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Research Paper

Comparative Study Of Carbon Monoxide On Heavy And Less Vehicular Traffic Areas In Different Locations In Owerri Municipality Of Imo State, Nigeria

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ABSTRACT
Carbon Monoxide (CO) poisoning is a seamless and dangerous problem in areas where the dirty and hazardous environment offers unique challenges to any deployed gas detection system. Nigeria is a fast growing country with many urban cities, urbanizing at very fast rates. Slow accumulation of the gas causes headaches, dizziness, nausea and confusion which are harmful for workers' safety and environmental protection. The gas detection solution needs to be wireless and instantly deployable. Crowcon gasman was used to record the level of carbon monoxide gas in air. Owerri Municipal (Urban region) had the greatest average concentration of measured pollution. Therefore, the movement of people, heavy duty commercial and private vehicles plying the routes have contributed significantly to traffic congestion and thereby increasing emission of CO concentration. The results of this study show that transport related pollution in Owerri is significant and need to be monitored. It is likely that air quality will deteriorate as the city continues to grow, which will result in possible several health consequences.
KEYWORDS: *Traffic Congestion, Carbon Monoxide, Concentration, Crowcon Gasman, Hazardous, Poisonous.*

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I. INTRODUCTION

In climatology, Carbon monoxide consists of one carbon atom and one oxygen atom, connected by a triple bond that consists of two covalent bonds as well as one dative covalent bond. However, carbon monoxide is the simplest Oxocarbon and Isoelectronic with the cyanide ion and molecular nitrogen. In sequence complexes coordination, the carbon monoxide legend is called carbonyl, [1]. Carbon monoxide is present in outdoor and indoor air, and is produced by burning fuel such as wood, oil, natural gas, propane, kerosene, Coal and gasoline. Carbon monoxide in outdoor air, is due primarily to exhaust from vehicles. Carbon monoxide in indoor air, is related to the presence of appliances which use carbon monoxide producing fuels, [2]. Carbon monoxide (CO) is a colourless, odourless gas with some degree of toxic to human beings and to animals as well. When encountered in a higher degree of concentration, it can be dangerous to health. It can be produced in normal animal metabolism in a low quantity, though having some degree of irritating gas, [3]. In atmospheric condition¸ it is thought to have reasonable biological functions. It is a product of incomplete combustion of fuel like coal, wood and natural gas. Vehicular exhaust is a major source of carbon monoxide, [2]. Exhaust pollutants, hydrocarbons, nitrogen oxide (NO_x), carbon monoxide and carbon dioxide exert deleterious effect on human health and environment [4].

The importation and excessive reliance on the use of automobile in Nigeria during recent times, have numerous benefit to human life. The benefits, however, have been accompanied by changes in the environment detrimental to man. In numerous cities across Nigeria, driving private car is probably a typical citizen's most "polluting" daily activities as emissions from millions of personal vehicles on the road add up. Automobile exhaust emission has been found to be the most widespread and intractable urban air pollution problem, [5]. To see automobile emission problem in Nigeria in proper perspective, the shores of Nigeria were kept wide open for importation of fairly used cars popularly called “Tokunbo” cars, by the Obasanjo administration of 1999 to 2007. Sequel to increase in workers' salary, by this exercise, skyrocketed the use of Tokunbo cars. In Imo State, the Governor Ohakim's clean and green concept, encompass the ban of motor cycle in Owerri Urban and the

introduction of multitude of tricycles popularly known as "kekenapep" and “kimkim” as an alternative means of transportation. The scenario worsened the already chaotic traffic congestion in Owerri, and increased automobile emissions and air pollution, [6].

It is noted that in history, sequel to automobile emission, Los Angeles city experienced air shed, climate change and obscuring of the sun causing eyes to irritate and stuffed-up noses. Exhaust pollutants; hydrocarbons, nitrogen oxides (No_x), carbon monoxide and carbon dioxide exert deleterious effects on human health and the environment, [7]. Hydrocarbons react in the presence of nitrogen oxides and sunlight to form ground-level ozone. Ozone irritates eyes and damages the lungs, [8]. A number of hydrocarbons are toxic, with the potential to cause cancer. Under high pressure and temperature conditions in an engine, nitrogen and oxygen atoms in the air react to form various nitrogen oxides, which also are precursors to the formation of ozone. When it rains, carbon monoxide contributes to the formation of acid rain. It reduces the flow of oxygen in the blood stream and is particularly dangerous to persons with heart disease, [9]. Carbon dioxide does not directly impair human health but it is a "greenhouse gas" that traps the earth's heat and contributes to potential global warming with solastolgic effects.

II. METHODOLOGY

The levels of CO concentration were detected at properly defined positions of the selected areas. These areas are Control, Ama JK and Rock View Round about in Owerri municipal council. We used Crowcon gasman monitoring device to detect the CO concentration at each location. We took data recording for five days simultaneously at the three locations. We avoided rain and some other factors that disturb the monitoring device from getting accurate reading. We recorded the day time and GPS of each location so that the CO concentration of the same area could be compared by other researcher, at other locations. We chose those locations on purpose, such as locations with high population, locations with vehicular traffic, location with waste combustion, location with local setting, low populated and so on. The purpose is to compare the result. Also to help us understand the activities that is key to increase in CO concentration in atmosphere. The Crowcon Gasman air monitoring device is very simple to use in the sense that it is simplified for on the spot CO measurement. The gas meter is raised upward to a certain height (6-8 ft) over a period of time. The knob is moved from the test position to on position. It makes a beep sound, this alarm indicates the measurement is working and that the battery is fully charged. A reading will appear on the screen, this reading will ascend, and descend, then gets stabilized at a certain level. The concentration of CO in PPM of that of the location appears on the screen and is recorded directly. It gives a continuous measurement of CO within a relative time interval in that location. Measurement is taken simultaneously at the sites for five (5) days, graphs are plotted and analyzed.

III. RESULTS

Table 1: Mean Value of Carbon Monoxide Concentration (ppm) by location **DAY 1**

Time (hr)	Control Junction	Ama JK	Rock View
8am – 11am	54.0	45.0	38.9
12.00 – 3pm	50.5	40.5	31.5
4pm – 7pm	58.0	43.8	36.8

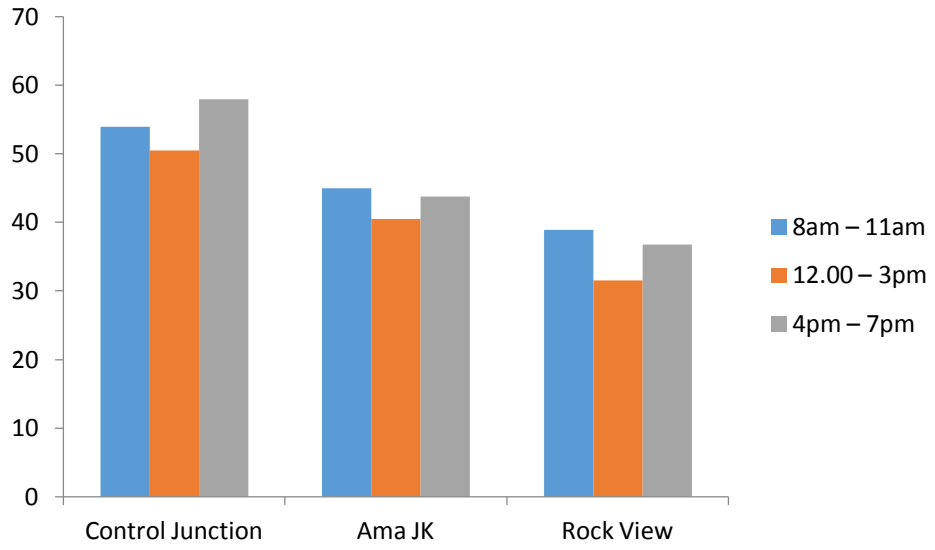

Figure 1: Bar chat of Mean Value of Carbon Monoxide Concentration (ppm) by location (DAY 1)

Table 2: Mean Value of Carbon Monoxide Concentration (ppm) by location **DAY 2**

Time (hr)	**Control Junction**	**Ama JK**	**Rock View**
8am – 11am	56.5	44.5	38.8
12.00 – 3pm	51.0	41.0	30.6
4pm – 7pm	58.0	43.6	35.8

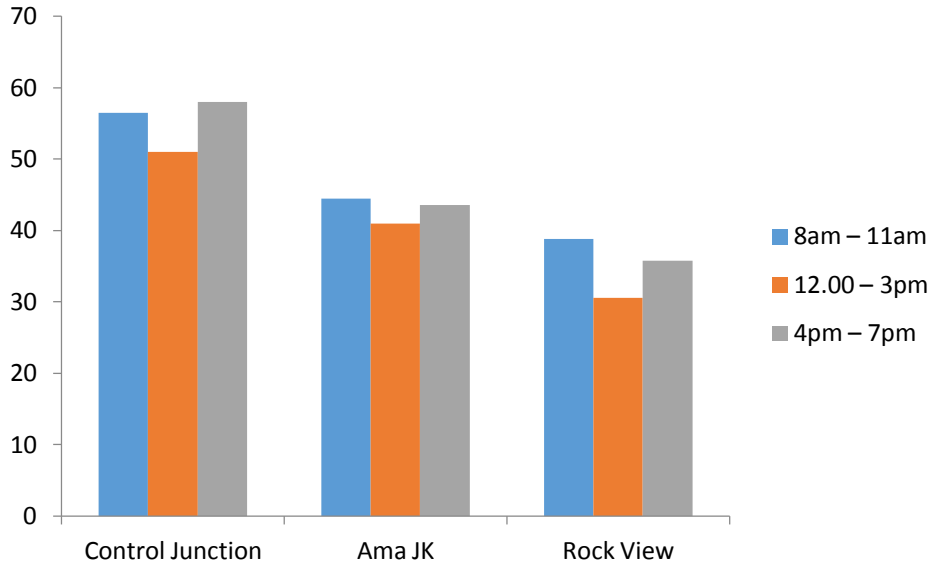

Figure 2: Bar chat of Mean Value of Carbon Monoxide Concentration (ppm) by location (DAY 2)

Table 3: Mean Value of Carbon Monoxide Concentration (ppm) by location **DAY 3**

Time (hr)	**Control Junction**	**Ama JK**	**Rock View**
8am – 11am	55.0	49.9	43.7
12.00 – 3pm	50.3	47.8	40.2
4pm – 7pm	57.6	45.9	43.3

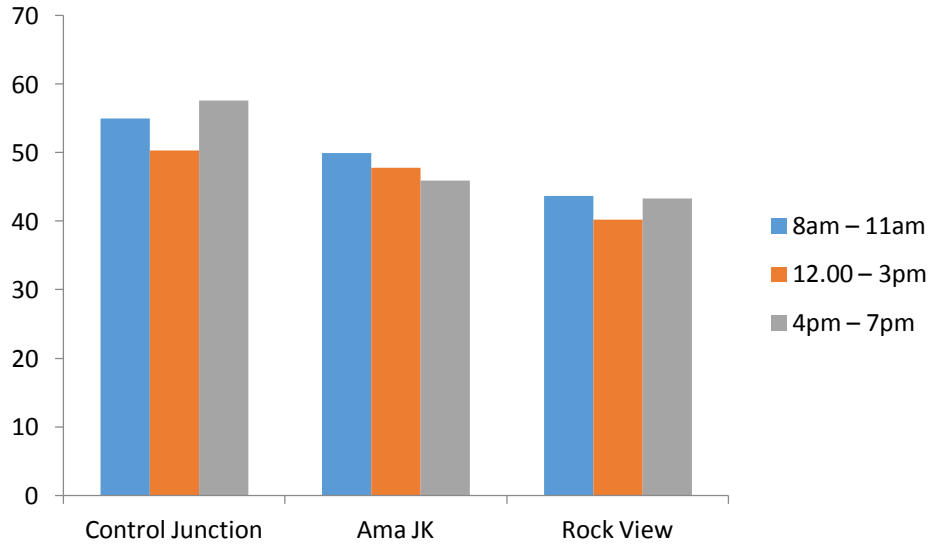

Figure 3: Bar chat of Mean Value of Carbon Monoxide Concentration (ppm) by location (DAY 3)

Table 4: Mean Value of Carbon Monoxide Concentration (ppm) by location **DAY 4**

Time (hr)	**Control Junction**	**Ama JK**	**Rock View**
8am – 11am	56.4	53.9	42.8
12.00 – 3pm	50.9	47.8	40.1

4pm – 7pm	57.8	56.5	42.8

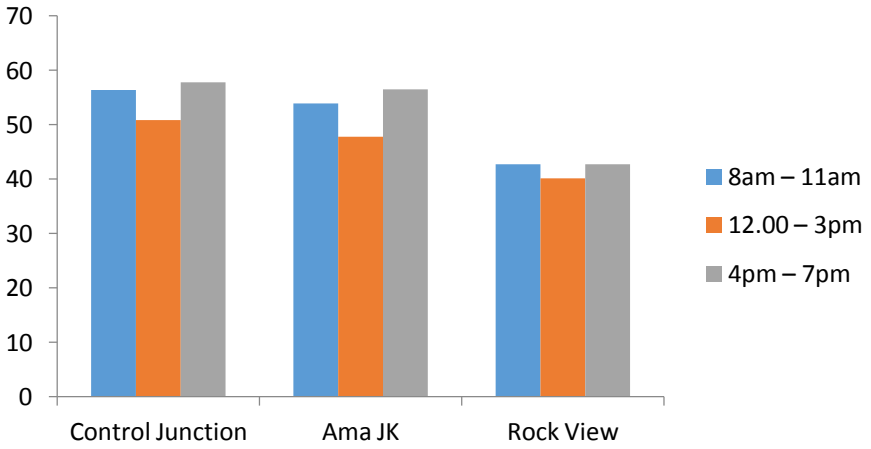

Figure 4: Bar chat of Mean Value of Carbon Monoxide Concentration (ppm) by location (DAY 4)

Table 5: Mean Value of Carbon Monoxide Concentration (ppm) by location **DAY 5**

Time (hr)	**Control Junction**	**Ama JK**	**Rock View**
8am – 11am	54.2	47.9	38.8
12.00 – 3pm	50.3	42.3	31.0
4pm – 7pm	58.1	44.6	35.9

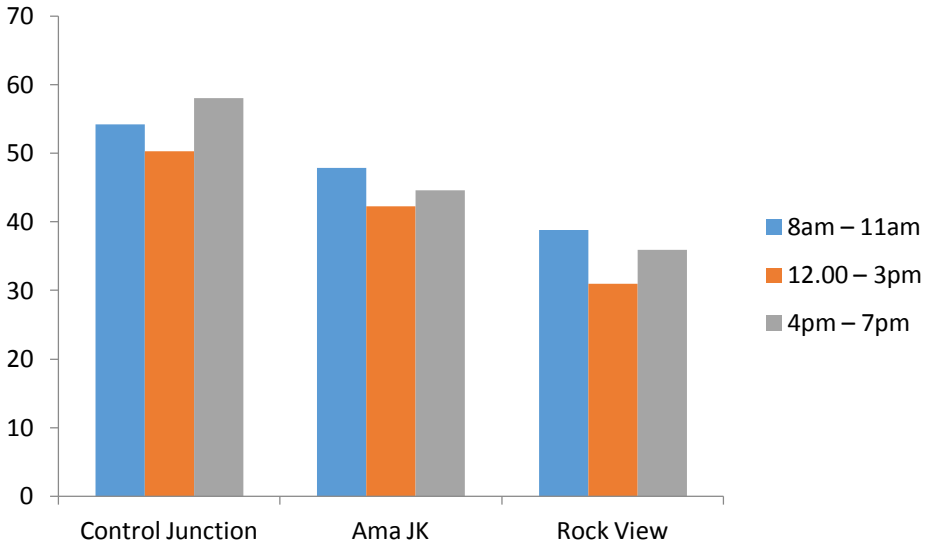

Figure 5: Bar chat of Mean Value of Carbon Monoxide Concentration (ppm) by location (DAY 5)

ANOVA RESULT

TEST OF HEMOGENEITY IN MEAN VARIANCE USING THE SINGLE FACTOR ANOVA

Table 6: Analysis of variance (ANOVA) Test

Location/ Time	**C**	**C^2**	**A**	**A^2**	**RV**	**RV^2**
8am – 11am	55.22	3049.25	48.24	2327.09	40.6	1648.36
120 – 3pm	50.60	2560.36	43.88	1925.45	34.7	120409
4pm – 7pm	57.90	3352.41	55.64	3095.80	38.92	1514.77
Total	163.72	8962.02	147.76	7348.34	114.22	4367.22

LOCATIONS: C = Control junction, A = Ama JK, RV = Rock view junction

Hypothesis

Ho: There is inequality of means among the three locations.

H_1: At least one or two locations differ in the means.

Step (1)

T = Σ (C + A + RV)
= (163.72 + 147.76 +114.22)
T = 425.70

Step (2)

Correction Factor (CF) = T^2/N
= 181220.49/N
N = 3 units x 3 locations = 9
N =9

CF = 181220.49÷9
CF = 20, 135.61

Step (3)

Sum of Square Deviation (SST)

$SST = \Sigma(C^2 + A^2 + RV^2)$

$= \Sigma(89620.02 + 7348.34 + 4367.22) - \frac{181220.49}{9}$

= 20677.58 – 20135.61

SST = 541.97

Step (4)

Sum of Square Deviation between the location (SSB)

$SSB = (\Sigma (A^2)/n_1 + \Sigma(A^2)n_2 + \Sigma(RV^2)/n_3) - T^2/N$

$= \left(\frac{8962.02}{3} + \frac{7348}{3} + \frac{4367.22}{3}\right) - 20135.6$

= 2987.34 + 2.449.45+1455.74 – 20135.61
= 6892.53 – 20135.61
SSB = -13243.08

Step (5)

Sum of square deviation with the location between (SSW)
SSW = SST – SSB
= 541.97 + 13243.08
SSW = 13785.05

Step (6)

Mean square deviation between the locations (MSB)
Degree of freedom (1) = K – 1
K = Number of location
V_1= K – 1
= 3 – 1
V_1 = 2
$MSB = SSB/V_1$
= -13243.08/2
= 6,621.54

Step (7)

Mean square deviation between locations (MSW)
$MSW = SSW/V_2$
V_2 =N – K
= 9 – 3
V_2 = 6
$MSW = SSW/V_2$
= 13785.05/6

= 2297.51

Table 7: ANOVA TABLE

Source of Variation	Degree of Freedom	Sum of Square Deviation	Mean Square	F-ratio
Location	P – 1 = 3-1 = 2	MSB = -13243.08	-6621.54	-6,621.54/2297.51
Error	N – P = 9 – 3 = 6	SSW = 13785.05	2297.51	-2.8801
Total	8	SST = 541.97		

Ftab = 4.76.
Fcal = -2.8801
Ftab > Fcal
:. The null hypothesis is accepted

IV. DISCUSSION

Measurement were taken along control junction located on the globe using GPS at (5.490, 7.020), Ama JK is located at (5.488, 7.026), while Rock View is located at (5.493, 7032) in Owerri municipal council. Control is positioned at a major road junction leading to Onitsha and Port Harcourt. It observed heavy traffic congestion all day. The result shows heavy pollution. Ama JK is the hub of traffic activities and the air pollution is noticeable. It links different parts of the city together. Cautions were taken by using nose mask on the sites of heavy present of carbon monoxide. In all, the volume part per million (PPM)of carbon monoxide concentration is above the standard. Rock View round about is a junction that connects the outskirt of the town to the main land of the city. The traffic there is mild. The air pollution is not as heavy as that of Ama JK or control junction, which suggested less heavy traffic congestion. Exhaust pollutants, hydrocarbons, nitrogen oxide (NO_X), carbon monoxide and carbon dioxide exert deleterious effect on human health and the environment, [4].According to EPA, Ambient CO concentrations are highest at monitoring sited closest to roadways (i.e, micro scale and middle scale monitors, and exhibit a diurnal variation linked to the typical commute times of the day, with peak concentrations generally observed during early morning and late afternoon during week days [10],[11].

Several researches has portrayed Nigeria as having some highly polluted cities with concentration of PPM1.0, a lot higher than the level approved by EPA [12]. Also World Bank has reported that 94 percent of the population in Nigeria is exposed to air pollution level that exceeded WHO guideline [13].

V. CONCLUSION

The volume part per million of carbon monoxide concentration are found to be higher doing the rush hours of the morning and evening. This is as a result of slow movement of traffic and the poor condition of some used cars imported into the city. The overall assessment of air quality at traffic clogged areas indicated a result that will be described as unhealthy. We therefore, admonish environmental management in the country especially that of Owerri municipality to enact policy that should be seriously pursued to help manage and reduce the adverse consequences of high concentration of carbon monoxide in the city of Owerri in Nigeria.

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