

Impact of Ardh-Kumbh Festival on Concentration Level of Suspended Particulate Matter (SPM) and Respirable Suspended Particulate Matter (RSPM) in Haridwar, India

K. K. Gangwar and Deepali

Punjab State Council for Science & Technology, Chandigarh 160019, India

kamalkishor14@rediffmail.com, deepali.phd@rediffmail.com

ABSTRACT: The present study was carried out from January 2004 to December 2004 to ascertain the impact of Ardh-Kumbh festival, on concentration level of suspended particulate matter (SPM) and respirable suspended particulate matter (RSPM) on sites namely; Singh Dwar, Ranipur More, Shiv Murti and Chandi Ghat. During the Ardh-Kumbh period, the over all highest mean concentration of SPM was $389.68\mu\text{g}/\text{m}^3$ on festive day of Ardh-Kumbh Punya Kal, at Singh Dwar whereas RSPM was $11.20\mu\text{g}/\text{m}^3$ on festive days of Basant Panchmi at Shiv Murti. The values of SPM increased sharply by 30.06%, on festive day of Chaitra Amavasya at Shiv Murti and RSPM by 21%, on Basant Panchmi at Singh Dwar, as compared to the pre-festive days of the said festivals. [New York Science Journal 2010;3(5):50-53]. (ISSN: 1554-0200).

Key words: Air pollution, SPM, RSPM, Ardh-Kumbh, pre and post festive days.

1. Introduction

The festival of Ardh-Kumbh held at an interval of six years. Present study was made during most specific festive occasion of Ardh-Kumbh, 2004. During this festival people all over the country congregate at Haridwar, to take sacred bath in the river Ganga. It is because during Kumbh, the sentiments and socio-religious psyche of majority community in India differ entirely, regarding pilgrimage and tourism at to place like Haridwar. The number of visitors come to Haridwar during this period of study reported around 1.8 million by the local news paper, being extremely high as compared to normal days. This temporarily but conspicuously affects the air quality on account of increasing human pressure. Major contributors to air pollution are automobiles running in the city. Vehicle exhaust is estimated to contribute more than 45 to 55 % of total pollution from all sources put together in the metropolitan cities in India (Joshi *et al.*, 2006).

2. Materials and Methods

Suspended Particulate Matter (SPM) and Respirable Suspended Particulate Matter (RSPM) were monitored at four busy intersections of Haridwar city, viz. Singh Dwar, Ranipur More, Shiv Murti and Chandi Ghat; during pre and post festive days (three days before and after the main festive day), in comparison to main festive days. The monitoring was conducted on six sacred bathing days i.e. Basant Panchmi, Chaitra Amavasya, Ramnavmi, Ardh-Kumbh Punya Kal, Baisakh Amavasya and Baisakh Purnima of Ardh-Kumbh Festival. Monitoring of

particulates was undertaken as per the norms prescribed by the Central Pollution Control Board (2001) and done for a period of 24 hours on each sampling site, by Envirotech Respiratory Dust Sampler (APM 460) on the same dates and timings. The apparatus was kept at a height of 2 meter from the ground level and the initial and final rotameter readings were recorded every eight hours and averaged for 24 hours.

3. Results

For each festival mean, maximum and minimum range values of SPM and RSPM concentration recorded during the study period are given in Fig. 1 and 2. Among the six specific festival of Ardh-Kumbh, the over all highest mean concentration of SPM was recorded $389.68\mu\text{g}/\text{m}^3$ on festive day of Ardh-Kumbh Punya Kal during the month of April at Singh Dwar whereas RSPM was recorded $11.20\mu\text{g}/\text{m}^3$ on festive days of Basant Panchmi at Shiv Murti. On the other hand the lowest mean value of SPM was noted $228.45\mu\text{g}/\text{m}^3$ during festive day of Ramnavmi at Ranipur More, while the value of RSPM was recorded $78.29\mu\text{g}/\text{m}^3$, during pre-festive day of Baisakh Purnima at Ranipur More. The over all lowest range value of SPM was $226.40\mu\text{g}/\text{m}^3$ during festive day of Ramnavmi, while RSPM was found $76.70\mu\text{g}/\text{m}^3$ during pre-festive day of Baisakh Purnima at Ranipur More. The highest range value of SPM was $393.40\mu\text{g}/\text{m}^3$ on festive day of Basant Panchmi at Singh Dwar and the range values of RSPM was $114.80\mu\text{g}/\text{m}^3$ on the festive day of Basant Panchmi at Shiv Murti, $8.50\mu\text{g}/\text{m}^3$ on festive-day of

Ardh-Kumbh Punya Kal at Singh Dwar and $17.30\mu\text{g}/\text{m}^3$ at Chandi Ghat, during festive-day of Ardh-Kumbh Punya Kal.

4. Discussion

Among the six bathing festival of Ardh-Kumbh, the highest difference in the concentration of SPM increased by 30.06 % during Chaitra Amavasya as compared to pre-festive days of the said festival at Shiv Murti (Fig. 1) due to the highest visitor influx. At Singh Dwar the maximum concentration of SPM was found to have increased by 25.19% on Basant Panchmi against the pre-festive days of the said festival. At Ranipur More the highest rise was recorded 27.97 % on post-festive days of Ramnavmi in comparison to festive days, at Shiv Murti the maximum rise was 30.06 % during festive day of Chaitra Amavasya in comparison to pre-festive day of the said festival, at Shiv Murti. For Chandi Ghat the maximum rise in SPM concentration was recorded by 18.76 % on Ardh Kumbh Punya Kal as compared to post-festive days of the aforementioned festival.

The over all highest mean concentration of SPM ($389.68\mu\text{g}/\text{m}^3$) was recorded at Singh Dwar during the main festive day of Ardh-Kumbh Punya Kal during the month of April and the lowest value ($228.45\mu\text{g}/\text{m}^3$) was noted at Ranipur More during the festive day of Ramnavmi. These observed values are

48.67 % and 12.45% higher than the specified limit ($200\mu\text{g}/\text{m}^3$ for residential and other areas) of Central Pollution Control Board (2001).

At Singh Dwar, during the month of April, this highest concentration of SPM ($389.68\mu\text{g}/\text{m}^3$) on Ardh-Kumbh Punya Kal day was attributed to the lots of pilgrims which came here to take the sacred bath on this auspicious day (Fig. 1). Most of the values recorded at this intersection are high and is exclusively due to heavy traffic by virtue of this sampling station is situated at Delhi-Dehradun National Highway and at the main entrance of the Haridwar city. While during the same month of study, the highest SPM concentration was noted $58.12\mu\text{g}/\text{m}^3$ for residential cum traffic intersection of Adyar in Chennai by Senthilnathan and Rajan (2003); which is 85.08% higher as compared to the above mentioned highest value for the present study. On the other hand, the highest SPM concentration is reported $1219.0\mu\text{g}/\text{m}^3$ at bus stand of Jhansi city by Srivastava *et al.* (2002), which is 83.59 % higher than the specified limit of CPCB (2001). These values are 65.96% and 77.23% higher than the prescribed limit of $200\mu\text{g}/\text{m}^3$ for residential and other areas. Relatively lower value of SPM ($287.87\mu\text{g}/\text{m}^3$) are reported 30.52% higher than the prescribed limit at Anand Rao circle of Bangalore city, in relation to road traffic (Mahendra and Krishnamurthy, 2004).

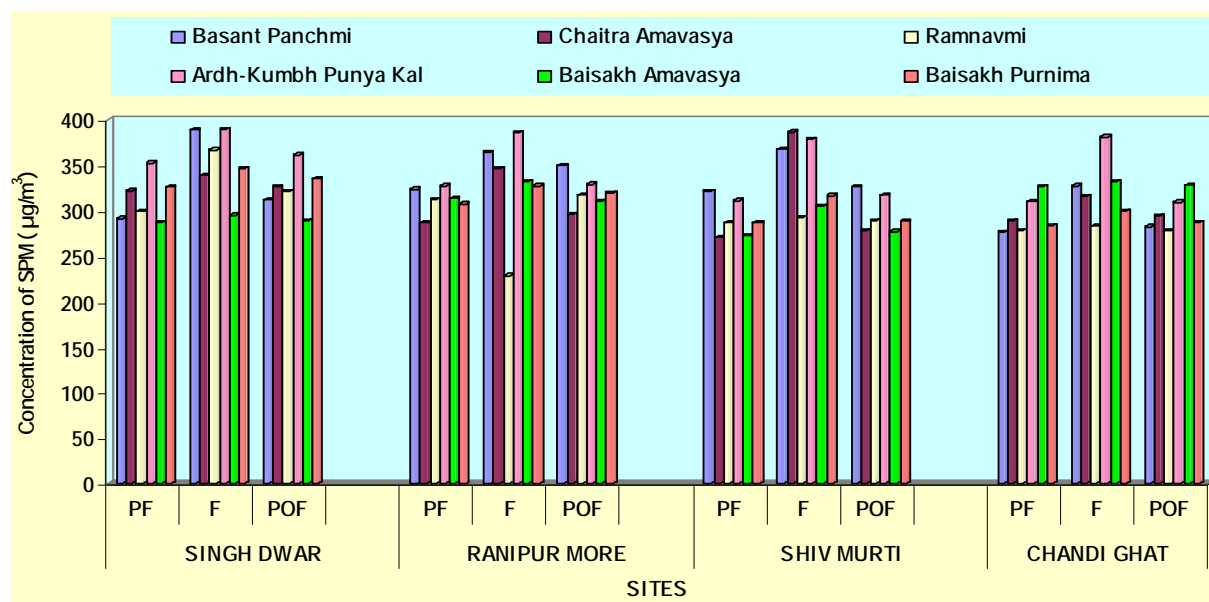


Fig. 1. SPM during Ardh-Kumbh festival (PF= Pre-festive, F=Festive and POF= Post-festive).

Kanan and Kapoor (2004) observed the SPM concentration was $342.0\mu\text{g}/\text{m}^3$ during the month of January and $314.0\mu\text{g}/\text{m}^3$ during the month of

February for the urban area of Delhi. Relatively similar value of SPM was found $389.50\mu\text{g}/\text{m}^3$ on the festive day of Basant Panchmi at Singh Dwar during

the month of January. Saini *et al.* (1994) reported the SPM concentration were $241.0\mu\text{g}/\text{m}^3$ and $281.0\mu\text{g}/\text{m}^3$ during the months of April and May, for the industrial area of Chandigarh city. While in the

present study, for the similar months, the SPM values were reported $389.68\mu\text{g}/\text{m}^3$ and $346.70\mu\text{g}/\text{m}^3$ on the festive day of Ardh Kumbh Punya Kal and Baisakh Purnima, respectively, at Singh Dwar.

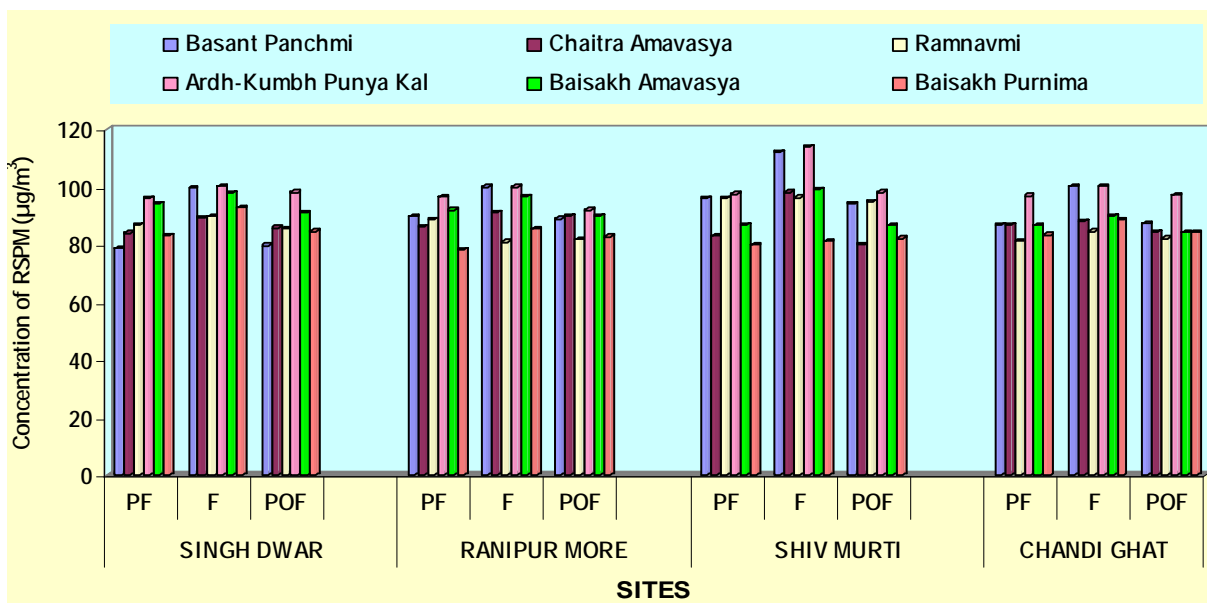


Fig. 2. RSPM during Ardh-Kumbh festival.

An over all highest mean concentration of RSPM was recorded $114.0\mu\text{g}/\text{m}^3$ on festive days of Ardh-Kumbh Punya Kal, during the month of April, at Shiv Murti and lowest was $78.29\mu\text{g}/\text{m}^3$ for the pre-festive day of Baisakh Purnima in the month of May, at Ranipur More. The highest value was 12.28 % higher and lowest was 21.71% less than the specified limit ($100\mu\text{g}/\text{m}^3$ for residential and other areas) of Central Pollution Control Board (2001). On the other hand, Senthilnathan (2005) reported the mean concentration of RSPM was $119.6\mu\text{g}/\text{m}^3$, during the month of April in Chennai city; which was 16.38% higher than the prescribed limit ($100\mu\text{g}/\text{m}^3$) for residential and other areas and 4.68% higher than the above mentioned value reported on the festive day of Ardh Kumbh Punya Kal. Similarly, Jain *et al.* (2004) reported the RSPM value was $131.66\mu\text{g}/\text{m}^3$ at Rambagh circle, Jaipur city; on the other hand, Sandhu *et al.* (2004) reported the RSPM concentration of $3900.0\mu\text{g}/\text{m}^3$ for the commercial area at Chandpol Gate of Jaipur city; which is 97.43% more than the prescribed limit of CPCB (2001). Thakur *et al.* (2004) made a study on vertical

distribution of particulate matter and reported relatively lower value $152.0\mu\text{g}/\text{m}^3$ at Cossipore location at Kolkata during the month of May, while in the present study, for the same month the value of RSPM was found 92.84 during the festive day of Baisakh Purnima at Singh Dwar. The important finding of this research work is that the data recorded for SPM and RSPM was found to have increased on festive as compared to pre and post-festive days.

Corresponding Author:

Dr. KK Gangwar
Punjab State Council for Science & Technology
Chandigarh 160019, India
E-mail: geetakh@gmail.com

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