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COMPARATIVE STUDY ON STATUS OF SPM OVER A PERIOD DECADE IN RURAL AREAS OF JAMMU, INDIA

SATBIR SINGH¹ AND R.K RAMPAL²

¹KVK, Reasi, SKUAST- Jammu, India

²Department of Environmental Sciences, University of Jammu, Jammu, India

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ABSTRACT

A study has been carried out to compare status of SPM level in 2002 and 2014 in outdoor air of rural areas of Jammu, so as to evaluate increasing or decreasing trends of change in SPM level. The analysis of data has revealed that all the seven sites of rural areas of Jammu has exhibited significantly ($p < 0.05$) rise in the values of SPM during the period of 12 years, i.e from 2002 to 2014. Increase in outdoor SPM can be attributed to the increase in number of vehicles, increase in traffic flow rate, increase in number of brick kilns, stone crushers, increase in agricultural processes, increase in industrial processes and domestic heating.

INTRODUCTIN

Unlimited exploitation of nature by man has disturbed the delicate ecological balance between living and non-living components of the biosphere. The air is one of the most important components of the environment. The atmosphere is an insulated blanket around the earth. It is a source of essential gasses. The qualitative and quantitative change in the composition of air results in pollution. So, air pollution is the unfavorable alteration of our environment and is an unwanted byproduct of man's actions. Air pollution has affected the quality of natural environment to such an extent it has put Man's future at considerable risk. Man in reality is destroying the biosphere which is essential for his survival. It is very common to find

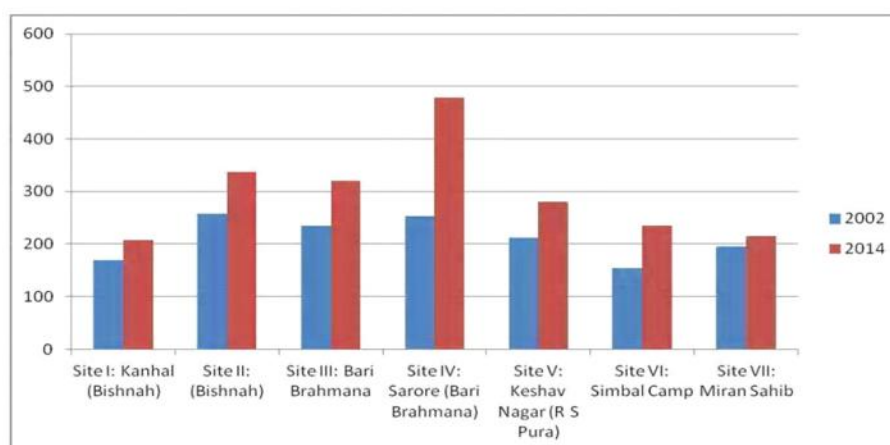
warnings at public places, readings as "air unfit for breathing" and "water unfit for drinking", and so on. Pollution is an undesirable change in the physical, chemical or biological characteristics of air, water and soil that may harmfully affect the life or create a potential health hazard or any living organism. Pollution is the direct or indirect change in any component of the biosphere that is harmful to the living components and in particular undesirable for man, affecting adversely the industrial progress, cultural and natural assets or general environment. Primary air pollutants include those which are emitted directly from the source of air pollutant, e.g. finer particles (less than 100 micrometer in diameter) and coarse particles (greater than 100 micrometer), sulphur oxide, oxides of nitrogen, carbon monoxide, halogen compounds,

*Corresponding author's email: satbirkuk@gmail.com (¹ Programme Assistant ; ² Prof. & Head)

Table 1. Comparative status of SPM over a period of decade in rural areas adjoining Jammu city.

S. No	Name of the Site	Average out door SPM ($\mu\text{g}/\text{m}^3$)	
		2002	2014
1	Site I: Kanhal (Bishnah)	169.888 \pm 24.3	208.333 \pm 28.3*
2	Site II: (Bishnah)	257.465 \pm 18.1	336.217 \pm 24.7*
3	Site III: Bari Brahmana	234.490 \pm 20.2	320.183 \pm 23.8*
4	Site IV: Sarore (Bari Brahmana)	252.679 \pm 21.3	478.394 \pm 32.4*
5	Site V: Keshav Nagar (R S Pura)	212.438 \pm 25.4	281.088 \pm 23.8*
6	Site VI: Simbal Camp	155.019 \pm 15.7	235.017 \pm 27.3*
7	Site VII: Miran Sahib	195.416 \pm 17.3	215.316 \pm 22.2*

*Values significant ($p < 0.05$).

**Fig. 1** Outdoor SPM level at different sites of study area during 2002 and 2014.

organic compounds, radioactive compounds and finer aerosols including particles of metal, carbon, tar, resin, pollen, and bacteria etc.

Particulate matter is a discrete mass of any material, except pure water that exists as liquid or solid in the atmosphere and of microscopic dimensions. Primary particulate matter includes dust which arises as a result of wind or smoke particles emitted from some factories. Atmospheric particulate matter ranges in size from 0.001 micrometer to several hundred micrometers. There are four types of sources of particulate matter: 1. Fuel combustion and industrial operations like mining, smelting, polishing, furnaces, textiles, pesticides, fertilizers and chemical production, 2. Industrial fugitive process (material handling, loading and transfer operations), 3. Non-industrial fugitive processes (roadway dust, agricul-

tural operations, construction and fire etc.), 4. Transportation sources (vehicle exhaust and related particles from fire clutch and break wear). The particulate matter is injurious to health. Soot, lead particles from exhaust asbestos, volcanic emission, pesticides, H_2SO_4 , mist, metallic dust, cotton and cement dust etc. When inhaled by man causes respiratory diseases such as tuberculosis and cancer. Cotton dust causes occupation disease Byssinosis which is very common in cotton mills. *et al.* (2002), while studying the exposure of air pollutants particularly PM10 and stroke mortality, observed a strong association between them. They also reported that elderly and women carry greater risk of stroke mortality due to the effects of particulate matter.

In the recent past outer areas of Jammu has seen substantial growth in terms of industrial expansion

which has led to increase in the levels of air pollution particularly the SPM levels. Therefore in the present study attempt has been made to compare status of SPM level in 2002 and 2014 in outdoor air of rural areas of Jammu so as to evaluate increasing or decreasing trends of change in SPM level during the 12 years.

MATERIALS AND METHODOLOGY

Suspended particulate matter was measured at seven sites i.e. Site I (Kanhah Bishnah), Site II (Bishnah), Site III (Bari Brahmana), Site IV (Sarore, Bari Brahmana), Site V (Keshav Nagar, RS Pura), Site VI (Simbal Camp) and Site VII (Miran Sahib) in the industrial area of Jammu. Sampling of outdoor SPM was done with the help of High Volume Air Sampler "Envirotech APM 415 (Dwarf model)". Glass microfiber filter paper (GF/A) 20.3 × 25.4 cm was used for sampling of SPM in air. Sampling was done for 24 hours thrice at each site during 2002 as well as 2014 and level of SPM was calculated by using following formula:

$$\text{SPM } (\mu\text{g}/\text{m}^3) = (\text{FW2}-\text{FW1}) \times 10^3 / \text{A.V}$$

Where FW1 is the initial weight of filter paper (mg), FW2 is the final weight of the filter paper (mg) and AV is the air volume sampled (flow rate of air × sampling time (in minutes)). Flow rate was calculated by the following formula =

$$\frac{\text{Initial flow rate} \pm \text{final flow rate}}{2}$$

RESULTS AND DISCUSSION

The analysis of data has revealed that all the seven sites of rural areas of Jammu has exhibited significant ($p < 0.05$) rise in the values of SPM during the period of 12 years, i.e. from 2002 to 2014. During 2002 Site I. (Kanhah), site VI (Simbal Camp) and site VII (Miran Sahib) exhibited the values of SPM within prescribed limits of 200 $\mu\text{g}/\text{m}^3$ as prescribed by CPCB, and rest of sites exhibited slightly higher values (with a difference of 12 - 57 $\mu\text{g}/\text{m}^3$) as compared with prescribed limits. But during 2014 Site I, Site VI and Site VII exhibited values more than prescribed values of CPCB (with a difference of 8-35 $\mu\text{g}/\text{m}^3$). But rest of values exhibited very higher values (with difference of 81-178 $\mu\text{g}/\text{m}^3$) of outdoor SPM during 2014. Yadav and Vinit (2012) while studying outdoor SPM on Jhansi reported limits above the prescribed limits of CPCB. Increase in outdoor SPM during 12 years is because of increase in number of vehicles, increase in traffic flow rate, increase in number of brick kilns, stone crushers, increase in agricultural processes, increase in industrial processes, domestic heating.

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