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Analysis of Carbon Emission due to Automobile exhaust at Bareilly City, India

Rajesh Kumar Dubey* and Agam Dayal

Department of Zoology, Bareilly College, Bareilly, 243005, U.P., INDIA

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ABSTRACT

India is facing some significant air pollution dilemmas since last 10 years and it's increasing at a worrying rate. Researchers Conclude that when the pollution level keeps on increasing at the current rate, the life span would decline at least 10 years in some parts of the country by 2022. Automobiles are the primary supply of air pollution in India's major cities. The current time vehicle exhausts situation is dependent upon improvements in perspective, type of vehicles, models, and year of manufactures. In India, transportation sectors produces an estimated 261 tonnes of CO_2, that 94.5% is contributed by road transport. The transportation sectors in India consume about 17% of total energy and responsible for a 60% production of the greenhouse gases from numerous activities. The pollution from automobile is a result of release like CO, unburnt HC, Pb, NO_2 and SO_2 and SPM primarily from tailpipes. The aim of this study was to examine the automobile pollution and traffic congestion at different locations of Bareilly. The CO emission at these locations was observed with CO-84 Monitor during peak hours. These values were interpreted with NAAQ standards and places where the deviation occurred were identified.

1) INTRODUCTION

The major factors responsible for increasing the level of Carbon Monoxide in the atmosphere is mainly due to automobile exhausts. The excessive uses of automobiles are responsible for increase in concentration of atmospheric CO [1]. Narrow roads are unable to match the volume of traffic, damage roads signal at junctions, lack of mass transport, increase in economic status in Bareilly, this contribute in enhancing the air pollution [2]

Automobiles are serious global threat for increase in black smoke released into the air by vehicles; it is the common form of pollution that we routinely face. Carbon dioxide and Carbon Monoxide emitted from automobiles are the largest contributors to the global warming [3]. The most characteristic sources of air pollution have always been combustion processes. Here the most obvious pollutant is smoke. However, the widespread use of fossil fuels has made sulphur and nitrogen oxides pollutants of great concern increasing use of petroleum-based fuels, a range of organic compounds have become widespread in the atmosphere. These vehicles are driven by the fuels such as for instance petrol, diesel, gas and CNG all leading to emission of CO_2, greenhouse gases and harmful pollutants at various concentrations. These pollutants are immediately affecting human's life when in terms of personal discomfort, loss in productivity, stress, frustration and different health problems affecting skin, cardiovascular system, nervous system, respiratory system and immediately or ultimately these contaminates are responsible for climate change, global warming and natural disaster.

The vehicles produced until recently are of having out dated design and technology. In turn, they have high levels of emission rate. The automobile and diesel generator emission contain about 1-4% carbon monoxide (CO), 18% hydrocarbons (HC), 20% oxides of nitrogen and the remaining particulate matter. This contributes to mixing of gasses and carcinogenic substance in the atmosphere which leads to deteriorating air quality day by day [4]. The total vehicles on the road, petrol driven two and three wheelers with two stroke engines account for 70%, petrol driven four wheelers with four stroke engines account for 14%, diesel driven vehicles account for the remaining. Apart from the number of vehicles, the other factors responsible for vehicular air pollution are congested traffic, poor road conditions and age of the vehicles [5]. The Central pollution control board, State pollution control board and other agencies had conducted studies in metropolitan cities and other towns to assess the vehicular pollution and paved way for the implementation of 'Euro standards'. The aim of this paper is to evaluate and explore the traffic volume and carbon emission of selected road junctions in Bareilly city.

Concept of Vehicle Emission/Exhaust: Automobile emission originate from by-products of the fuel as the combustion process mostly toxic pollutants emitted out blended with the air molecule in the environment. The automobile emission in the city might be categorized in to two forms including exhaust emission and evaporative emission. Evaporative emission running losses and hot soak emissions made from fuel evaporation when a motor remains hot by the end of the journey and diurnal emission might be happened because of incidence of evaporative emission. Thus, exhaust emission again may be categorized in to two forms, one is start up emission and another is running emission. Start-up emission may be described when the automobile is start initially, it

* Corresponding Author: **Rajesh Kumar Dubey**
Email address: rajeshdubey6681@gmail.com

could be cold start and hot start. The cold start identifies when the automobile is started suddenly after a long gap of use, while hot start identifies when the automobile is started without the automobile getting enough time to cool off [6].

2) MATERIALS AND METHODS

Study area: **-** Bareilly city is located at the latitude between 28^0, 2' N to 28^0,5'N and longitude between 79^0, 0'E to 79^0,48'E above the sea level, elevation to south end and 90 km from east to west end. A state highway is running almost in the centre of the city in east- west direction and there is every possibility of it being upgraded into as Lucknow- Delhi Road with more volume of traffic.

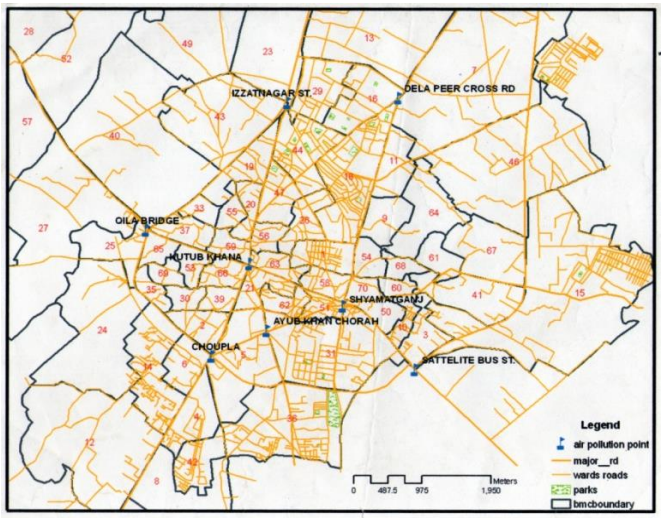

Fig.2 Location Map of Study Area

A survey was conducted at 8 selected locations in and around for the study of CO in ambient air during peak hours. The selected locations included the junction road major state highways where the level of traffic volume was high. Monitoring station 1 (Qilla Chauraha) Monitoring stations 2 (ChauplaChauraha) ,3 (Ayub Khan), 4 (Shyamganj Chauraha,) 5 (Kutub Khana Chauraha), 6 (Izzatnagar Station), 7 (Satellite Bus Stand) and 8 (Dhellapeer Chauraha). Stations 7and 8 were situate the southern side of the city. The level of traffic volume was carefully analyzed at peak hours of the day (09.00-10.00, 13.00- 14.00, 16.00- 17.00, 20.00-21.00) with the help of recorded video clips. In each peak hour, the number of vehicles like two wheelers, three wheelers, light four wheelers and heavy four wheelers passing through each location were recorded separately and presented in (Table 1).
The CO concentration was recorded using CO-84 monitor, at each of monitoring stations, the CO concentrations were observed with the monitor during peak hours and also continuously to calculate 1 hour's averages. The readings were tabulated and presented in (Table 2). The National Ambient Air Quality Standards for carbon monoxide is given in Table 3. All the sampling stations selected in these studies come under the category of residential areas. The permissible 1hour average CO concentration is 4.0 mg/m^3 [7] [8].

3) RESULT AND DISCUSSION

Swift urbanization leads to growth of vehicles and contributing severe environmental complications related to air pollution. Carbon emission is one the major anxiety in some countries while an ignored dimension in the other [9, 10]. The elevated carbon emission is closely associated with adverse impacts on human health which ranges from minor stresses to severe type of skin diseases, hair loss as well as heart and respiration problem. Carbon emission is affected by factors such as traffic volume and speed of vehicles, pavement type, and vehicle conditions. In general, from small vehicles the major part of carbon emitted is at the pavement-tyre interface, and from the engine. It is clearly observed that the main contributors of carbon emission in this city are road transportation. The traffic volume and carbon emission data collected from different selected monitoring sites displayed in different time interval.

Monitoring stations 1 and 2 (Qilabridge and Chaupla Chauraha)
The CO values observed in these stations during peak ranged was 3.51 to 4.20mg/m^3 and 4.14 to 6.34mg/m^3.Both the minimum and maximum values are higher than the permissible value of 4mg/m^3. This indicates the severity of CO pollution in these locations. Proper remedial measures have to be implemented to reduce the level of pollution in these locations.

Monitoring Stations 3 and 4 (Ayub Khan Chauraha and ShyamganjChauraha)
The observed CO ranges at these locations were 2.95 to 4.52mg/m^3 and 3.00 to 5.73mg/m^3 respectively. At these site co level was fluctuated within permissible and above the permissible level
If traffic regulations are imposed in these locations, the CO level may be kept within the standards.

Monitoring Station 5 and 7 (Kutub Khana Chauraha and Satellite Bus Stand)
These stations are located in places where the traffic volume was less, especially two wheelers. and the passing speed of vehicle are high so CO emission was noted low. The road conditions were also good since they were located on periphery of the city. Due to these factors, the CO level was always less than the permissible value, indicating slightly to no pollution.

Monitoring Station 6 and 8 (Izzatnagar Station and Dhellapeer Chauraha)
The range of CO in these two stations varied abnormally from permissible range to values higher than standards [3.11 to 4.82mg/m^3]. The vehicles passing in these two locations were more in number during the evenings and night hours. Hence there was an abnormal increase in CO level when compared to the CO level in day time. Both the stations reported higher concentrations.

4) CONCLUSION

In this paper, the results explored the number of vehicles and carbon emission at selected road junctions. Qilla markets, Kutubkhana, Rajendranagar Chauraha, Dhellapeer Chauraha monitoring stations were showed higher concentration of CO from the permissible standard. Ayubkhan Chauraha, Shyamganj Chauraha, Kutub Khana Chauraha, Satellite Bus stand were showed the concentration of CO with in permissible standard. Automobile emission can be reduced by avoiding unnecessary driving of vehicles, use of public transportation, emission test by RTO, Ban of vehicles more

than 15 years of age, by introducing Metro (Maintenance of road) Flyovers, underpass, By-pass road and by the environment education awareness programs.

Table-1: Number of Vehicles at selected locations

Monitoring Stations	2 Wheeler	3 Wheeler	4 Wheeler (Light)	4 Wheeler (Heavy)	Total
1. Qilla bridge	3126	714	1264	121	5225
2. Chaupala Chauraha	2696	532	125	325	3678
3. Ayubkhan Chauraha	2958	321	241	6	3536
4. Shyamganj \Chauraha	3251	123	321	21	3716
5. Kutubkhana Chauraha	1256	245	214	51	1756
6. Izzatnagar Station	3254	126	748	1025	5153
7. Satellite Bus Stand	3214	352	845	653	5064
8. Dhellapeer Chauraha	1457	124	264	697	2542

Table-2- Recordings of CO concentrations in automobile emissions

Monitoring stations	Observed CO range	1 Hours average
1.Qilla bridge	3.51-4.20	3.85
2.Chaupala Chauraha	4.14-6.34	5.08
3.Ayubkhan Chauraha	2.95-4.52	3.79
4.Shyamganj Chauraha	3.00-5.73	4.54
5.Kutubkhana Chauraha	2.65-3.90	3.36
6.Izzatnagar Station	3.11-4.82	3.96
7.Stellite Bus Stand	2.77-3.56	3.18
8.Dhellapeer Chauraha	2.39-3.15	2.87

*****Values are in mg/ m^3

Table- 3- National ambient air quality standards for CO

Carbon monoxide	Time	Concentration in a Industrial area	Ambient Air	Sensitive area
			Residential	
			Rural and other areas	
CO	8 hours	05	02	01
CO	1 hour	10	04	02

***Source: CPCB (2012)**

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