Available online at www.pelagiaresearchlibrary.com

Pelagia Research Library

European Journal of Experimental Biology, 2011, 1 (1):90-96

ISSN 2248 –9215

Study on ambient concentration of air quality parameters (PM_{10}, SPM, SO_2 and No_x) in different months

*** Niramaya Suresh Muchate and Annarao Maruti Chougule**

Dayanand Science College, Latur, Maharashtra, India

ABSTRACT

The present study aims to measure the concentration of various pollutants present in the ambient air. The primary focus of the study was on Respirable Suspended Particulate Matter (PM_{10}) and Suspended Particulate Matter (SPM) although it also deals with other pollutants like SO_2 and No_x. High volume Respirable dust sampler (RDS machine) with Thermo electrically cooled gaseous sampling attachment is used for sample collection. Ambient air monitoring is done at three different sites in Latur city comprising Residential, Commercial and Industrial areas. RDS machine was operated continuously for 48 hours at each site in a weak covering a period of six month. Result of investigation indicates that concentration of RSPM and SPM are exceeding the National Ambient Air Quality Standard at residential and commercial area whereas the concentration of SO_2, NO_X is bellowing the prescribed limits. Increasing vehicular activities are more responsible for the emission of Particulate matter (PM_{10}). The measure causes includes inadequate improper traffic management system, road condition, absence of effective mass rapid transport system.

Keywords- Ambient air quality, RSPM, SPM, SO_2, NO_X, traffic density.

INTRODUCTION

Study Area

Latur is a major district in Maharashtra state of India. It is well known for its quality of education, administration, food-grain trade and oil mills. City is situated 636 meters above mean sea level. The entire district of Latur is situated on the Balaghat plateau, 540 to 638 meters from the mean sea level. Annual temperatures range from 13 to 41 °C, the highest maximum temperature ever recorded was 45.8 °C. The lowest recorded temperature was 6.9 °C. Rainfall occurs in the monsoon season from June to September, varies from 9.0 to 693 mm/month. Average annual rainfall is 725 mm.

MATERIALS AND METHODS

Both the gaseous and particulate components of atmospheric aerosols and particularly atmospheric pollutants contribute to the deterioration of air quality. Pollution has become a local as well as a regional issue of big cities due to industrial centers and surroundings of transport routes, especially roads and highway [1]. The increasing development of human activities has given rise to a significant increase in atmospheric pollutants which may have an impact on human health [2]. Air pollution is one of the most serious environmental problems in India. In India, urban air pollution is the result of emissions from a multiplicity of sources, mainly stationary, industrial and domestic fossil fuel combustion, motor vehicles emissions and ineffective environmental regulations. Adverse effects of air pollution include an increase in cardiovascular and respiratory deaths among elderly people as well as increased hospital admissions for heart and respiratory diseases. It is well known that health effect associated with air born particles are depends on there toxicity. The extent to which air born particles penetrates into the human respiratory system is mainly determined by the size of the penetrating particles [3]. There are several epidemiologic studies which have demonstrated a direct association between atmospheric inhalation of particulate matter and respiratory diseases, pulmonary diseases and mortality especially in urban areas.

Particulate matter

PM can be classified considering their size. The smallest particles have very short lifetimes in air because their attachment to larger particles. The largest particles are short lived and remain airborne near to their source due to their high rate of sedimentation [4]. PM may be originated by some natural and anthropogenic sources. Natural sources exceed anthropogenic emissions, but the latter are frequently concentrated in urban environments. Natural sources of atmospheric particles are volcanic out gassing, forest fires, sea salt (directly emitted), and gas phase conversion of other atmospheric compounds. Anthropogenic sources are mainly burning of fossil fuels (industrial, transport and domestic burning), diverse industrial processes, mining and agriculture. Industrial and transport emissions are a significant source of particles mainly due to combustion of fossil fuels. They can be responsible of high concentration of particles in the air in great urban settings. However, the distribution of atmospheric particles in urban settings will depend on the characteristics of the urban planning. In canyon streets higher PM emitted by car engines have been found closer to the ground [5]. PM is important for public health impact in urban settings. The effect of PM on health has been often studied in relationship to hospital admissions due to cardiovascular and respiratory diseases, but also with some types of cancer

Oxides of nitrogen

Motor vehicles significantly contribute to ambient nitrogen oxides (NO_X) although all motor vehicles emit oxides of nitrogen majority of on road emission occurs from diesel vehicles [6]. The long term exposure to nitrogen dioxide, peoples may found to exhibit increased incidence of chronic cough and decreased lung function parameter.

Sulfur dioxide

Although motor vehicles emit sulfur dioxide and other sulfur containing compounds, traffic sources typically make only small contribution to ambient concentration [6] whereas near most industries are also responsible for sulfur dioxide emission. The sulfur dioxide is known as major respiratory irritant since many years.

Measurement of PM_{10} and SPM

Sample collection and data analysis was carried out by using a commercially available Respirable dust sampler (RDS- Envirotech APM 411TE model), on a weekly basis from June 2010 to December 2010. The particulate pollutant concentrations were estimated by drawing the measured volume of air into the covered housing of RDS. Usually, the air was drawn at a flow rate of 1.1 to 1.2 m3 per minute. The air inside the sampler passed through a combination of cyclone separator and filter in two stages. At the first stage, the cyclone separator was used to collect the bigger particles (particles in the size range of 10 to 100µm). The rest of the particulates in the size range of 2.5 to 10µm were collected over a previously dried and weighed glass micro fibre filters (Whatman GF/A, 203*254 mm). RDS is operated continuously for 48 hours. However filter paper and cyclone cup was replaced at interval of 8 hours as per central pollution control board norms and conditions .Thus, the collection inside the container attached with the cyclone separator could give the mass of $PM_{10–100}$, and the collection over the filter paper could represent the mass of PM_{10} (Respirable particulate matter (RPM)). The loaded and unloaded filters were weighed after conditioning them in desiccators and oven. Finally, the SPM (Suspended particulate matter) concentration was calculated by summing the PM_{10} and $PM_{10–100}$ concentrations.

Measurement for SO_2 and NO_X

Sample collection and data analysis was carried out by using a commercially available Thermo electrically cooled gaseous sampling attachment to RDS machine. Frequency of Sample collection is of 4 hours duration, machine works for two days at each site in weak. TCM and arsenite are used as absorbing reagent for SO_2 and NO_X respectively. Collected samples are then bring to laboratory and analyzed by West & Geake method for SO_2 and Jacob & Hochheiser method for NO_X. And from the procedure concentration of SO_2 and NO_X in µg / m^3 is obtained.

RESULTS AND DISCUSSION

Ambient air was monitored covering a period of six month from July to December. Six filter paper and cyclone cup were collected by using RDS at each weak from one site. The statistical results RPM for different sites have been presented in table1. The observed minimum RPM concentration was 93mg/m^3 and maximum was 125 mg/m^3 at residential area. Minimum RPM concentration was 90mg/m^3 and maximum was 131 mg/m^3 at commercial area. Minimum RPM concentration was 42mg/m^3 and maximum was 99mg/m^3 at Industrial area. Average RPM concentration was112 mg/m^3, 104 mg/m^3, 70 mg/m^3 at residential, commercial and Industrial areas respectively. Average SPM concentration was 210 mg/m^3, 245 mg/m^3, and 147 mg/m^3 at residential, commercial and Industrial areas respectively. It was noticed that average concentration of PM_{10} and SPM at residential as well as commercial areas are above the National ambient air quality standards, India. This may be due to the vehicular activity.

Seasonal variations are also found at all sites. During the month of October the concentration of SPM, PM_{10}, SO_2 and NO_X at sensitive and commercial area are found to be maximum. The reason may be increased October heat and festival activity like Dashra and Diwali [7]

The particulates are directly emitted into the atmosphere through natural and manmade (anthropogenic) processes including transportation, fuel combustion, industrial processes, land cleaning, wild fires and solid waste disposal [8]. In urban conditions, small aerosol particles are mostly emitted from combustion processes, i.e. car engines and industry. Urban aerosols have a higher proportion of vehicular emissions, which are in very fine size range. The larger particles correspond to the effects of human activities including road dust raised by vehicular motion, building activities and industrial emissions [9]. From the particle formation studies, it could be assumed that the majority of the submicron particles were primary emissions from traffic, or at least particles were formed very close to the sources (car engines) of precursor gases [8]. In addition to this the use of construction & demolition processing facilities is a growing trend. However, a consequence of this process is the generation of Particulate matter [10].

Table1. Monthly average concentration of RSPM (PM_{10}) in µg/m^3 at three sites

Month	Residential area	Commercial area	Industrial area
July	124	98	95
August	112	95	42
September	93	90	52
October	113	131	60
November	109	112	75
December	125	100	99

Table2. Monthly average concentration of SPM in µg/m^3 at three sites

Month	Residential area	Commercial area	Industrial area
July	154	231	193
August	234	264	89
September	194	221	135
October	234	298	136
November	193	220	154
December	251	240	176

Table3. Monthly average concentration of SO_2 µg/m^3 at three sites

Month	Residential area	Commercial area	Industrial area
July	5	7	6
August	4	4	4
September	4	6	5
October	7	6	2
November	6	7	5
December	2	3	2

The statistical results sulfur dioxide and oxides of nitrogen for different sites have been presented in table 4 and 5. Average concentration of SO_2 and NO_X was bellowing the permissible limit of National ambient air quality standards, India at three sites.

Table4. Monthly average concentration of NO_X μg/m^3 at three sites

Month	Residential area	Commercial area	Industrial area
July	17	15	12
August	9	11	12
September	11	15	12
October	19	20	7
November	9	14	9
December	11	12	9

Table5. Average Concentration (μg/m^3) of different pollutants for six Months at three sites

Sampling sites	RSPM	SPM	SO_2	NO_X
Residential	112	210	4	12
Commercial	104	245	5	14
Industrial	70	147	4	10

Table6. National ambient air quality standards for different parameters in (μg/m^3) For 24 hours

Sampling sites	RSPM	SPM	SO_2	NO_X
Residential	75	100	30	30
Commercial	100	200	80	80
Industrial	150	500	120	120

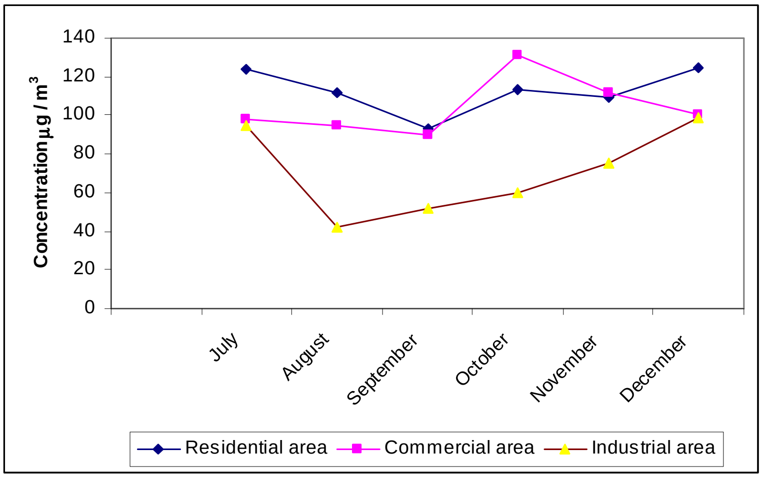

Fig 1- Showing Monthly average concentration of RSPM (μg/m^3)At residential, commercial and industrial area

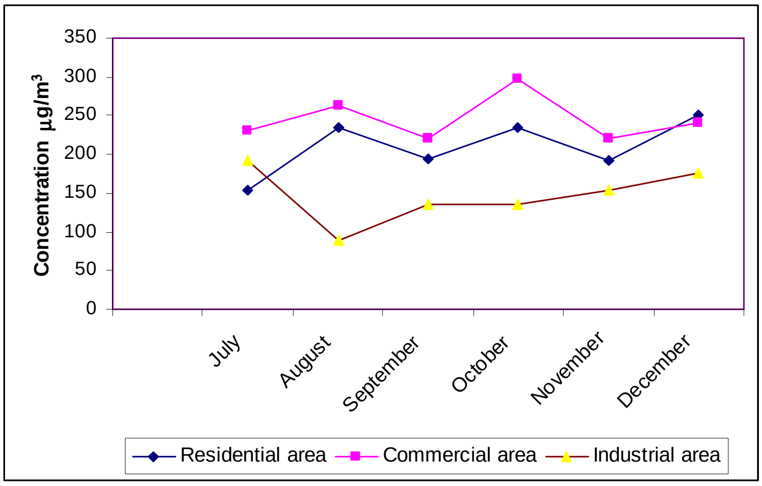

Fig 2- Showing Monthly average concentration of SPM (µg/m^3) at Residential, commercial and industrial area

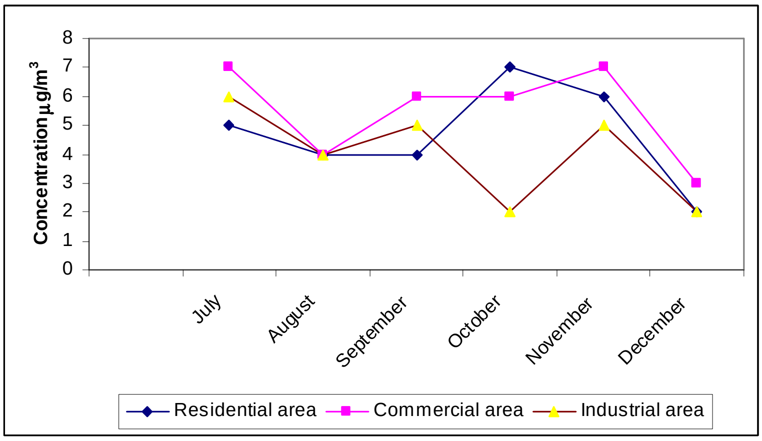

Fig 3- Showing Monthly average concentration of SO_2 (µg/m^3) At residential, commercial and industrial area

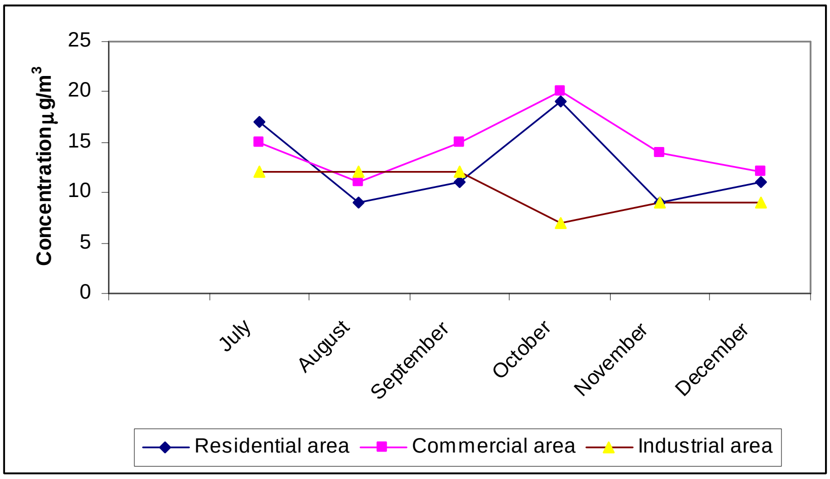

Fig 4- Showing Monthly average concentration of NO_X (µg/m^3) At residential, commercial and industrial area

CONCLUSION

The present study has provided a preliminary assessment of RPM, SPM, SO_2 and NO_X concentrations and its frequency distributions in Latur city. The Average RPM and SPM concentrations showed a well-defined variation and are higher in residential, commercial areas. The concentration of RPM is corresponds to SPM. And the average concentration of SO_2 and NO_X was bellowing the permissible limit of National ambient air quality standards, India at three sites. In general transportation, small-scale industries, and elevated rate of combustion of convectional fuels are found to be the source of particulate pollutant in Latur city. The highest concentration of RPM and SPM at residential, commercial area might be attributed pollution from automobiles. Traffic-derived aerosol particles were emitted into the atmosphere due to abrasion processes of automobile components such as the brake or tire wear. Therefore, the emissions and abrasion of the components of automobiles might be the major contributors to the mass of total particles along with emissions from some small-scale industrial sources [11]

REFERENCES

[1] Hrdlickova, Z., Michalek, J., Kolar, M. Vesely, V. (**2008**). *Atmospheric Environment*, 42(37), pp 8661–8673

[2] Atash, F. (**2007**). The deterioration of urban environments in developing countries: Mitigating the air pollution crisis in Tehran, Iran. *Cities*, 24(6), pp 399–409.

[3] Balachandran S. Bharat R.M. Khillare PS (**2008**) *Env Int* 26:49-54

Amoroso, G.G., and Fassina, V., **1983**, Stone decay and conservation: Atmospheric Pollution, Cleaning, Consolidation and Protection, Amsterdam Elsevier

[4] Amoroso, G.G., and Fassina, V., **1983**, Stone decay and conservation: Atmospheric Pollution, Cleaning, Consolidation and Protection, Amsterdam Elsevier

[5] Janhäll, S., Olofsson, K.F.G., Anderson, P.U., Pettersson, J.B.C., and Hallquist, M.,**2009**, *Atmospheric Environment*, 40, pp 5355-5366

[6] R. Baldaut. N Watkins. D Heist. C Bailey. R. Shores (**2009**) *Air Qual Atmos Health* 2:1-9

[7] J.Deshpande, R.Tiwari, A.Deshpande (**2008**) *journal of IAEM* vol 35: 139-142

[8] Vakeva M, Hameri K, Kulmala M, Lahdes R, Ruuskanen J, Laitinen T (**1999**) *Atmos Environ* 33:1385–1397

[9] Clarke AG, Azadi-Boogar GA, Andrews GE (**1999**) *Sci Total Environ* 235:15–24

[10] Jason M. Young & Timothy M. Kelly & Leonard Vance (**2008**) *Air Qual Atmos Health* 1:91–100

[11] Harison R, Yin J (**2000**) *Sci Total Environ* 249:85–105

[12] B. Vijay Bhaskar & R. V. Jeba Rajasekhar & P. Muthusubramanian & Amit P. Kesarkar (**2008**) *India Air Qual Atmos Health* 1:45–55

[13] Cizao Ren and Shilu Tong (**2008**) *Environmental Health* 7:56

[14] "Gazetteers Department - lATUR". maharashtra. gov. in (Government of maharashtra). http://www.maharashtra.gov.in/english/gazetteer/Latur_Site/index.html. Retrieved 2007-02-27.

[15] Harrison RM, Jones AM, Lawrence RG (**2004**) *Atmos Environ* 38:4531–4538

[16] Ozelem Ozden and Tuncay Dogeroglu (**2008**) *Environmental monitoring and assessment* 142:1-3