Original Article

# Monitoring and statistical analysis of ambient air quality status at industrial sites of Aurangabad (Maharashtra) India

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**Abstract**

Air pollution due to anthropogenic sources, is a matter of concern in whole world. India experienced rapid industrial growth. In every city, the levels are getting worse because of raid industralization, growing number of vehicles, energy consumption and burning of wastes. Several cities face severe air pollution problems, with annual average leves of pollutants $SO_2$, $NO_X$, RSPM and SPM. A statistical analysis of ambient air in industrial sites of Aurangabad city (M.S.) during the year Nov. 2010 to Oct. 2011 and its concentration of parameters i.e. SO2, NOX, RSPM and SPM were studied besides meterological parameters such as temperature, relative humidity. Wind speed and direction for a period from Nov. 2010 to Oct. 2011. Quaterly and seasonal variations of these pollutants have been monitored or sampled. On the basis of annual average concentration the ambient air quality for the pollutants was analysed statistically and as a results of air pollution gives suggestion for control of air pollution and suffer from many more diseases.

**Keywords:** Ambient air quality, SO2, NOX, RSPM, SPM, ANOVA.

**Abbreviations:** RSPM (Respirable Suspended Particulate Matter), SPM (Suspended Particulate Matter), ANOVA (Analysis of Variance), df (Degree of Freedom), ss (Sum of Square), mss (Mean Sum of Square), f (Coefficient Factor)

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## INTRODUCTION

India, a developing country, is one of the first ten industrial countries of the world.[1] Because of the enhanced anthropogenic activities[2] in India, air pollution problems have become a topic of intense debate at all platforms. Air pollution in India has increased rapidly because of intensive population growth, increase in number of vehicles, use of fuels with poor environmental performance, badly mentioned transportation systems, poor land use pattern, industrialization and above all ineffective environmental regulations.[3] Long term and short term effects on human health have been observed due to poor air quality.[4] Air pollution may have adverse impacts on human health[5,6,7] as well as the health of other living entities, manmade heritage and life support system. The concept of Air Quality Index was introduced by the Environmental Protection Agency (EPA) in USA to measure the pollution levels due to major air pollutants. AQI has been used effectively to determine effect of pollution on human health.[8, 9,10] Study area was industrial area of Aurangabad. In this study a number of parameters $SO_2$, $NO_X$, RSPM and SPM affecting air quality are analysed at industrial sites of Aurangabad city (M.S.) with the meterological parameters. During the study seasonal variations of the pollutants have been monitored and statistically analysed the parameters i.e. $SO_2$, $NO_X$, RSPM and SPM. The co-ordinates for Aurangabad are N-$19^0$ $53^{'}$ $47^{"}$ E $75^0$ $23^{'}$ $54^{"}$ The city is surrounded by hills on all directions. Anual mean temperature in Aurangabad range from 17 to $33^{O}$C. Most of the rainfall occurs in the

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mansoon season from June to September. Average annual rainfall is 710mm. Major industrial areas of Aurangabad are Chikalthana and Waluj MIDC.

## MATERIAL AND METHODS

Study area was industrial sites of Aurangabad. Site description was MIDC Waluj and Chikalthana MIDC. Samples were collected at five different sites for a period of average 24 hours during the period of Nov. 2010 to Oct. 2011. Analytical. **Procedure:** The method adopted for measurement of Suspended Particulate Matter (SPM), Nitrogen oxide, Oxides of Sulpher are available in literature.[11, 12, 13] The presented data were statistically analyzed for analysis of variance (ANOVA)[14] and described in detail.

**Experimental results**: Ambient Air Quality summarised data of industrial sites (sectorwise)

**Table 1:** B-Sector, D-Sector, E1 and E2, H4, MIDC Chikalthana

| Industrial Sites | N | | Parameters | | | |
|---|---|---|---|---|---|---|
| | | | $SO_2$ | $NO_X$ | RSPM | SPM |
| B-Sector | 6 | Mean | 24.06 | 23.95 | 61.36 | 122.76 |
| | | S.D. | 3.76 | 2.11 | 4.02 | 4.69 |
| | | C.V. | 15.62 | 8.81 | 6.55 | 3.82 |
| D-Sector | 15 | Mean | 21.14 | 16.71 | 54.92 | 91.54 |
| | | S.D. | 4.22 | 3.86 | 5.04 | 8.40 |
| | | C.V. | 19.98 | 23.10 | 9.17 | 9.17 |
| E1 and E2 Sector | 08 | Mean | 23.09 | 22.08 | 83.46 | 104.94 |
| | | S.D. | 2.26 | 3.21 | 9.17 | 54.94 |
| | | C.V. | 9.79 | 14.53 | 10.98 | 52.35 |
| H-4 Sector | 03 | Mean | 26.85 | 25.83 | 77.48 | 116.69 |
| | | S.D. | 1.07 | 0.83 | 4.94 | 11.83 |
| | | C.V. | 3.98 | 3.21 | 6.37 | 10.13 |
| E-Sector MIDC Chikalthan | 6 | Mean | 22.79 | 21.95 | 74.30 | 47.10 |
| | | S.D. | 4.61 | 3.78 | 9.50 | 1.78 |
| | | C.V. | 20.24 | 17.24 | 12.78 | 3.78 |

## DISCUSSION

Statistical analysis for analysis of variance (ANOVA) of $SO_2$, $NO_X$, RSPM and SPM at five industrial sites (i.e. B-Sector, D-Sector, E1 and E2, H4, MIDC Chikalthana)

**Table 2:** $SO_2$ B-Sector, D-Sector, E1 and E2, H4, MIDC Chikalthana

| Source | *df* | SS | MSS | *f* |
|---|---|---|---|---|
| Area | 4 | 35.09 | 8.77 | 5.07** |
| Times | 2 | 0.33 | 0.16 | 0.10 NS |
| Error | 8 | 13.83 | 1.73 | |
| **Total** | **14** | **49.26** | | |

**Table 3:** $NO_X$ B-Sector, D-Sector, E1 and E2, H4, MIDC Chikalthana.

| Source | *df* | SS | MSS | *f* |
|---|---|---|---|---|
| Area | 4 | 247.66 | 61.92 | 5.16** |
| Times | 2 | 46.47 | 23.23 | 1.94 NS |
| Error | 8 | 95.93 | 11.99 | |
| **Total** | **14** | **390.06** | | |

**Table 4:** RSPM B-Sector, D-Sector, E1 and E2, H4, MIDC Chikalthana

| Source | *df* | SS | MSS | *f* |
|---|---|---|---|---|
| Area | 4 | 1452.80 | 363.20 | 9.16** |
| Times | 2 | 17.53 | 8.76 | 0.22 NS |
| Error | 8 | 317.34 | 39.67 | |
| **Total** | **14** | **1787.67** | | |

**Table 5:** SPM B-Sector, D-Sector, E1 and E2, H4, MIDC Chikalthana

| Source | *df* | SS | MSS | *f* |
|---|---|---|---|---|
| Area | 4 | 6505.03 | 1626.25 | 24.16** |
| Times | 2 | 272.68 | 136.34 | 2.02 NS |
| Error | 8 | 538.56 | 67.32 | |
| **Total** | **14** | **7316.27** | | |

The average concentration of Ambient Air Quality Monitoring (AAQM) has been presented in table. The results obtained on ANOVA for SO2, NOX, RSPM and SPM are follows - $SO_2$ - *f* (5.07), $NO_X$ - *f* (5.16) area, RSPM - *f* (9.16), SPM - *f*(24.16) at five industrial sector. *f* values for SO2, NOX, RSPM and SPM areawise significant and timewise non significant and all values for all the five sectors were within the prescribed limit.

## CONCLUSION

The results obtained for the values of variance ratios (*f*) clearly indicated that there was statistically significants differences in the values of $SO_2$, $NO_X$, RSPM and SPM at different locations of the industrial area. But day by day pollution is increased continously for the human safety or their diseases control the pollution level.

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