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Effect of Traffic Congestion on The Emission of Carbon monoxide in Minna Metropolis

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ABSTRACT

Air pollution is the contamination of the atmosphere by the discharge or emission of undesirable substances and gases, or their formation from the emissions by chemical reactions in the atmosphere. Traffic in metropolitan areas is the leading cause of pollutants emission especially for CO and also NOx, VOCs, SOx and particulates The study is aimed at assessing the effect of Traffic Congestion on The Emission of Carbon monoxide in Minna Metropolis.Traffic monitoring was carried out in the morning to evening (7:30am-6:30pm) while air sample was monitored simultaneously for the presence and varying concentrations of carbon monoxide (CO) with the aid of Altair 4X gas detector. Data collection was done from June – July 2020. The study recorded significant relationships between traffic congestion and the concentration of Carbon monoxide emission in the study area. The finding of this study suggests that the concentrations of the carbon monoxide measured along Kpakungu – Gidan Kwanu, Minna Metropolis are above the limits stipulated by the WHO. Therefore, there is an urgent need to focus on air quality management in Minna Metropolis to safeguard the environment and public health. The study recommends the provision of required road facilities, enforcement of traffic control laws by relevant authorities and good transportation management system in the study area.

Keywords: *Traffic Emission, Air Pollution, Traffic flow, Pollutant.*

1 INTRODUCTION

Air pollution is a basic problem in today's world. The major classification of pollutants is based on their sources. There are two broad categories namely; anthropogenic and natural sources. Anthropogenic emission occur as a result of day to day human activities connected with industry, transportation, mining, construction and domestic life in the household (such as cooking and heating). Natural sources include volcanic, lighting and the digestive tracks of animals. Biomass burning is a special category of sources, categorized as savanna, forest and agricultural waste burning. It includes both human and natural fires (Aghedo, 2007). Exposure to ambient air pollution has been linked to a number of different health outcomes, starting from modest transient changes in the respiratory tract and impaired pulmonary function, continuing to restricted activity/reduced performance, emergency room visits and hospital admission and to mortality. There is also increasing evidence of adverse effects of air pollution not only on the respiratory system, but also on the cardiovascular system (WHO, 2004). The major sources of human activities that cause air pollution in cities are motor traffic, industry, power plants, and domestic fuel (Mayer, 1999). Environmental Pollution by vehicular emissions is worsen by inefficient vehicles, bad road networks, traffic congestion, and fuel adulteration (Hopkins *et al.,* 2009; Osuji *et al.,* 2009; Assamoi *et al.,* 2010). Traffic emissions contribute about 50-80% of NO_2 and CO concentration in developing countries (Goyal, 2006). Nevertheless, studies and environmental research on air pollution confirm that motor vehicles, through consuming fuel in vehicle engines, emit a large amount of substances and gases (Briggs et al., 1997). Motor vehicle emissions, including nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM), and sulphur dioxide (SO_2) as well as volatile organic compounds (VOC) and ozone, are primary pollutants. In addition, some secondary emissions may occur as a result of interaction between the primary pollutants and certain other elements (Ting and Shaodong, 2009;).

In most developing countries of the world vehicular growth has not been checked properly by environmental regulating authorities leading to increased levels of pollution (Han, and Naeher, 2006). Information on traffic related environmental pollution in developing nations is scarce compared to the information available in the developed world (Okunola *et al*., 2012). This situation is alarming and is predicated on the poor economic disposition of developing countries. Poor vehicle maintenance culture and importation of old vehicles, which culminates in an automobile fleet dominated by a class of vehicles known as ''super emitters'' with high emission of harmful pollutants, has raised high this figure of emission concentration (Ibrahim, 2009).

In low industrialized countries like Nigeria, majority of the air pollution problems result from automobile exhaust. In the major towns of some developing countries, because of tropical nature of the climatic conditions, many activities are performed outdoors. People stay along the busy roads every day either to do their work or to sell their wares. Therefore, the ill effects on health due to air pollution resulting from automobile exhaust emission must be seriously addressed (Ayodele and Bayero, 2009). Also, the affecting factors include an increase in the numbers of private cars, the time and duration of exposure (including the duration of staying inside a vehicle), physical activity levels, age and health conditions, fuel consumption, weather conditions, topographical conditions as well as the types of technologies used in fleet vehicles (Gorham, 2002). Urban air quality remains a major environmental concern around the world, and its significance is increasing as the world becomes more urbanized. The world's urban population was expected to reach 3.3 billion in 2008 and 5 billion in 2030 (UNFPA, 2007). Urban air pollution has been associated with increased morbidity and mortality (WHO, 2005). CO is a slow poison that kills by reducing the oxygen supply in the body (Greiner 1991). Discharged CO from motorized vehicles and other sources to air will have indirect effects on climate change and in addition adverse health effects on exposed humans (AGU, 1995). The symptoms of exposure to CO start with headache, tiredness, dizziness, nausea, vomiting, and drowsiness and in very acute situation; unconsciousness and death will follow (Harrop, 2002).

2 METHODOLOGY

Study Area

Minna is 100 km from Abuja the Federal Capital of Nigeria. Its climate lies between the Sahel and Guinea Savanna regions (that is the midland region). The dry season occurs between November and March while the rainy season is between April and October, with the peak rainfall in September.

The population of Minna was 60,000 in 1963, when the state was created. The population had increased to 122,031 in 1991 with a growth rate of 2.8%. There has not been a corresponding increase in industrial activities in the town. Major industries in the town include small agricultural processing industry, confectioneries, Pharmaceutical and Surgical Company and plastic manufacturing industries. On the other hand, there has been an increase in the number of vehicles for personal and commercial use in the town. Thus, traffic emission is expected to be a major source of air pollution in the town.

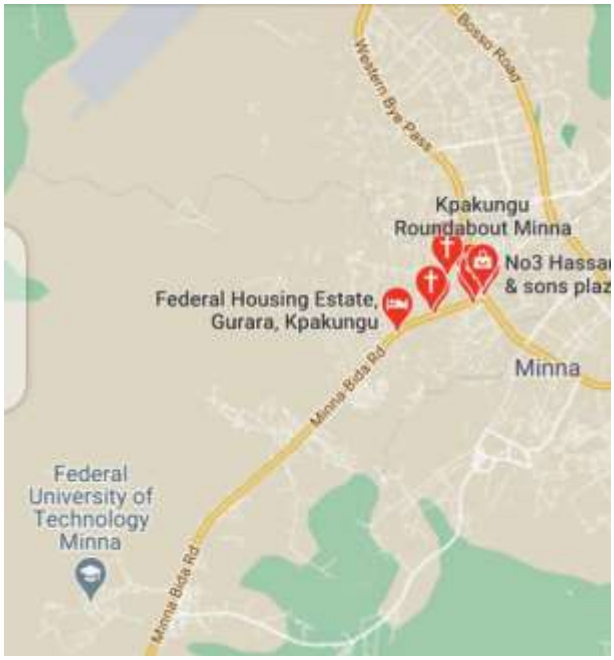

Figure 1: Map of Minna metropolis showing the study area. (Source: 2020 Google map data.)

The Kpakungu to Gidan Kwanu experiences the most traffic congestion in Minna. This site with the most traffic congestion was selected for this investigation. The site is located in the central business district of the town and it is congested during the morning hours of 7:30 - 9:30 am, when offices and commercial centres opened for business and 4:30-7:00 pm in the evening when the offices and business centres are closed.

Data Collection

Traffic monitoring was carried out from morning to evening (7:30pm- 6:00pm). The vehicles where classified into motorcycle, tricycle, car, van, pick up, Bus, Heavy vehicle 2, 3, 4 and 5+ axle.
The pollutant concentration was measured with the corresponding traffic count for Carbon monoxide using a portable gas detector and an Android phone. Air samples were randomly collected and monitored simultaneously for the presence and varying concentrations of Carbon monoxide CO. Data was collected from June - July 2020.

RESULTS AND DISCUSSION

The results obtained for the analysis of carbon monoxide concentration are shown in the Figures below.

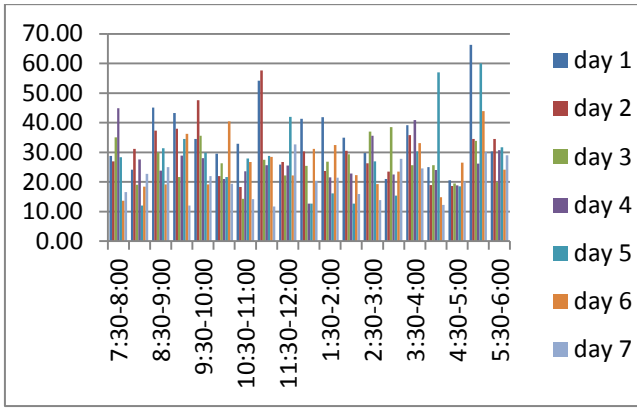

Figure 1: Concentration of Carbon monoxide for 7days with Time

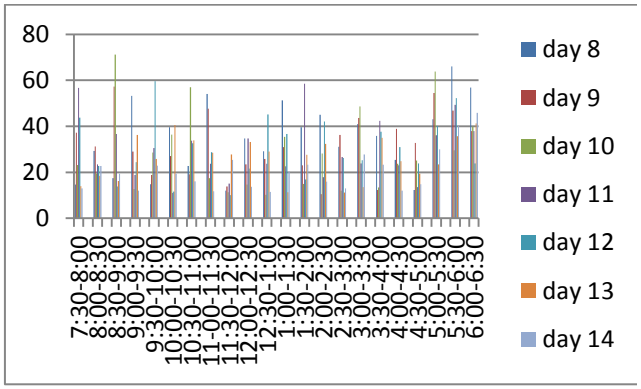

Figure 2: Concentration of Carbon monoxide for 7days with Time

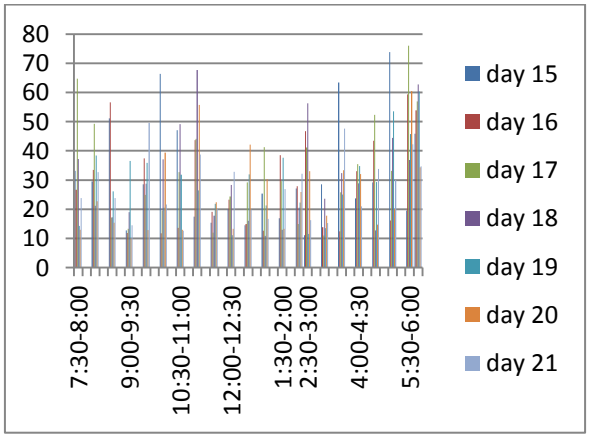

Figure 3: Concentration of Carbon monoxide for 7days with Time

Figures 1-3 give the concentration of carbon monoxide measured at 30 minutes interval. It was observed that the highest concentration of carbon monoxide measured for most days were above the 48ppm stipulated by the WHO which falls within the peak period. This indicates that the number of vehicle contribute to the increase of CO concentration.

This was observed for day 1 and day 2 at 5pm, day 3 and 4 at 8:30am, day 15 to day 20 at 5:30. Day 6, Day9, Day 12 had the highest value during the off peak period.

The maximum concentration of CO detected was 76.08ppm along the corridor when compared with values reported in other literature which was found to be higher than 15 ppm reported by Ndoke and Jimoh in 2004, but lower than 130ppm reported in Port-Harcourt metropolis (Augustine 2012). Short-term exposure to high concentrations of CO loading in blood reduces volume of blood distributed to body tissues. As a result, educe the ability of healthy individuals in term of running, working, walking and other activities (Harrop, 2002).

CONCLUSION

The concentrations of the carbon monoxide measured are above the standard of WHO at both morning and evening peak period. As a result, there is an urgent need to focus on air quality management in urban areas to safeguard the environment and public health. The study recommends the proper enforcement of traffic control laws by relevant authorities and good transportation management system in the study area.

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