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Impact of Supreme Court orders on air pollution pollutants (No_2, So_2 and SPM) level of Agra city India

Peetam Singh[1], Vineeta Singh[2], RB Singh[3*]
[1-2] Department of Statistics, Institute of Social Sciences, Dr. Bhimrao Ambedkar University, Agra, Uttar Pradesh, India
[3] Department of Zoology, School of Life Sciences, Dr. Bhimrao Ambedkar University, Khandari Campus, Agra, Uttar Pradesh, India

Abstract
Substances are put into air by the activity of mankind into concentration sufficient to cause the harmful effect to health, vegetables, property on interfere with the enjoyment of his property. Present investigation mainly deals with the constant mean model and it found that the air pollution is decreasing in Agra city due to the impact of Supreme Court intervention in 1996. All assumptions of constant mean model are lied and observations are generally uncorrelated. The application of constant mean model on the air pollution data of NO_2, SO_2 and SPM level of Agra city, U.P. (India).

Keywords: air pollution data, Agra city, harmful effects

Introduction
In the last few decades the various studies carried out on the air pollution contributes to mortality and economic losses of financial resources that are required for providing medical assistance to affected people. Present study has been taken to understand the condition of air pollution level in Agra city, U.P. (INDIA). The pressure of atmospheric pollution at Agra which is Determinated to Taj Mahal and effects the measures undertaken to check the air pollution and pollutants (NO_2, SO_2 and SPM). Air pollution is also forecasted by moving average number for Agra. It may be because of the effect of Supreme Court ruling of 1996. Hence it can be concluded that the air pollution is decreasing in Agra. Air pollution is not a new problem. It has been around for centuries ago, Scientist John Elyven described with accuracy many of the effects of the air pollution arising from the combustion of the coal, reduction in sunshine, dust fall and corrosion of materials.

Materials and Methods
Air Pollution
The major air pollutants from atmospheric air [1, 9] are Nitrogen oxides (NO_2), Carbon monoxide (CO), Sulphur dioxide (SO_2), gaseous halogens, Suspended Particulate Matter (SPM), Peroxy Acetyl Nitrate (PAN), Hydrocarbons etc. The major air pollutants like NO_2, SO_2 and SPM are described as follows:

Nitrogen oxide (NO_2)
There are seven oxides of Nitrogen as: N_2O, NO, NO_2, NO_3, N_2O_3, N_2O_4 and N_2O_5 and two hydrated oxides of Nitrogen HNO_2 and HNO_3 which can theoretically exist in the atmosphere. Nitric oxides and nitrogen dioxide arises from many human activities and have been classified as pollutants. In atmosphere analysis they are usually reported as "Total oxides of Nitrogen". In all probability, Nitrogen oxides enters the atmosphere as nitric oxide and gets oxidized first to NO_2 and then to N_2O_5, which are in the presence of water vapour, forms Nitric acid (HNO_3). NO_2 has been the only widely prevalent pollutant gas that is coloured. Pure NO_2 is a deep radish brown and causes much of the atmospheric discolouration on bad smog days in the metropolitan areas. Power plants and other energy conversion systems as well as a variety of chemical process industries emitted NO_2 into the atmosphere but in the most metropolitan areas the most important secures is vehicular exhaust.

Sulphur dioxide (SO_2)
Sulphur pollutants are present into the air in enormous quantities as part of the industrial effluent. Atmospheric sulphur comes mainly from the sulphur content of fuels. Nearly, 80% of the sulphur in SO_2 is initially emitted as hydrogen sulphide and is converted to SO_2 in atmosphere. SO_2 and its end products are having a severe corrosive and deteriorating effect can many material. SO_2 and SO_3 are especially damaging to building materials that contains carbonates such as, limestone, marble, mortar, roofing state works of art in or near industrial areas and cities are in serious jeopardy. One of the two specimens of clepatria's needle was moved to New-York's Central Park in 1880. SO_2 can damage materials and property, mainly through their conversion into the highly reactive sulphuric acid. Discolouration and physically deterioration are produced in building materials as: limestone, marble, mortar, roofing state and sculpture.
The damaging action of SO_2 has been described to the result of the oxidizing or reducing property of SO_2 by itself and not due to the action of acid. Sulphur dioxide is also involved in the erosion of many building materials like, limestone, marble, mortar, roofing state, and deterioration of statues. This especially occurs near SO_2 emitting source viz., petroleum refineries smelters, Kraft paper mills etc.

Suspended Particulate Matter (SPM)
Major sources of Suspended Particulate Matter (SPM)

include soot and condensed vapours from combustion in vehicles, stationary combustors, open burning of agricultural and domestic wastes, wind-blown dust from Devegetated areas. Dust stirred up by vehicular traffic and smelting and processing of non-metallic minerals. In Asian cities, on average over 60% of SPM is less than 10 microns in size (inhalable size range), frequently in the range of 0.6-1.0 microns and 5-7 microns.

Exposure to height short-term of SPM has been linked to increase in the illness and death from respiratory causes, especially when particulate matter include acid aerosols such as sulphate and nitrate particulates matters and especially in the presence of high level of SO_2, Long-term exposure to high SPM level results in increased susceptibility to respiratory illness, death from respiratory causes and diminished lung function.

Supreme Court's Rulings on Air Pollution

Perhaps no other historical monuments had evoked as much awareness and administration from tourists and travelers alike as the magnificent Taj Mahal. Air pollution is also affecting the Taj Mahal. It is damaging the marble and is the main cause of deterioration of the monument.

The Hon'ble Supreme Court after examining all the reports viz., four reports from NEERI, Two reports from Varadarajan and several reports by Central Pollution Control Board (CPCB) and Uttar Pradesh Pollution Control Board (UPPCB). On 31.12.1996 directed that the industries in the TTZ (Taj Trapezium Zone) were the active contributors to the air pollution in the side area [8-17]. All the 292 Industries were to approach to the GAIL before 15.01.1997 for grant the industrial gas connection. The GAIL should commence supply of gas to industries by 30.06.1997, with those directions the issue relating to 292 industries was disposed off.

The Supreme Court's orders, to save the damage of Taj Mahal from air pollution. The Mahajan (Sri Krishan Mahajan Advocate) Committee was constituted by the orders of 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 Taj Mahal 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 Taj Mahal. The Hon'ble Supreme Court on 30.08.1996 and 30.12.1996 directed the Ministry of Environment and Forest, Government of India, for monitoring and maintenance of the trees planted in the green belt area. On the direction of Hon'ble Supreme Court on13.09.2000, the Central Pollution Control Board (CPCB) inspected the Foundry Nagar Industrial Area, Agra and the premises of the Taj Mahal and submitted its report with its recommendations. The Hon'ble Supreme Court on 07.11.2000 while accepting the recommendations of the CPCB directed that the four Ambient Air Quality Monitoring Stations (NAAQMS) be installed in Agra region and these stations be run continuously for one year all the seven days in a week. The Hon'ble Supreme Court considered the proposed of the CPCB and accepted the recommendations of Mahajan Committee in the matter on 04.05.2001 directed that the full cost towards the hardware for monitoring stations. The CPCB has established for ambient air quality monitoring stations in Agra and these stations have been commissioned in the month of January, 2002. Monitoring reports are being submitted to Hon'ble Supreme Court on regular basis since February, 2002.

Central Pollution Control Board (CPCB) Findings

No pollution monitoring is being done at the Taj Mahal as to the quantum of polluting gases and Suspended Particulate Matter (SPM) affecting the monuments [18, 22]. The A.S.I monitoring station inside the Taj Mahal has deal equipment, no stores of necessary supplies, no record keeping and no attendance record. The UPPCB air monitoring station inside the Taj Mahal is closed.

Neither of the two stations have continuous electricity as per the January, 1998 directions of this Hon'ble Supreme Court to the UPSEB. The public display of on line pollution level inside the Taj Mahal is not being done on the digital display system at the entrance to the Taj Mahal. In November, 1996 the Mahajan Committee report had found the same situation and in the year 2000 it is no different.

Results and Discussion

Analysis of Air Pollution

To check whether there is any effect of Supreme Court's rulings on air pollution data [23, 24] of NO_2, SO_2 and SPM for the year 1990 to 2000 is analyzed. The source of data in the reports of Central Pollution Control Board (CPCB). The index number, chain index number is calculated for NO_2, SO_2 and SPM for 1990 to 2000 are indicated by the following formula.

$$\text{Index No.} = \frac{P_1^{(i)} \times 100}{P_0^{(i)}},\ i = 1, 2, --, 10, = \frac{P_1^{(i)} \times 100}{P_0^{(i)}}$$

$P_0^{(i)}$ - Price of ith commodity in the base year

$$\text{Chain Index No.} = \frac{Index\ No. \times P_1^{(i)}}{P_0^{(i)}},\ P_1^{(i)}$$ - Price of ith commodity in the current year

Formula for Normalization

Let x_1, x_2, x_3 (SO_2, NO_2 & SPM) be the mean values, Then

$$\text{Norm y} = \sqrt{x_1^2 + x_2^2 + x_3^2}$$

$$\text{Normalized values} = \frac{x_1}{y}, \frac{x_2}{y}, \frac{x_3}{y};$$ (for SO_2, NO_2 & SPM)

Average of NO_2, SO_2, SPM is $\left(\frac{x_1}{y}, \frac{x_2}{y}, \frac{x_3}{y}\right) \Big/ 3$

The calculate values of air pollutants NO, SO_2 and SPM shown its index number and chain index number are given in Table-1,2,3,4 and 5.

Table 1: For NO_2, Index Number and Chain Index Number

Year	NO_2	Index No. $\frac{P_1^{(i)} \times 100}{P_0^{(i)}}$	Chain Index Number = (Index No × $P_1^{(i)}$) / $P_0^{(i)}$
1990	12.7	100	100
1991	11.8	$\frac{11.8 \times 100}{12.7} = 92.91$	$\frac{92.91 \times 12.7}{12.7} = 92.91$
1993	11.3	$\frac{11.3 \times 100}{12.7} = 88.98$	$\frac{88.98 \times 11.8}{12.7} = 82.67$
1994	10.2	$\frac{10.2 \times 100}{12.7} = 80.31$	$\frac{80.31 \times 11.3}{12.7} = 71.46$
1995	10.3	$\frac{10.3 \times 100}{12.7} = 81.10$	$\frac{81.10 \times 10.2}{12.7} = 65.14$
1996	13.0	$\frac{13.00 \times 100}{12.7} = 102.36$	$\frac{102.36 \times 10.3}{12.7} = 83.02$
1997	12.0	$\frac{12.0 \times 100}{12.7} = 94.49$	$\frac{94.49 \times 13}{12.7} = 96.72$
1998	10.8	$\frac{10.8 \times 100}{12.7} = 85.04$	$\frac{85.04 \times 12}{12.7} = 80.35$
1999	9.7	$\frac{9.7 \times 100}{12.7} = 76.38$	$\frac{76.38 \times 10.8}{12.7} = 64.95$
2000	9.2	$\frac{9.2 \times 100}{12.7} = 72.44$	$\frac{72.44 \times 9.4}{12.7} = 55.33$

Table 2: For SO_2, Index number and Chain Index number

Year	SO_2	Index No.	Chain Index No.
1990	22.2	100	100
1991	21.1	95.05	95.05
1993	25.9	116.67	110.89
1994	21.7	97.75	114.04
1995	18.0	81.08	79.25
1996	17.0	76.58	62.09
1997	13.7	61.71	47.26
1998	12.1	54.50	33.63
1999	10.7	48.20	26.63
2000	10.3	46.40	22.36

Table 3: For SPM, Index number and Chain Index number

Year	SPM (m µ)	Index No.	Chain Index No.
1990	937	100	100
1991	519	118.76	118.76
1993	443	101.37	120.39
1994	368	84.21	85.37
1995	423	96.80	81.52
1996	480	109.84	106.332
1997	380	86.96	95.52
1998	507	116.02	134.60
1999	418	95.65	91.49
2000	33	76.20	58.07

Table 4: Average of NO_2, SO_2 and SPM based on Index number and Chain Index number

Year	Average of NO_2, SO_2 and SPM	Index No.	Chain Index No.
1990	0.3593	100	100
1991	0.3541	$\frac{0.3541 \times 100}{0.3593} = 98.55$	$\frac{98.55 \times .3593}{0.3593} = 98.55$
1993	0.3609	$\frac{.3609 \times 100}{0.3593} = 100.45$	$\frac{100.45 \times .3541}{0.3593} = 98.996 = (99.00)$
1994	0.3615	$\frac{0.3615 \times 100}{0.3593} = 100.61$	$\frac{100.61 \times .3609}{0.3593} = 101.058 = (101.06$
1995	0.3552	$\frac{0.3552 \times 100}{0.3593} = 98.86$	$\frac{98.86 \times .3615}{0.3593} = 99.47$
1996	0.3538	$\frac{.3538 \times 100}{0.3593} = 98.47$	$\frac{98.47 \times .3552}{0.3593} = 97.35$
1997	0.3554	$\frac{.3554 \times 100}{0.3593} = 98.92$	$\frac{98.52 \times .3538}{0.3593} = 97.41$
1998	0.3482	$\frac{.3482 \times 100}{0.3593} = 96.91$	$\frac{96.91 \times .3554}{0.3593} = 95.86$
1999	0.3494	$\frac{.3494 \times 100}{0.3593} = 97.25$	$\frac{97.25 \times .3482}{0.3593} = 94.25$

2000	0.3525	$\frac{.3525 \times 100}{0.3593} = 98.11$	$\frac{98.11 \times .3494}{0.3593} = 95.41$

Table 5: Average of NO_2, SO_2 and SPM (Based on Norm Value)

Year	NO_2, SO_2 and SPM (Average mean value)
1990	(0.0507 + 0.0290 + 0.9982)/3 = 0.3593
1991	(0.0406 + 0.0227 + 0.9989)/3 = 0.3541
1993	(0.0584 + 0.0255 + 0.9989)/3 = 0.3609
1994	(0.0588 + 0.0277 + 0.9979)/3 = 0.3615
1995	(0.0425 + 0.0243 + 0.9988)/3 = 0.3552
1996	(0.0354 + 0.0271 + 0.9990)/3 = 0.3538
1997	(0.0360 + 0.0315 + 0.9988)/3 = 0.3482
1998	(0.0239 + 0.0213 + 0.9995)/3 = 0.3482
1999	(0.0256 + 0.0232 + 0.9994)/3 = 0.3494
2000	(0.0309 + 0.0276 + 0.9991)/3 = 0.3525

Conclusion

From the Table- 1, 2, 3 and 5, it is clear indicated that the air pollution is decreasing in Agra and it may the effects of Supreme Court Rulings of 1996. Also the Table-4, it is clear that the air pollution in Agra is decreasing. The publicity of harmful effects of air pollution and its control measures should be undertaken through Radio, Television, News Paper and also by group discussion. Diesel, kerosin oil and coal give more pollutants than petrol and battery system or electrical system in the vehicles.

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