

## Air quality index analysis of ambient air in Shahganj, Jaunpur, U.P. (India)

Manju and Vishnu Kumar Maurya

Department of Chemistry, T.D.P.G. College, Jaunpur (U.P.).

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**Abstract :** Air quality monitoring was conducted out sides in Shahganj traffic zone and five indoor house near each sites. The air quality was assessed by standard air quality index table. The suspended particulate matter was higher at Shahganj Chawk, i.e.,  $682 \mu\text{g}/\text{m}^3$  in rainy season where as it is minimum  $125 \mu\text{g}/\text{m}^3$  at Shahganj-Azamgarh chauraha. The concentration of  $\text{CO}_2$  is higher in winter season in comparison to rainy season significantly. Nitrous oxide concentration exceeded at private bus stand & roadways bus stand due to situation near railways station where loading and unloading of coal and other chemical took place. Organic volatile matter initiated due to heating of fat molecule. Near bus stand & railway station its concentration exceeds than permissible limit. The pollutants concentration significantly affected by climatic condition and seasonal variascons. It was observed that Shahganj city is more polluted near bus stand in comparison to other sites.

**(Keywords :** Air quality index, suspended particles, pollutants, air pollutions.)

### Introduction

Air pollution is contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere. Air pollution like oxides of Carbon, Nitrogen, Sulphur and harmful volatile organic materials make air unfit for all the living beings including plants due to unwanted air component different respiratory diseases in human, plants and non-living creature such as buildings and statues. Historical buildings get corroded rusted and lose their significance due to air pollution<sup>1-5</sup>.

Shahganj is located at 82.604/26.0434° Shahganj is one of the eminent Tahsils of Jaunpur promising to become a district head quarter. Shahganj Tahsil head quarter is highly polluted even more that the head quarter Jaunpur district. It is because of reason that it contain railway junction highly densed transportation and haphazard settlements of population. Unplanned daries, poultry farms, industries, kilns, brick industries, poor municipals management and unplanned settlement of the areas.<sup>6-9</sup> Also the urban settlement of the town is Sandwiched b/w a net of transportation of inside road, fore lane roads and railway line.

The puffing off trains creates vomiting of poisons gasses causing huge pollution in atmosphere. Such inhaler of harmful gasses may cause suffocation or even unconsciousness. It is very essential that we know enough about the air around us and the mens to keep it clean. India's main problem of air pollution arises on account of industrial production, vehicular traffic organization, explosive population and growth and other factor. The major air pollution of a city can be studied on account of outdoor and indoor pollution. The outdoor pollutants constitute automobile, exhaust, industry emission and other energy production unit whereas indoor pollutants are kitchen emission, building and ceramic construction etc. In this paper we are considering effect of particulate matter (P.M.), Carbon dioxide ( $\text{CO}_2$ ), Carbon monoxide (CO), Nitrogen oxide ( $\text{NO}_2$ ) and organic volatile matter on human beings.<sup>10-13</sup>

## Materials and Methods

Monitoring of ambient air was carried out in Shahganj (Jaunpur) city. The sampling of ambient air was carried out in 2021-2022 in Shahganj at three traffic intersection to assess air quality standards. The sampling was done at private bus stand, roadways bus stand Shahganj Chowk, Khutahan Chauraha and Azamgarh-Shahganj Chauraha. Monitoring was done by using high volume air Sampler-Envirotech APM-415. The selected parameter of CO<sub>2</sub>, CO, NO<sub>2</sub>, PM and Organic volatile was performed where sample was carried out for 8 hours at all traffic intersection and inside building of that particular area. The sampler was placed at a height of 1.523m above the ground level.

The SPM was sampled using GF/A whatman filter paper, by the Gravimetric method for 8 hours. The collected samples were weighed according to the BIS procedures and calculations were based on IS 5182, part 4, in order to obtain the final concentration of the SPM.

The gasses sulphur dioxide and oxides of Nitrogen were collected twice in 8 hours at an interval of 4 hours by absorption in suitable

solutions which were analyzed spectrophotometrically with the help of systronic UV VIS (Visible) spectrophotometer 108 in the laboratory. The modified west and Gaeke method-IS 5182, part-II was used to determine the concentration of SO<sub>2</sub>. The IS 1582 part IV namely the JOCOB and Hochheiser modified method was used to determine the NOx content in the samples.

The concentration of the pollutants was calculated in micrograms/cubic meter (µg/m<sup>3</sup>). Air quality index was then calculated using the formula of (Rao and Rao, 1989).

$$AQI = \frac{1}{5} \left[ \left( \frac{CO}{SCO} \right) + \left( \frac{NOx}{SNOx} \right) + \left( \frac{SPM}{SSPM} \right) + \left( \frac{SPM}{SSPM} \right) + \left( \frac{CO_2}{SCO_2} \right) + \left( \frac{OV}{SOV} \right) \right] \times 100$$

where NOx, SPM, CO<sub>2</sub>, CO, OV represents the individual concentration and SNOx, SSPM, SCO, SCO<sub>2</sub>, SOV represents the ambient air quality standard for CO, CO<sub>2</sub>, NOx and SPM respectively.

## Results and Discussion

The prescribed National ambient standard (NAAQS) and rating scale AQI values are represented in table-1 and 2.

**Table-1:**

National Ambient air quality standard (NAAQS)

| Pollutants       | Time (Hrs) | Concentration of pollutant ambient air quality (µg/m <sup>3</sup> ) |              |                        |
|------------------|------------|---------------------------------------------------------------------|--------------|------------------------|
|                  |            | Industrial                                                          | High Traffic | Sensitive/ Residential |
| CO <sub>2</sub>  | 8          | 120                                                                 | 80           | 30                     |
| CO               | 8          | 45                                                                  | 25           | 9                      |
| NOx              | 8          | 105                                                                 | 72           | 25                     |
| SPM              | 8          | 130                                                                 | 200          | 100                    |
| Organic volatile | 8          | 160                                                                 | 210          | 90                     |

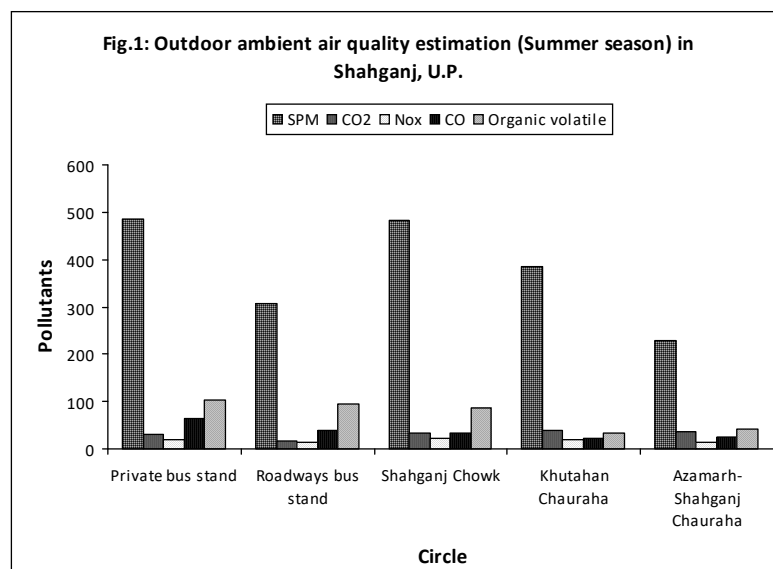
**Table-2:**

Rating scale of AQI values

| Index Value | Remarks                      |
|-------------|------------------------------|
| 0-25        | Clean air (CA)               |
| 26-50       | Light air pollution (LAP)    |
| 51-75       | Moderate air pollution (MAP) |
| 75-100      | Heavy air pollution (HAP)    |
| >100        | Severe air pollution (SAP)   |

**Table-3:** Outdoor ambient air quality estimation in Shahganj, Jaunpur, U.P.

| S. No. | Pollutants       | Seasons | Circle ( $\mu\text{g}/\text{m}^3$ ) |                    |                |                   |                            |
|--------|------------------|---------|-------------------------------------|--------------------|----------------|-------------------|----------------------------|
|        |                  |         | Private Bus stand                   | Roadways Bus stand | Shahganj Chowk | Khutahan Chauraha | Azamgarh-Shahganj Chauraha |
| 1      | SPM              | Rainy   | 355                                 | 860                | 928            | 380               | 440                        |
|        |                  | Winter  | 476                                 | 370                | 792            | 566               | 192                        |
|        |                  | Summer  | 486                                 | 308                | 482            | 386               | 230                        |
| 2      | CO <sub>2</sub>  | Rainy   | 19                                  | 34                 | 26             | 18                | 23                         |
|        |                  | Winter  | 49                                  | 51                 | 56             | 53                | 47                         |
|        |                  | Summer  | 30                                  | 16                 | 34             | 39                | 36                         |
| 3      | NO <sub>x</sub>  | Rainy   | 46                                  | 62                 | 41             | 38                | 51                         |
|        |                  | Winter  | 68                                  | 43                 | 33             | 25                | 22                         |
|        |                  | Summer  | 19                                  | 14                 | 21             | 20                | 15                         |
| 4      | CO               | Rainy   | 42                                  | 36                 | 34             | 16                | 21                         |
|        |                  | Winter  | 59                                  | 51                 | 39             | 18                | 27                         |
|        |                  | Summer  | 63                                  | 38                 | 33             | 21                | 25                         |
| 5      | Organic volatile | Rainy   | 86                                  | 78                 | 69             | 84                | 39                         |
|        |                  | Winter  | 92                                  | 85                 | 78             | 39                | 46                         |
|        |                  | Summer  | 102                                 | 95                 | 86             | 33                | 42                         |



Concentration of SPM, CO<sub>2</sub>, NO<sub>x</sub>, CO and organic volatile was measured thrice in a seasons. It was found that SPM was higher in rainy season at Shahganj Chauk (928 µg/m<sup>3</sup>) and minimum at Azamgarh-Shahganj Chauraha (192

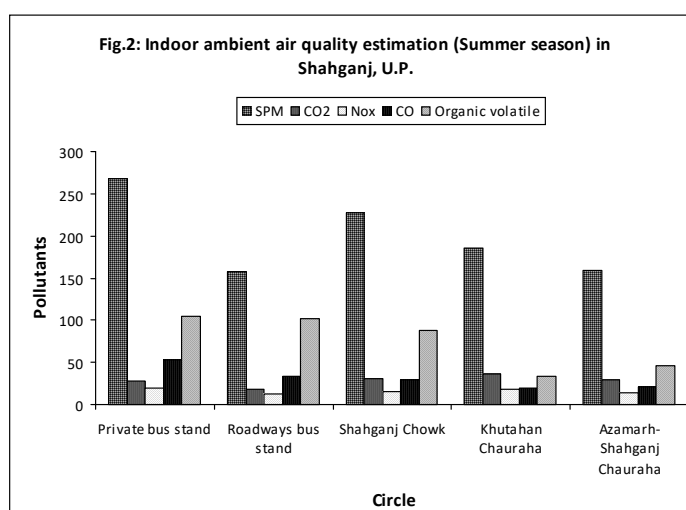
µg/m<sup>3</sup>). Due to high density SPM does not precipitate in rainy season. Shahganj has least plantation inside the city. So CO<sub>2</sub> concentration is winter season at Shahganj-chauk and minimum (18 µg/m<sup>3</sup>) at Khutahan Chauraha in rainy season.

**Table-4:** Indoor ambient air quality estimation in Shahganj, Jaunpur, U.P.

| S. No. | Pollutants       | Seasons | House Near Circle |                    |                |                   |                            |
|--------|------------------|---------|-------------------|--------------------|----------------|-------------------|----------------------------|
|        |                  |         | Private Bus stand | Roadways Bus stand | Shahganj Chowk | Khutahan Chauraha | Azamgarh-Shahganj Chauraha |
| 1      | SPM              | Rainy   | 160               | 544                | 682            | 188               | 229                        |
|        |                  | Winter  | 244               | 166                | 419            | 256               | 125                        |
|        |                  | Summer  | 268               | 158                | 228            | 186               | 159                        |
| 2      | CO <sub>2</sub>  | Rainy   | 16                | 29                 | 22             | 15                | 21                         |
|        |                  | Winter  | 41                | 33                 | 36             | 33                | 28                         |
|        |                  | Summer  | 28                | 18                 | 31             | 36                | 30                         |
| 3      | NO <sub>x</sub>  | Rainy   | 39                | 51                 | 32             | 31                | 41                         |
|        |                  | Winter  | 58                | 33                 | 34             | 26                | 19                         |
|        |                  | Summer  | 20                | 12                 | 16             | 18                | 14                         |
| 4      | CO               | Rainy   | 32                | 26                 | 28             | 15                | 19                         |
|        |                  | Winter  | 49                | 53                 | 32             | 17                | 25                         |
|        |                  | Summer  | 53                | 34                 | 30             | 19                | 21                         |
| 5      | Organic volatile | Rainy   | 92                | 82                 | 71             | 86                | 42                         |
|        |                  | Winter  | 93                | 88                 | 80             | 41                | 48                         |
|        |                  | Summer  | 105               | 102                | 88             | 34                | 46                         |

Table-4 provides details of different pollutants during different seasons of the year 2021-2022. The data revealed that the concentration of SPM, CO<sub>2</sub>, NO<sub>x</sub> were not in permissible limit recommended by NAAQS were as CO and organic volatile matter exceed from permissible limit. It was observed that pollutant concentration near bus stands is higher than other three sites. The status of air quality at different traffic intersection was also assessed the using AQI

values. Shahganj chowk area has more particulate matter in comparison to that of bus stand in rainy seasons. The carbon dioxide concentration is higher in rainy season in comparison to summer season. Maximum CO<sub>2</sub> concentration observed in winter season at Shahganj Chowk. Organic volatile matter was maximum on both bus stands in all the seasons due high consumption of fat/ ghee.



Indoor ambient air quality is significantly affected by outdoor pollutants concentrations. The average value of all the measure gases from Kitchen, living room and bed room are mentioned in Table-4. Particulate matter is higher in rainy seasons at Shahganj Chowk and Roadways bus stand. Carbon dioxide concentration is higher winter season at private bus stand and lower Khutahan Chauraha in rainy seasons. Carbon monoxide concentrations generally raise in winter and summer season and decrease in rainy season significantly. Organic volatile matters concentration higher in summer season in dens populated area in Shahganj, i.e., private bus stands and roadways bus stands.

**Significance:** Measurement of air quality index in urban populated area is essential for awareness

of particulars dwellers. There are long gap between outdoor and indoor air quality specially CO<sub>2</sub> and CO. Our research work throws light on variation of air quality in populated region which compare with their activities. Now a day's vehicular pollution and traffic are more toxic emission than other pollution activities. Living area is less populated than kitchen which reflect that kitchen might been included with exhaust assembly. Municipal area of Shahganj might take prosecution and seek needful actions.

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