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Estimation of Carbon Emission Through Vehicle Load In Patan City

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ABSTRACT

Increasing human population, industrialization and urbanization is rapidly spreading over the urban areas and deteriorating the environmental quality continuously. Air pollution became a major problem in compared to the other types of pollution due to its harmful effects on man and materials and difficult remedial measures. The major sources of the air pollution are industries and vehicles that emitting many air pollutants to the ambient environment as well as the life on the Earth. Present study was carried out to know the role of vehicles on the air quality of Patan city of Gujarat. The study has been carried out in four zones of the city, viz., residential zone, industrial zone, commercial zone and suburb zone. All the sites were investigated for the carbon emission by scrutinizing the vehicle load with their fuel use pattern and then it was calculated using carbon calculator. It was found that the vehicles operated by diesel are contributing more carbon to the atmosphere in Patan city in compare to petrol and gas operated vehicles.

Keywords : Air Pollution, Carbon emission, Vehicles.

I. INTRODUCTION

At the global level, the rapid growth in motor vehicle activity has serious energy security and climate change implications. The transport sector already consumes nearly half of the world's oil. But in urban areas – both developing and developed countries, it is predominately mobile or vehicular pollution that contributes to air quality. Two-wheelers account for about 72 percent of the total vehicular population in city (Mahadevappa *et al.*, 2012). In developing countries the air quality crisis in cities often attributes in large measures (40–80%) to vehicular emission. Despite the improved performance of technology is presently insufficient to counteract the growth of vehicles (Anon., 1997). Increase in the number and use of private vehicles led to the deterioration of ambient air quality due to pollutants released through auto mobile exhausts which has a direct impact on human and the environment.

Currently, in India, there is a high influx of population to urban areas, which has led to sharp increase in traffic. The major contributors to this widespread air pollution in urban areas is vehicular emission which is of great concern, as these are ground level sources and have maximum impact on the general population. The slow growth of road infrastructure and high growth of vehicles imply that Indian roads are reaching a saturation point in utilizing the existing capacities, hence, leading to congestion and further contributing to air pollution load (Pranav Raghav Sood *et al*., 2012). In urban areas mobile or vehicular pollution is predominant and significantly contributes to air quality problems. Road traffic produce volatile organic compounds, suspended particulate matter, oxides of sulphur, oxides of nitrogen, and carbon monoxide, which makes adverse health effects on the exposed population(Sopan T. *et al*., 2005). Recent evidence indicates that motorized vehicles are a major source of air pollution in urban areas, on the other hand transportation engineers aim at steps to reduce congestion and trying to improve the flow conditions at various road network in urban streets (Bhawna Dubey *et al*., 2013). Every year, more than 3080 million tons of CO_2 and other pollutants are releasing into the earth's atmosphere.

In human Population, road transportation, vehicular traffic and industries which have resulted in further increase in the concentration of gaseous and particulate. (Agbaire *et al.,* 2009). Air pollution is an inevitable harmful by product of rapid industrialization and urbanization that is responsible for variety of deleterious

effects on both human and plant communities. (G. Buchchi Babu *et al.,* 2013). The urban air quality is continuously affected by emissions from both stationary and mobile combustion sources. Mobile sources contribute to the emission of major urban air pollutants including: carbon monoxide (CO), Nitrogen oxides (NOx), Sulphur oxides (SOx), particulate matter (PM), lead (Pb), photochemical oxidants such as ozone (O_3) and ozone precursors like hydrocarbons and volatile organic compounds (Costa *et al.,* 2001 and S. Ramesh Kumar, *et al.*, 2013)

There are no such big industries are available in Patan which can highly cause the air pollution of the City. The major source of Air Pollution of the city was vehicles and there were no more work has been done on role of the vehicles in pollution. The work has been carried out to study the role of vehicles in air pollution of Patan city through vehicle load survey of various places with reference to vehicle types and fuel uses.

II. MATERIALS AND METHOD

Study Area:

The present study has been carried out in Urban Patan. Patan city is situated at the Northern part of Gujarat Region of India and geographically located between 23° 51' 5.81796" North and 72° 6' 53.49096" East. It is one of the fastest growing cities in Gujarat. With a population of 2011 in 1, 25, 027 indicating a development of 741 Sq.km areas. The city having, the Residential, Commercial Shops, Hospitals, Schools, Colleges and also a Head quarter of Hemchandracharya North Gujarat University.

Selection of Study Sites:

Study area was divided into four different zones like Residential area, GIDC area, Commercial area and Suburb area according to the source of Pollution and study sites were selected randomly in the above mentioned zones.

Investigation of Carbon Emission:

The carbon emission by vehicles at the selected study sites were investigated in January 2014 through the direct count of different types of vehicles passed from all those sites. For this investigation, we counted and categorized vehicles in to different categories such as two wheelers, three wheelers, four wheelers and heavy vehicles. The vehicles were counted between the 2:00 pm to 4:00 pm for all the study sites. Using the Secondary data, the average milages were find out for each different types of vehicles like two wheelers, three wheelers, four wheelers and Heavy vehicles as per their fuel used like petrol, diesel and gas. After counting vehicles, the carbon emission was calculated for the 500 m^2 areas of each study sites using CO_2 emission calculator by finding the mileage of the vehicles passed from study sites with their type and fuel.

III. RESULTS AND DISCUSSION

IV.

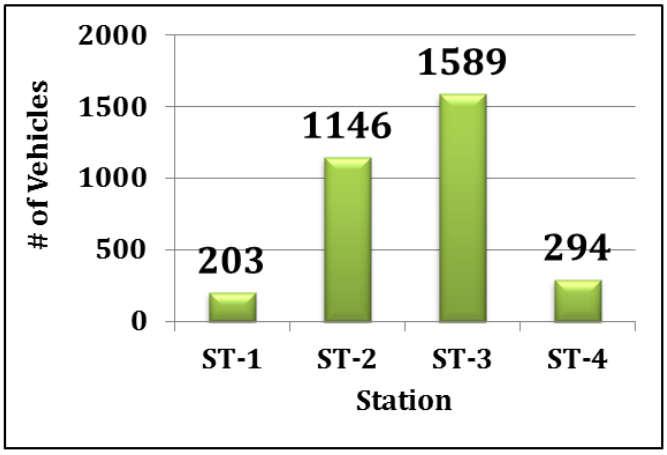
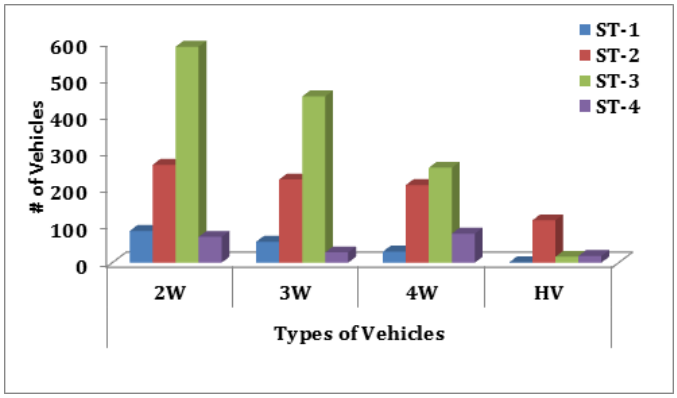


Figure 1. Vehicle load in study sites (# Vehicles/hr)

For the carbon emission investigation, the vehicular load was investigated for all the study sites along with their types and fuel used pattern. According to the past research, the average milages were find out for each different types of vehicles like two wheelers, three wheelers, four wheelers and Heavy vehicles as per their fuel used like petrol, diesel and gas. Figure 1 shows that the vehicles loads of the selected study sites were 1589, 1146, 294 and 203 vehicles passes in 1hour in ST-3, ST-2, ST-4 and ST-1 respectively. The Vehicle load found higher at the ST-3 which was the commercial area and that was due to the main market and center of the city. The same was found lowest at the ST-1 which was the residential area.



(2W= Two wheelers, 3W= Three wheelers, 4W= Four wheelers and HV= Heavy vehicles)

Figure 2. Types wise vehicle load in study sites per hours

Figure 2 shows that the higher 2W rush of 587, 266, 86 and 70 vehicles passed per 1 hour in the ST-3, ST-2, ST-1 and ST-4 respectively. Higher 3W rush of 452, 226, 57 and 28 vehicles passed per one hour in the ST-3, ST-2, ST-1 and ST-4 respectively. The rush of four wheelers 258, 211, 79 and 30 vehicles per one hour was in the ST-3, ST-2, ST-4 and ST-1 accordingly. ST-3 was having the high load of the two wheelers, three wheelers and four wheelers because of the commercial area having the commercial market, shops, center of the city, lots of hospitals and bus station. The high rush of Heavy vehicles was 115, 18, 16 and 1 vehicles per hour in the ST-2, ST-4, ST-3 and ST-1 in that order. ST-2 was having the high heavy vehicles because it was a GIDC area which was connected the city with other cities.

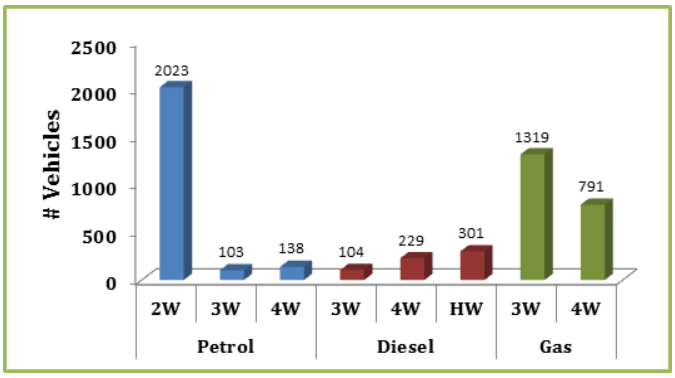


Figure 3. Average Fuel wise vehicle load

Figure 3 clearly shows that two wheelers are mostly operated by petrol, heavy vehicles through diesel and three wheelers are mostly operated by gas. Figure 3 depicts that 45 % of vehicles in the city are run by petrol, 42 % by gas and only 13 % by diesel.

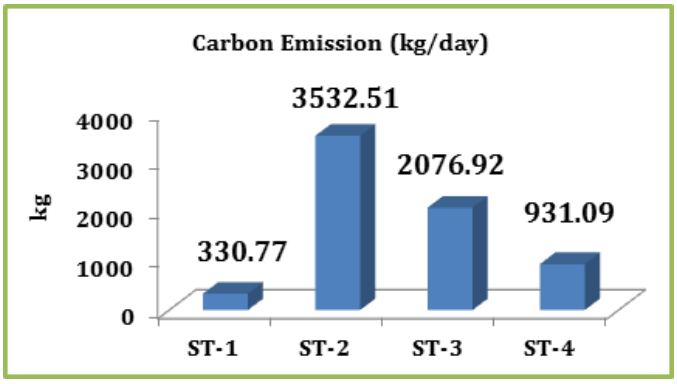


Figure 4. Carbon Emission of study sites (kg/day)

Patel et al., 2012 had estimate the carbon emitted from the vehicles by surveying 500 different types of vehicles including two wheelers, three wheelers and four wheelers of Patan city in 2012 and resulted that approximately 1019.8 kg carbon was emitted by 500 vehicles per day in Patan from mainly two wheelers, three wheelers and four wheelers. Carbon emission is depend on the types of fuel uses by the vehicles. In the above figure 4, it has shown that the carbon emission in the 500 m2 areas of the selected study sites were higher in the ST-2, followed by ST-3, ST-4 and ST-1. Carbon emission from the vehicles was high in the ST-2 though the vehicles load was higher in the ST-3 shown in the Figure 5.1 due to the high rush of the heavy vehicles in site 2.

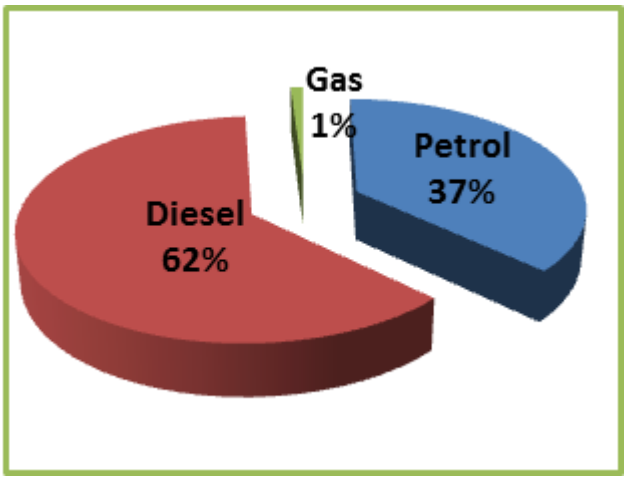


Figure 5. Fuel wise carbon emission ratio

Figure: 5 shows that the carbon emission ratio by vehicles was using different kind of fuel and also illustrating that 62% of carbon were emitted by the

diesel operated vehicles, 37 % by Petrol vehicles and 1 % by the gas operated vehicles in the selected study sites.

V. CONCLUSION

Carbon emission in the city was 62% by diesel operated vehicles, 37 % by Petrol vehicles and 1 % by the gas operated vehicles in the selected study sites. Carbon emission in the different areas of city was highest in ST-2 and lowest in ST-1. ST-2 area having lower vehicle load than ST-3 but having the higher carbon emission due to high rush of diesel vehicles in the area and ST-1 having lower vehicle load and lowest carbon emission in the area. Carbon emission can be reduced by changing the fuel pattern like use of gas or petrol operated vehicles instead of diesel operated vehicle.

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