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ANALYSIS OF PARTICULATE POLLUTANT ($PM_{2.5}$) AND GASEOUS POLLUTANT (CO) AT JABALPUR, MP

Kalpana Sagar and R.K. Srivastava

Environmental Research Laboratory, P.G. Department of Environmental Science, Govt. Model Science College (Autonomous), NAAC RE-Accredited – 'A' Grade, College with Potential for Excellence, UGC, Jabalpur 482001(M.P.) India

E-mail: kalpanasagar.sagar2@gmail.com (**Corresponding Author*)

srivastavaratna@yahoo.co.in

Abstract: India's economy is growing faster as compared to many other countries in the world resulting in the growth of industries and infrastructure activities, leading to enhance emission of particulate matter ($PM_{2.5}$) and gases mainly like-carbon monoxide (CO). We were studying this parameter in Jabalpur city during 2014. The yearly average concentrations of $PM_{2.5}$ and CO were found in the range 41μg/m^3 and 0.34ppm. The correlation value was obtained (r =-0.0506) which is negative.

Keywords: Gaseous pollutants, Particulate Matter, Diurnal average, Seasonal average, Positive correlation.

INTRODUCTION

Air pollution has been aggravated by developments that typically occur as countries become industrialized, growing cities, increasing traffic, rapid economic development and industrialization, and higher levels of energy consumption. The high influx of population to urban areas, increase in consumption patterns and unplanned urban and industrial development has led to the problem of air pollution. Currently, in India, air pollution is widespread in urban areas where vehicles are the major contributors and in a few other areas with a high concentration of industries and thermal power plants. Vehicular emissions are of particular concern since these are ground level sources and thus have the maximum impact on the general population. Also, vehicles contribute significantly to the total air pollution load in many urban areas.

India has made rapid strides in industrialization, and it is one of the ten most industrialized nations of the world. Particulate pollutants have major negative impacts on climate and health. They also play significant role in environmental changes. It is well known that clean air is considered as a key requirement for human health. Several chemicals are

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released into the air from natural and anthropogenic sources. It is expected that the increasing load of atmospheric carbon monoxide (CO) and particulate pollutant (PM_{10}) will add to global climate change. **Shrivastava** et.al (2013) studied by air pollution due to road transportation in India: a review on assessment and reduction strategies**.** They found that, CO is the major pollutant coming from the transport sector, contributing 90% of total emission of gaseous pollutant. **Mishra** et.al (2013) worked on measurement and analysis of the gaseous pollutants in the surrounding areas of an upcoming airport. They obtained results from the analysis and compared them from the standards prescribed by CPCB data. **Dey** et.al (2014) studied the particulate matters, heavy metals and gaseous pollutants at Gopalpur (23°29′52.67″ N, 87°23′46.08″E), a tropical industrial site in eastern India. They found that monitored data exceeded the National Ambient Air Quality Standards (NAAQS) for PM_{10} and gaseous pollutants in the ambient atmosphere. **Sindhwani** and **Goyal** (2014) studied the assessment of traffic–generated gaseous and particulate matter emissions and trends over Delhi (2000–2010). In their study they found that 60% of total registered vehicles have been major contributors towards emissions of the pollutants considered.

SIGNIFICATION OF THIS STUDY

This monitoring network study is generating huge amount of data, which need to be properly collected, collated, evaluated, interpreted and compiled in the form of reports. The data will provide seasonal and diurnal information on the success of the abatement measures, air quality trend, and impact of policies etc. Good public information system is needed for air pollution in severely polluted countries.

MATERIAL AND METHODS

Sampling site- Jabalpur is located in central part of India. It is situated at 23°9′38″N 79°56′19″E. Atmosphere of Jabalpur is affected by emissions from vehicle exhaust, factory, particulate matter and moderate concentrations of surface ozone that predominantly arise during the summers have been shown to be detrimental to human health and destructive to vegetation (NRC, 1991). In this study, the status of ambient air quality due to the presence of different pollutants in the environment of Jabalpur is monitored specially PM_{10} and CO.

Fig. 1 Location of science college India

Instrumentation-

Ambient Air Quality Station

Ambient Air Quality Monitoring Systems (AQMS) monitored the level of pollutants – NOx, CO, CH_4, Particulate Matter (PM_{10} & $PM_{2.5}$),Ozone, etc. in the ambient atmosphere. From a single analyzer to complete systems provides a wide range of solutions to meet much of the Ambient Air Quality Monitoring demands.

Ecotech established an instrument for environmental monitoring that is WinAQMS (Air Quality Monitoring Station). WinAQMS has been designed as a client/server program. This means that WinAQMS has two parts: the client and the server. The server handles all the communication between the logger and the analysers, recording of data and starting/stopping of calibrations. The client is concerned with giving the users access to settings and data. On its own the server has no user interface and there is no way you can interact with it using the mouse or keyboard. The client is the visual interface of WinAQMS

and communicates with the server by requesting information or receiving information that it has asked for at a prior time. This arrangement means that the WinAQMS server must always be turned on before the WinAQMS client program can connect to it. In the Environmental research laboratory various ambient air quality analyzers for detection of the ambient air quality are installed.

The instrument *Ambient Air Quality Monitoring System (AAQMS)* was manufactured by Ecotech Australia. It consists of assembly of many transducers and analyzers employing various instrumentation techniques. These are:

a) Ec9830 Carbon Monoxide Analyzer (Co) Carbon monoxide absorbs infrared radiations (IR) at wavelengths near 4.7 microns; therefore, the presence and the amount of CO can be determined by the amount of absorption of the IR. The absorption spectrum between the measured gas and other gases present in the sample is analyzed to determine the concentration of Carbon Monoxide.

Particulate Matter Monitoring by BAM (Beta Attenuation Monitor)

The met one instrument model BAM-1020 automatically measures and record airborne particulate concentration level using the principal of beta ray attenuation. Thousands of BAM-1020 units are currently deployed worldwide, making the unit one of the most successful air monitoring platforms in the world. This method provides a simple determination of concentration in units of milligrams or micrograms of particulate per cubic meter of air. A small ^{14}C (carbon 14) element emits a constant source of high-energy electrons known as beta particles. These beta particles are detected and counted by a sensitive scintillation detector. An external pump pulls a measured amount of dust-laden air through a filter tape. After tape is loaded with ambient dust, it is automatically placed between the source and detector thereby causing an attenuation of the beta particle signal. The degree of attenuation of the beta particle signal is used to determine the mass concentration of particulate matter on the filter tape, and hence the volumetric concentration of particulate matter in ambient air is obtained.

OBSERVATION TABLE

The site for the study is quite dense related to residential area but the place of Jabalpur is also very near to green belt. While on monitoring the ambient air by AAQMS (Ambient Air Quality Monitoring System) of the city, some gaseous pollutants are like carbon monoxide (CO) and particulate pollutants ($PM_{2.5}$).The observation of gaseous pollutants and PM has

been observed of the year 2014. Here, the graphical representation showing the annual average comparison of CO and $PM_{2.5}$ is also presented.

Table 1: Yearly average of particulate pollutant ($PM_{2.5}$) and carbon monoxide (CO) concentration in 2014.

2014		
MONTH	**$PM_{2.5}$ $\mu g/m^3$**	**CO ppm**
JANUARY	**74**	**0.29**
FEBRUARY	**53**	**0.33**
MARCH	**35**	**0.27**
APRIL	**39**	**0.49**
MAY	**35**	**0.58**
JUNE	**27**	**0.55**
JULY	**18**	**0.31**
AUGUST	**17**	**0.18**
SEPTEMBER	**25**	**0.22**
OCTOBER	**39**	**0.30**
NOVEMBER	**66**	**0.31**
DECEMBER	**69**	**0.30**
Average	**41**	**0.34**

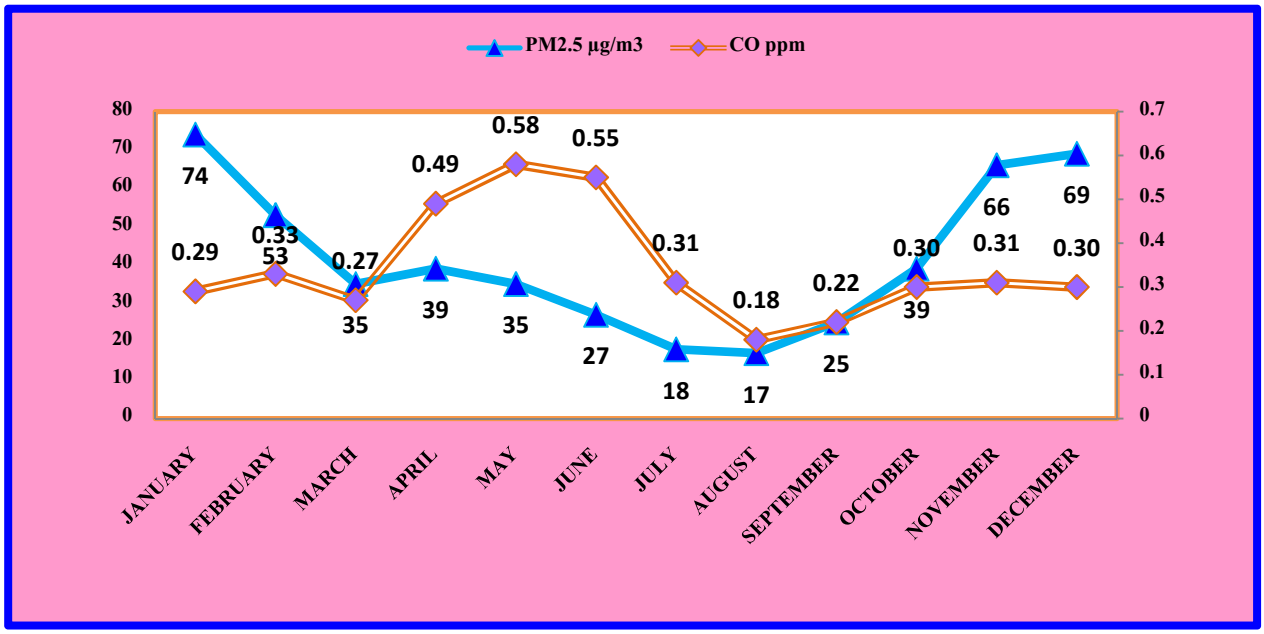

Fig. 2 Concentration of $PM_{2.5}$ and CO

RESULT AND DISCUSSION

This paper presents monitoring results of atmospheric concentrations of $PM_{2.5}$ and carbon monoxide (CO) of an Indian city, at Jabalpur stations during one year period (2014). The

objective of this work was to estimate yearly variations of these pollutants on urban air quality levels using simple statistics. The monitoring sites were selected based on the dominant activities of the area. The yearly average concentrations of $PM_{2.5}$ and CO were found in the range 41μg/m^3 and 0.34ppm. The maximum frequency of $PM_{2.5}$ appears in the month of January and maximum range of 74μg/m^3 and minimum in the month of August 17μg/m^3 was obtained, whereas CO is higher in the month of May 0.58ppm and minimum in the month of August 0.18ppm, (Table-1) In the monsoon season the pollution level is low because of lower boundary layer and higher in winter and summer season.

The correlation between these pollutants parameters observed during the study is shown below-

Yearly Correlation in 2014			
	R value	***R^2 Value***	***Correlation***
$PM_{2.5}$ with CO	**-0.0506**	**0.0026**	**Negative**

CONCLUSION

The concentration of particulate matter ($PM_{2.5}$) of 24hr average was higher than the permissible limit at the selected sites in Jabalpur city. So the ambient air quality was polluted due to dust of construction activities and due to vehicular emission. On the other hand, gases like carbon monoxide (CO) were below than standard limit prescribed by Central Pollution Control Board. It was observed that local people were suffering from allergic problems such as eyes and skin irritation, asthma and lung diseases etc.

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