ASSESSMENT OF AMBIENT AIR QUALITY MONITORING IN TRAFFIC JUNCTIONS, VELLORE

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Abstract

Today modern world mostly depend the motor transport mode which causes the major reason for air pollution in urban area. The city like Vellore face more transport emission due it's over loaded vehicles. Although Vellore is 8th polluted zone of the country because of its industries so we decide to reveal the Vellore air pollution due to transport emission. This project deals with ambient air quality monitoring in Vellore road traffic junction. An ambient fine dust sampler is to be run for 8hours at the location to carried out the following contents particulate matter (PM_{10} ,$PM_{2.5}$), SO_x ,NO_x, CO. Quality of Air is compared with the ambient air quality standards of NAAQS. An 'Air Quality Index', is calculated for the sampling points of Vellore junctions. Based on the obtained air quality values Vellore zone will be rated.

Keywords: *Ambient Air Quality, Transport Emission, (PM_{10} ,$PM_{2.5}$), SO_x , NO_x, CO, NAAQS, Air quality Index.*

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1. INTRODUCTION

Air pollution in one of the major problem faced by urban areas. It causes more ill effects on human health, environment as well as building structures. Moreover Vellore is rated as 4th polluted zone based on industrial pollution. In current studies we concentrate on traffic emissions, particulate matters and gaseous pollutants are main pollution emitted by vehicle transportation. National ambient air quality standard 2009 is followed for analysis of air quality index. Based on the wind direction traffic density green circle and old bus stand junction are chosen for air sampling. Sampling taken at locations 3 days in each month. Sampling duration 8 hours per day (NAAQS).Air sampling is taken at the season of post monsoon (Jan –march).

List of pollutants considered in this project are:-

(i) PM_{10}
(ii) $PM_{2.5}$
(iii) Sulphur dioxide
(iv) Oxides of Nitrogen
(v) Carbon monoxide

2. MATERIALS AND METHODS

Collection of particulates was performed using standard procedure and using particulate sampling equipments in Vellore traffic junction (Green circle and near old bus stand)

***Instrument used*:** Respirable dust sampler and Fine Dust sampler. It is use to determine the particles below 10 µm in atmosphere. And fine dust sampler is an advanced instrument, used to determine the concentration of respirable particulate matter of size less than 2.5 µm. It is designed to comply with EPA method for determination of $PM_{2.5.}$ Components such as a flow rate measurement device, temperature and barometric pressure.

Fig -1: Respirable dust sampler and Fine Dust sampler

Study area

Sampling location

Green Circle junction is located at 12°55'54.6"N 79°08'17.5"E and Old bus stand junction is located at 12°54'59.4"N 79°07'56.6"E above the mean sea level of 216m. units (in parentheses). Due to unregulated population growth, Vellore town experiences an exponential growth in the vehicular usage, which results in an increased concentration of particulate matter in the surrounding air. Based on the traffic density, Green circle and old bus stand in the city has been chosen for air sampling. Point sources and Non-point sources around the selected location, responsible for emission of particulates were analysed.

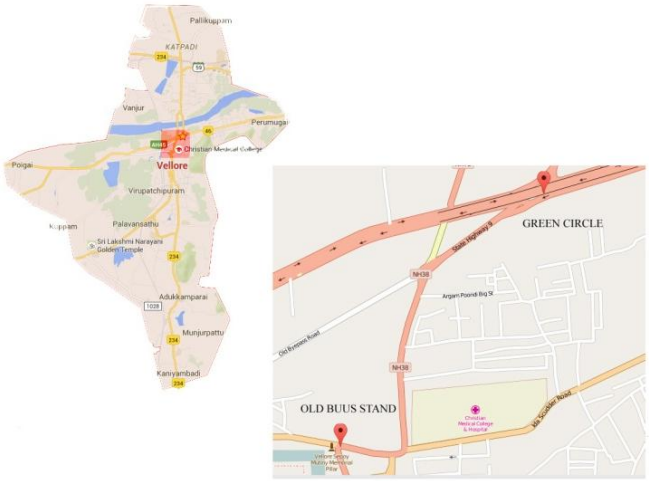

Fig -2: Sampling location map view (Vellore city)

Sampling period

The sampling was done continuously on an 8 hr for one day per month for period of three months (January 2016 to march 2016), which represents the post monsoon season of the year.

Sampling duration

The samples were collected 8 hours continuously for a period of one day per month.

Measurements of meteorological parameters

Wind Direction:

The instrument used for measuring wind direction is a simple one, which employs the conventional wind vane to sense the direction.

Wind Speed:

Instruments for measuring wind speed are called anemometers. The rate of rotation of the shaft to which the cups are attached indicates the wind speed. It employs a four cup anemometer wind. The motion of the cup is transferred after reducing the speed by a gear system to a scale which shows the numerical value of wind speed in Kmph.

Temperature:

Temperature is directly calculated by the wet and dry bulb thermometer.

Air Quality Index (AQI)

An 'Air Quality Index' is used to convert the average value of pollution concentration into a single value and here the formula,

$$AQI = \frac{1}{5}\left[\frac{PM_{10}}{SPM_{10}} + \frac{PM_{2.5}}{SPM_{2.5}} + \frac{SO_2}{S_{SO2}} + \frac{CO}{S_{CO}} + \frac{NO_X}{S_{NOX}}\right]$$

Where, SPM_{10}, $SPM_{2.5}$,S_{so2} S_{co} and S_{NOx} represents the air quality standards for RPM, carbon monoxide, Sulphur dioxide and Nitrogen dioxide respectively.

Table -1: Air quality index

Air pollution index	Air pollution level	Remarks
0-25	Clean air	good
26-50	Light air pollution	acceptable
51-75	Moderate air pollution	Unsatisfactory
76-100	Heavy air pollution	Unhealthy
Above 100	Severely Polluted	Highly unhealthy

3. RESULTS AND DISCUSSION

Baseline Data Analysis

The vehicle count was taken for reference at monitoring station during the sampling period. The observations of the traffic survey are given in Table 2.

Table -2: Vehicle count

S.NO	SAMPLING LOCATION	DATE OF SAMPLING	TWO WHEELER	LMV	HMV
1	Green Circle	05-01-2016	22240	1290	3840
		08-02-2016	21350	1384	2327
		10-03-2016	22450	1233	3362
2	Old bus stand	05-01-2016	14805	1032	2832
		08-02-2016	15430	1122	2366
		10-03-2016	14560	1053	2452

Table -3: Metrological data

Date of sampling	Ambient temperature (°C)	Pressure (hPa)	Wind Speed (Kmph)	Relative humidity (%)	Rain Fall
05-01-2016	30	1003	7	79	-
08-02-2016	33	1009	8	87	-
10-03-2016	39	1007	10	51	-

Table-4: Pollutant Concentration at Vellore Traffic Junctions

S.No	Location Name	Date	Parameters						
			PM_{10} µg/m³	$PM_{2.5}$ µg/m³	SO_2 µg/m³	NO_2 µg/m³	CO mg/m³	AQI	Remarks
1	Green Circle	05-01-2016	141.1	96.5	42.3	49.2	1.15	89.01	HAP
		08-02-2016	138.2	94.7	41.1	47.5	1.45	87.1	HAP
		10-03-2016	140.9	93.3	41.9	46.2	1.91	90.85	HAP
2	Old bus stand	05-01-2016	128.5	85.2	36.2	44.4	1.15	80	HAP
		08-02-2016	127.2	82.2	35.9	43.4	1.20	78.4	HAP
		10-03-2016	126.4	83.0	34.6	43.2	1.71	80.94	HAP

*Note
CAP – Clean Air Pollution
LAP – Light Air Pollution
MAP – Moderate Air Pollution
HAP – Heavy Air Pollution
SAP – Severe Air Pollution

Fig -3: Sampling location

Graphical Representation of Pollution Concentration In Green Circle

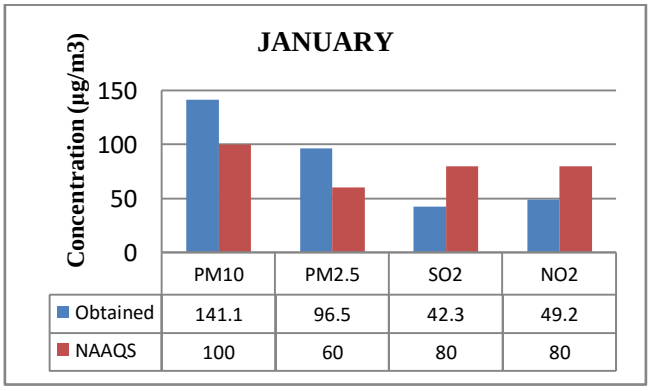

Chart -1: Pollution concentration in green circle January

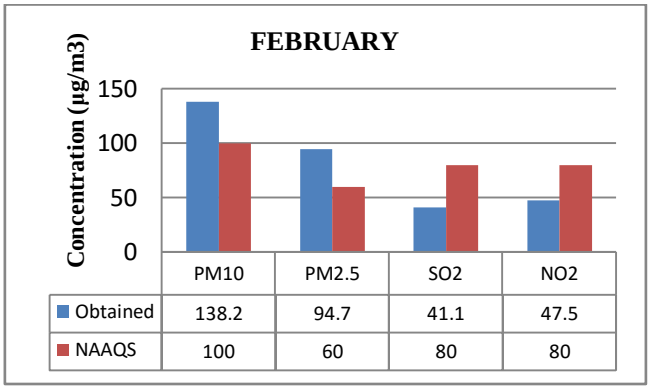

Chart -2: Pollution concentration in green circle February

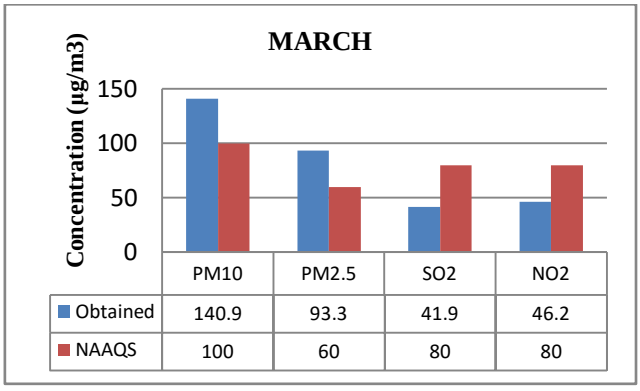

Chart -3: Pollution concentration in green circle March

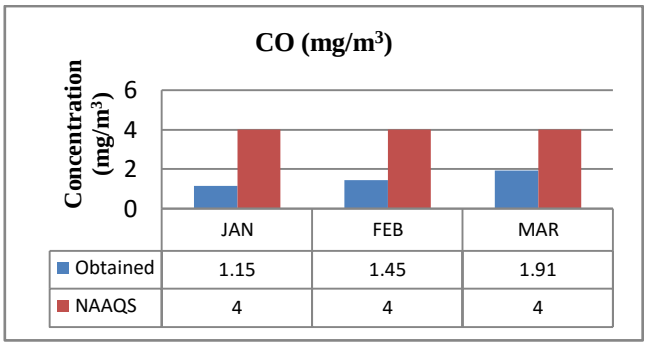

Chart -4: Carbon monoxide concentration in green circle

Graphical Representation of Pollution Concentration In Old Bus Stand

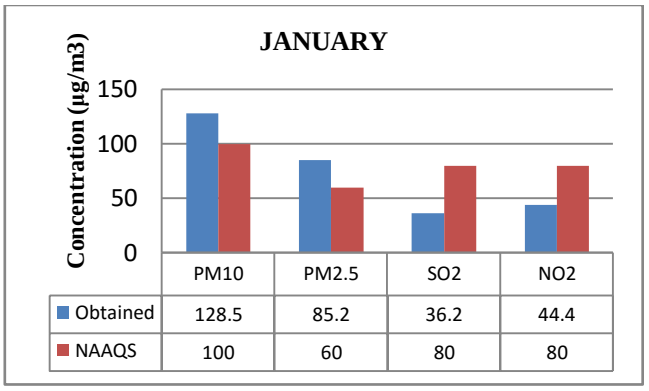

Chart -5: Pollution concentration in old bus stands January

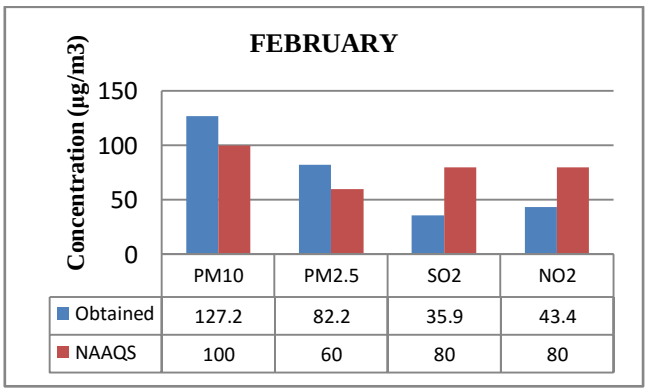

Chart -6: Pollution concentration in old bus stands February

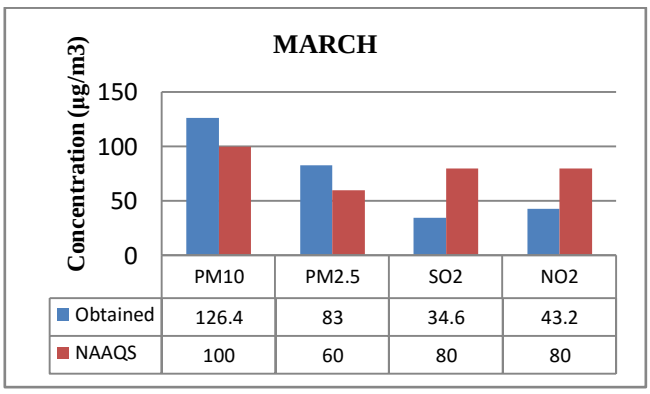

Chart -7: Pollution concentration in old bus stands March

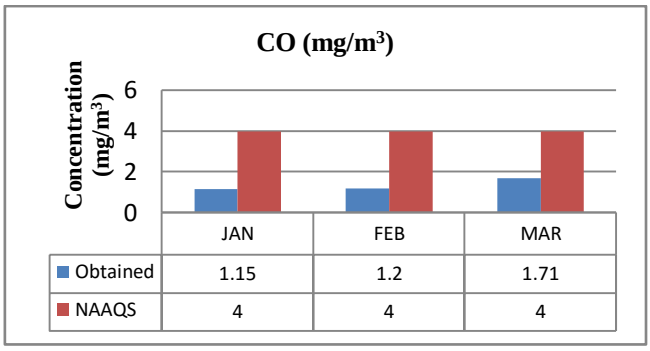

Chart -8: Carbon monoxide concentration in Old bus stand

From the currents studies concentration of particulate matters PM_{10} and $PM_{2.5}$ were monitored. Gaseous pollutants such as SO_2, NO_x, and CO were monitored in the selected location in Vellore city. It was founded particulate matters $PM_{10,}PM_{2.5}$ concentration is over the acceptable limits. Based on the average density of the pollutants Air Quality Index should be calculated and it denotes Vellore as Highly Air Polluted due to heavy traffic.

4. CONCLUSIONS

A brief review on monitoring of ambient air quality parameters such as PM_{10},$PM_{2.5,}SO_X$,NO_X,CO at Vellore traffic junctions overall results indicate the Vellore city is highly air polluted. Especially particulate matters PM_{10} and $PM_{2.5}$ (standard concentration from NAAQS 100µg/m^3, 60µg/m^3) concentration is over the acceptable limits (From table.4). It creates harmful ill effects to public and environment. It may controlled by reducing number of vehicles, this can done by encouraging walking, or by restriction of heavy vehicles and limited access to vehicles by local government. Also speed limitation may implement to control respirable dust particle. And Correction of road design should control air pollutions.

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