
(iii) Taratola	80.3	120
(iv) Gariahat	61.0	80
(v) Shyam Bazar	68.0	80
(vi) Hazra	61.4	80

Calculation

Air Pollution Index (I)

$$I = \frac{1}{n} \sum_{i=1}^n A_i \text{ where } A_i = \frac{C_i}{S_i} \times 100$$

where C_i = concentration of pollution i
 S_i = Air quality standard for pollutant i
 I = Air pollution Index

The comparative study of air pollution index of Agra and Kolkata city are shown in Table-4.

Table 4: Comparative analysis of air pollution index of Agra and Kolkata city Air Pollution Index in Agra city

Places	Air Pollution Index
(1) TajGanj	320.48
(2) DayalBagh	161.11
(3) St. Johns crossing	446.51
(4) Manas Nagar	498.09
(5) Sadar Bazar	378.82
(6) Foundry Nagar	86.203

Table 5: Air Pollution Index in Kolkata city

Places	Air Pollution Index
(1) BBD Bag	134.67
(2) Howrah	216.05
(3) Taratola	197.35
(4) Gariahat	289.31
(5) Shyam Bazar	264.01
(6) Hazra	480.00

Conclusion

From Table-1, 2 and 3, can be concluded that the minimum air pollution index is in the Foundry Nagar, Agra. The Air Pollution Index of TajGanj, St. John's crossing, Manas Nagar and Sadar Bazar is hazardous. Air pollution in DayalBagh, Agra is unhealthy and minimum air pollution in Foundry Nagar is moderated from Table- 2. It seems that the air pollution index of BBD Bag, Howrah and Taratola (Kolkata) is moderated. Air pollution of Gariahat, Shyam Bazar and Hazra is hazardous. Air pollution can cause death, health reduce visibility bring about vast economic losses and contributes to deterioration of both Agra and Kolkata cities and country side. It can also cause intangible losses to the historical monuments. The air pollution is also forecasted by moving average and chain index number method for decreasing air pollution in Agra.

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