

Seven-Day Monitoring of SPM in a Dusty Environment of Pital Nagari (Moradabad)

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Abstract

Present study reveals the seven day monitoring of suspended particulate matter (SPM) during the unusual particulate pollution episode in and around the city. For this purpose, three specific stations of Moradabad were selected at different locations such as Mughalpura, Townhall and Police Training Center (PTC) which are industrial, commercial and residential areas respectively. A sudden increase in the concentration of suspended particulate matter was recorded in and around the city environment which was reported in almost all the daily newspaper from 1 to 7 June 10. An unusual concentration of SPM was recorded above the national standard value at all the three sites making the things hardly visible. From the recent study it was concluded that it may be possibly due to western disturbances created in Rajasthan affecting the western parts of Uttar Pradesh including Delhi and Moradabad.

Key words : Suspended particulate matter, Dusty storm, Environment, Pollution.

Air pollution may be defined as any atmospheric condition in which substances are present at concentration high enough their normal ambient levels to produce a miserable adverse effect on man, animals, vegetation and materials (1). Air pollution from suspended particulate matter (SPM) heavily contributes to air pollution as shown by a long term monitoring of the metro city Delhi and recorded SPM rates of 430 to 496 $\mu\text{g}/\text{m}^3$ as designated very high for any residential area (2). Though there is a little information how suspended particulates cause harm to human health, however, it has been well-documented that even for short term exposure these particulate raise a stroke risk (3) because it remain suspended in air for a long time. SPM are particulate/aerosol having diameter less than 100μ and sea salt, soil dust, volcanic particle, smoke from forest fires are the natural sources of total suspended particulate and fossil fuel burning and industrial processes are the anthropogenic sources of suspended particulate matter. Particulate matter is also a mixture of many subclasses of pollutants that contain many different chemical species. The particle size is described by aerodynamic diameter. The size of particles is directly linked to their potential for causing health problems (4, 5) and affects the morphology and anatomy of the plants (6).

During the life time PM may remain suspended to serve as media for the transfer or distribution of metals across various environmental reservoirs on the earth's system. They are ever finally removed from the atmosphere by either wet or dry proportion (7). The ambient air quality has already reached an alarming level, which potentially poses high risk to vegetation and natural ecosystems. To date limited research findings in countries of south and southern Asia suggested that there might be even a larger impact on vegetation in these regions (8—11). The objective of this short term study was to measure the particulate matter and reason for its sudden exceedance in the first week of June so as to provide the baseline data for short term forecasting for such events.

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Methods

Moradabad is known as Pital nagari as it is fa-

Table 1. Motor vehicles in Moradabad (UP to March 2009).

Year	Passenger		Four wheeler	Two wheeler	Other	Total	
	Heavy vehicles	vehic- cle					
98-99	403	49	222	828	9111	1035	11648
99-2000	312	88	82	944	8309	903	10638
2000-01	192	98	44	830	7581	856	9601
01-02	158	14	80	784	9810	671	11517
02-03	220	52	74	765	11868	607	13586
03-04	822	90	99	1138	14708	424	17281
04-05	1000	98	64	1432	17204	510	20388
05-06	754	136	108	1305	18093	467	20863
06-07	896	89	106	1590	18638	402	21721
07-08	1377	45	100	1829	18678	596	22625
08-09	1247	137	361	1890	19892	550	24077

mous for brassware industries and contains around 40 lac population. Numerous sources emit air pollutants including several major and minor brass industries along with other industries located within the city. These brass foundries are the major air pollution source emitting a large quantity of metal fumes polluting the surrounding area. Moradabad is one of the semi-arid zones towards the north-west of India with extreme summer and winter conditions. It is located at an average height of 76.19 m above sea level in the western gangetic plain of Indian subcontinent at latitude 28.15 N and longitude 74.49 E. Thus present study is carried out to evaluate the concentration level of SPM in the ambient air of Moradabad city since 1 June to 7 June 2010 and to make the recommendations for such episodes.

Site Selection. A network of three air monitoring and sampling stations i.e. Mughalpura, Town hall and PTC (Police Training Center) were operated during the period of seven days i.e. from 1 to 7 June 2010. The three sites represent three distinct areas and are described below.

S₁ PTC (Police Training Center). Located in a peaceful area and vehicular and other disturbances is almost nil. This is a residential area having a large open space and almost free from pollution so some where it is treated as a control area.

S₂ Town Hall. This is very busy commercial site located in northern part of the city. A large number of shops, restaurants and workshop in addition to some government establishment such as Tehasil is situ-

Table 2. Pollution level of SPM in seven major cities and Moradabad city in India during 2006 and 2008. *National Ambient Air Quality Standard for 24 hours average of 500 µg/m³ for industrial and 200 µg/m³ for commercial and residential.

Pollution Level	SPM			
	Industrial		Residential	
	2006	2008	2006	2008
Hyderabad	M	M	C	C
Delhi	H	H	C	C
Ahmedabad	M	M	C	H
Bangalore	M	H	H	C
Mumbai	M	M	C	C
Chennai	L	L	H	M
Kolkata	M	H	C	C
Moradabad	C	C	H	C

Annual Mean Concentration Range (µg/m³)

Low	0-180	0-70
Moderate	180-360	70-140
High	360-540	140-210
Critical	>540	>210

ated near this site. The movement of the traffic is highly congested and slow due to high density of vehicles and encroachment on both sides of the road (Table 1).

S₃ Mughalpura. This is an industrial site of Moradabad city. Where brassware industries are situated. It is dense area with narrow streets. The emission from the industries and automobiles are the major sources of air pollution in this region.

SPM samples were collected with the help of high volume samplers at rate of two to three samples per week on glass fiber filter paper—EPM 2000 for 24 h with air flow rate of 1—1.5 m³/min. The difference in initial and final weights of the filter paper gave the total quantity of SPM collected over the 24 hours period. The values of SPM were reported in µg/m³.

Results and Discussion

The investigation revealed that the values of SPM during one week were unusually high compared to the permissible limits and this was an infrequent event in about 10 years (Table 2). Main sources of SPM in Moradabad is mainly due to dust, fly ash, emissions from diesel and petrol driven vehicles, domestic refuse and various industries mainly brassware

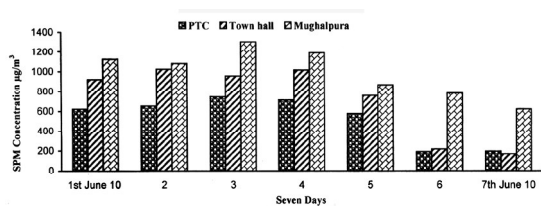


Figure 1. SPM concentration on seven days at different sites of Moradabad city.

(12—14). But this observed trend in the rise of SPM is not due to local sources but due to westerly disturbances from Rajasthan (15). This sudden dusty climate was observed only for five days i.e. 1 June to 5 June 2010 and after 5 June the concentration declined and may be due to ceasing of westerly depressions.

The detailed results for SPM at three selected sites show that the 24 hours concentration of SPM at PTC (residential area, S_1), Townhall (commercial area, S_2) and Mughalpura (industrial area S_3) were in range of 191.25 to 743.51 $\mu\text{g}/\text{m}^3$, 169.78 to 1021 $\mu\text{g}/\text{m}^3$ and 621.15 to 1202 $\mu\text{g}/\text{m}^3$ respectively (Fig. 1). During the investigation period the highest concentration of SPM was recorded at S_3 (1302.25 $\mu\text{g}/\text{m}^3$) on 3 June 2010 and lowest concentration of SPM was recorded at S_1 (191.25 $\mu\text{g}/\text{m}^3$) on 5 June 2010.

The study also showed that the concentration level of SPM was remarkably high at all the stations were almost three times higher than the national ambient air quality standard (Table 2). This high concentration was recorded due to the duststorm from western UP and it is a well-known that the fate of the particulate matter is governed by the wind direction regardless of their origin (16). This unusual high concentration of particulates during these days is associated with the dust storms from Rajasthan (17) can be explained as the westerly depression caused due to the low pressure created in Rajasthan (17).

However, brass foundry areas are the constant source for the emission of metallic fumes (13, 14) in industrial area and every fourth person is suffering from skin ailments and asthma (detailed work to be done). Vehicle numbers are constantly increasing in Moradabad (Table-1) as it is a fast growing center of brassware exports. Thus vehicles and industries contribute to most of the particulate pollution which

causes harmful effect on plants (18, 19). Against the permissible limit of 200 $\mu\text{g}/\text{m}^3$ for SPM noted by the Central Pollution Control Board it was almost three times higher than Deepawali on 3 June facing critical level of air pollution. Thus this is a highly irregular or infrequent event in past years. The ambient air quality of seven major cities of India during 2006 and 2008 was compared with ambient air quality of Moradabad city and it was observed that mean concentration of SPM was critical at industrial area and high at residential area (Table 2).

The ambient air quality levels of Moradabad city are degrading day after day, thus there is an urgent need to study this sporadic high concentration events in detail so as to conclude its adverse effects even in short time. This sudden rise in particulate matter may cause health responsible to influences the climate of the region and consequently the public health of the people residing in that region.

References

- Gupta A. K., K. Karar, S. Ayoob and J. Kuruvilla. 2008. Saptio-temporal characteristics of gaseous and particulate pollutants in an urban region of Kolkata. India. *Atmos. Environ.* 87 : 103—115.
- Awasthi K. 2007. *Down To earth*. 39. 15 Sep.
- Paul V. 2010. Can pollution raise a stroke risk? *Times of India*. 12 Jul.
- Teague W. G. and C. W. Bayer. 2001. Outdoor air pollution : Asdthma and other concerns. *Pediatric Clinics of North Am.* 48 : 1167—1183.
- Geroge K., A. Chaloulakou and P. A. Kassomenos. 2007. Development of an aggregate Air Quality Index of an urban Mediterranean agglomeration : Relations to potential health effects. *Environ. Int.* 33 : 670—676.
- Ishii S., J. N. B. Bell and F. M. Marshall. 2007. Phytotoxic Risk assessment of Ambient air pollution on agricultural crops in Selangor State, Malaysia. *Environ. Pollut.* 150 : 267—279.
- Salve P. R., A. Maurya and S. R. Wale. 2006. Distribution of trace metals in atmosphere particulate matter of rural environment. *I.J.E.P.* 26 : 673—677.
- Agrawal M., B. Singh, M. Rajput, F. Marshall and J.N.B. Bell. 2003. Effect of air pollution on peri-urban agriculture : A case study. *Environ. Pollut.* 126 : 323—329.
- Ishii S., F. M. Marshall, J. N. B. Bell and A. M. Abdullah. 2004. Impact of ambient air pollution on locally grown rice cultivars (*Oryza sativa* L.) in Malasia. *Water, Air and Soil Poll.* 154 : 187—201.
- Sharma R. K., M. Agrawal and F. M. Marshall. 2008. Heavy metal concentration of vegetables in urban

- India : A case study in Varanasi. *Environ. Pollut.* 154 : 254—263.
11. Tripathi A., P. B. Tiwari, Mahima and D. Singh. 2009. Assessment of air pollution tolerance index of some trees in moradabad city. India. *J. Environ. Biol.* 30 : 545—550.
 12. Tripathi R. M., R. N. Khandekar, R. Raghunath and U. C. Mishra. 1989. Assessment of atmospheric pollution from toxic heavy Metal in two cities in India. *Atmos. Environ.* 23 : 879—883.
 13. Tripathi R. M., R. N. Khandekar and U. C. Mishra. 1990. Toxic trace metal in the atmosphere of Moradabad (India). *Ind. J. Environ. Hlth.* 32 : 140—147.
 14. Tripathi A., P. B. Tiwari, Mahima and D. Singh. 2009. Assessment of air pollution tolerance index of some trees in Moradabad city, India. *J. Environ. Biol.* 30 : 545—550.
 15. Anonymous. 2010. *Times of India*. 4 Jun 2010.
 16. Khannan G. K. and V. Rajpla. 2000. Air quality forecast for the next seven days by an air quality index. *I.J.E.P.* 26 : 321—330.
 17. Sher Z. and F. Hussain. 2006. Effect of automobile traffic on some cultivated trees along road side in Peshawer. *Pak. J. Pl. Sci.* 12 : 47—54.
 18. Ali M. and M. Athar. 2008. Air pollution due to traffic, air quality monitoring along three seasons of national highway N5, Pakistan. *Environ. Monit. Assess.* 136 : 219—226.
 19. Prajapati S. K., B. D. Tripathi and V. Pathak. 2009. Distribution of vehicular pollutants in street canyons of Varanasi, India : A different case. *Environ. Monit. Assess.* 148 : 172—176.