Effect of Carbon Dioxide Emission to Vehicular Traffic and Environment in Ogun State, Nigeria

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Abstract: The quantity of carbon dioxide contributed by automobile emissions to the environment was determined at some area in Abeokuta and Sango Ota metropolis of Ogun State, Nigeria. The study was performed in selected populated areas of vehicle in the two towns. In Abeokuta, the study was conducted in five areas, namely, Sapon, Ibara, Lafenwa, Adatan and Panseke area. Similarly, five tests were also conducted at Sango Ota area, namely Sango garage, Owode, Idi iroko road (under bridge), Iyana iyesi and Ota junction. A gas sampling pump and tubes that could detect carbon dioxide were used to detect the quantity of carbon dioxide in the environment. The result obtained shows a variation in the amount of carbon dioxide in the environment. Areas with relatively heavy congestion show high concentration of carbon dioxide while area of minimal traffic shows a lower concentration of carbon dioxide. The literature shows that increasing carbon dioxide level have adverse effects such as the greenhouse effect, which may lead to global warming, as well as a number of other climatic events. These concentrations are still not high enough to cause any serious health effects but they provide a baseline study for policy makers.

Index Terms: Carbon dioxide, Concentration, Greenhouse, Emission, Pollution

I. INTRODUCTION

The most important human impact on our environment is the rapid increase in atmospheric carbon dioxide caused by our profligate use of fossil fuels with various activities which produces carbon dioxide [1]. The increase in carbon dioxide is more rapid that at any time in the past due to the unexpected increase in industrial activities. Industrialized area account for roughly 80% of the carbon dioxide buildup in the atmosphere to date with more than 60% of global industrial carbon dioxide emission annually. Global atmospheric concentration of carbon dioxide, methane and nitrous oxide has increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years [2].

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The global increase in carbon dioxide concentration is due primarily to fossil fuel use and land-use-change while these of methane and nitrous oxide are due to agriculture [3]. Though carbon dioxide is not toxic but its release is of interest is small increase of carbon dioxide concentration in the atmosphere can result in increased ambient temperature and climate change [1]. It is a clear knowledge that human being have been responsible for most of this increase in carbon dioxide due to a tremendous dependence on machine and equipment that burns fossil fuels such as automobiles and generators as well as enhanced chemical processes carried out in factories and power plants.

Carbon dioxide is an essential ingredient in the cycle of life on earth. Plants directly uses carbon dioxide in the process of photosynthesis were combine with water, it is after converted into sugar and oxygen. Plants use the sugar to fuel their growth and animal's breadth in the oxygen, consume plant matter and exhale carbon dioxide. The more carbon dioxide available, the better plant grows. Carbon dioxide only directly becomes a problem to animal life including human, if atmospheric concentration continue to grow to toxic levels carbon dioxide is emitted by natural and human-induced activities. The most common natural source is respiration. Carbon dioxide emission due to human activities is pin-pointed to three major causes, transportation, Industry and power plants.

Transportation, however contributes a greater percentage of carbon dioxide emission as a result of the combustion of fossil fuel. Motor vehicles are major sources of air pollutant. As industrialization and technological development continues, there will be a corresponding increase in income and hence cities will experience a greater increase in the number of vehicles on the roads. With increase in vehicle, it will become imperatives that more attention will be paid to vehicular pollutants, most especially

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carbon dioxide which is a direct product from the combustion of fossil fuels. It is estimated that for every 4 litres of fuel consumed by a motor vehicle about 19 pounds of carbon dioxide goes directly into the atmosphere. In other words, for a typical fill up at service station estimated at about 60 litres of petrol, about 30 pounds of carbon dioxide are eventually released into the atmosphere [4].

Similarly, the basic process by which carbon dioxide is released from automobile is through combustion of fossil fuels or petroleum. The reaction of alkanes with oxygen to form carbon dioxide, water and heat is the chief reaction occurring in the internal combustion engine (ICE) of motor vehicles. Most motor vehicle fuels are combusted by moving the fuels with stoichiometric amount of air in an internal combustion chamber. This mixture is pressurized then ignited by either a sparking device or by the cylinder – compression heat. Products of combustion consist of carbon dioxide, water vapor, nitrogen oxide, sulphur oxides, particulate matters, carbon monoxide and the unburned hydrocarbons [5].

GLOBAL WARMING AND CLIMATE CHANGE EFFECT: Since the beginning of the industrial revolution, the atmospheric concentration of carbon dioxide has increased considerably as well as those of other greenhouse gases. This increase in concentration is likely to accelerate the rate of climate change which is an indirect implication of global warming. The global warming may be explained as follows; the earth's climate is driven by a continuous flow of energy from the sun [6]. This energy arrives mainly in the form of visible light. About 30% is immediately scattered back into space but most of the 70% which is absorbed passes down through the atmospheric energy back out into space in the form of infrared radiation. Being much cooler than the sun, the earth does not emit energy as visible light. Instead; it emits infrared or thermal radiation. "Greenhouse gases" in the atmosphere block the infrared radiation from escaping directly from the surface into space. This is known as the greenhouse effect [1].

The main greenhouse gases are carbon dioxides, methane, which is 20 times as potent a greenhouse as carbon dioxide, nitrogen oxide plus three fluorinated industrial gas, hydroflurocarbons, perflurocarbons and sulphur hexafluoride's. Water vapors are also considered a greenhouse gas. Many of these greenhouse gases are actually life-enabling, for without them, heat would escape back into space and earth's average temperature would be a lot colder. However, if the greenhouse effect becomes stronger, then more heat get trap than needed and the earth might become less habitable for humans, plants and animals. Levels of the greenhouse gases are rising as direct result of human activity. Apart from global warming, greenhouse gases are also responsible for the phenomena referred to as Ozone layer depletion. It is predictable that the global average temperature will rise by about 2^0C (3.6^0F) by the year 2100 if current emission treads continues [9].

II. MATERIALS AND METHODOLOGY

The experiment was carried out using gases detection tubes and sampling pump manufactured by RAE system Inc. This is piston type hand pump that draws a fixed volume of gases, selected at either 50ml or 100ml by rotating the handle. A tight vacuum seal is formed by a greased plunger gasket. The tapered rubber inlet accommodates a range of tube diameter for different types of tubes. The inlet filter prevents glass pieces and dust from entering the shaft. An end-of-flow indicator in the hand turns while the gas sampling is completed. A pump stroke counter is rotated to keep track of the number of strokes completed

The detection tube was broken at both ends using the tube tip-beaker and then inserted into the sampling pump according to the arrow show on the tube. Then, the sampling volume of 50ml was selected. The handle was pulled quickly until is stopped at ½ strokes which is indicated 50ml. This was left for a sampling time of 1minute to allow the air to be drawn through the tube. When the flow of air was complete, the end –of –flow indicator was completely bright to show that air-sampling was completed. After the completion of the sampling time of 1minute, the colour of the reagent in the tube changed from white yellow. The length of the colour change was measured and recorded. Another sampling volume was taken and the procedure repeated. This was done after an interval of 5 minutes from the first sampling. Several readings were taken using this procedure and the average for each period for each day calculated.

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III. RESULTS

The average hourly concentration of carbon dioxide at Abeokuta and Sango Ota metropolis of Ogun State, Nigeria is shown below. Meanwhile, a daily average of the concentration at the various areas is itemized in the table below.

Table 1: Area 1: Abeokuta

S/N	Area	Average concentration (ppm)
1	Sapon	1325.50
2	Ibara	1241.00
3	Panseke	1524.67
4	Lafenwa	1335.00
5	Adatan	1363.17

Table 2: Area 2: Sango Ota

S/N	Area	Average Concentration (ppm)
1	Sango garage	1704.00
2	Owode	1513.20
3	Under bridge	1837.40
4	Iyana iyesi	1615.80
5	Ota junction	1759.80

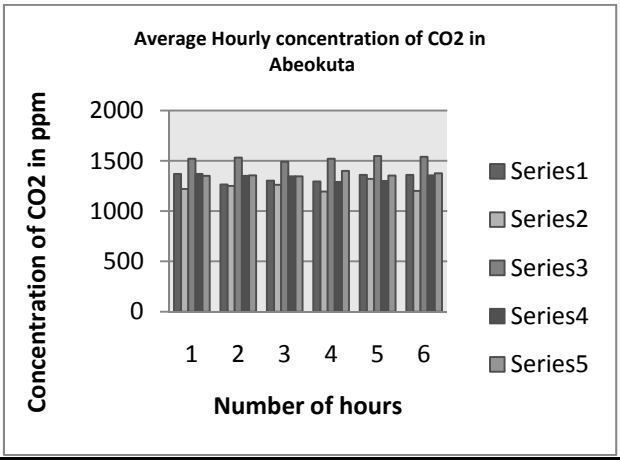

Figure 1: Average Hourly concentration of CO_2 in Abeokuta, Ogun State, Nigeria

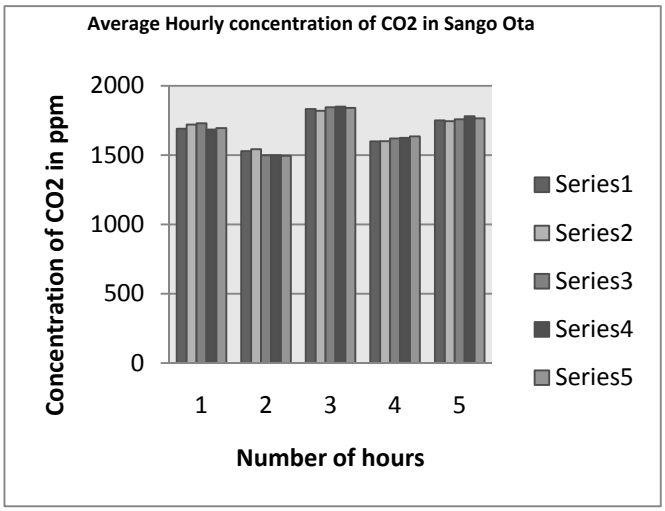

Figure 2: Average Hourly concentration of CO_2 in Sango Ota, Ogun State, Nigeria

IV. DISCUSSION

The Nigerian Ambient Air Quality Standard does not provide limits for carbon dioxide. However, a table showing the composition of clean, dry air near sea level gives the concentration of carbon dioxide in mole percent as 0.0350. The atmosphere contains carbon dioxide in variable amounts, usually 3 to 4 parts per 10,000. [1] .The results obtained for the selected project areas show a higher concentration of carbon dioxide in Sango Ota compare to Abeokuta metropolis. This is because Sango Ota metropolis is more industrialized area than Abeokuta.

Similarly, the result obtained in each area also gives a remarkable relationship between congestion and concentration of carbon dioxide in that area. The control areas used are areas which area relatively quiet with minimal vehicular activity. Therefore, the values obtained here are far less than those obtained at heavily congested areas. These values, for the congested area were obtained at high peak period between the hours of 3.00 – 6.00 pm when the areas were considerably busy. The high values indicate that with increase in vehicular concentration, there will also be a high level of carbon dioxide emitted in the atmosphere due to the combustion of petroleum products.

The congestion of vehicle in Sango Ota is contributing to the carbon dioxide concentration level in the atmosphere, and this in turn affected by metrological conditions such as wind speed, wind direction and precipitation which can cause dispersion of air pollutants,

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and topographical factors which include valleys, oceans, lakes, foliage, and even man-made elements like bridge and roads. This means that the concentration of carbon dioxide at any given time is never constant. However, the more congested areas have the higher carbon dioxide concentration in the atmosphere and vice versa.

V. CONCLUSION

The quantity of carbon dioxide in the environment presently is not only due to automobile emission. It is affected by other factors such as electricity consumption, manufacturing and construction industries, petroleum refining as well as other chemical – based industries and even residential areas [7]. The bulk of the quantity is contributed by the transportation sector. From data obtained from the study, it is observed that there is more carbon dioxide emitted in areas with higher congestion of vehicles compared to the areas with minimal traffic. The high levels of carbon dioxide concentrations obtained shows that with increase in congestion and number of vehicles passing a given area at any time, there would be an increase in the quantity of carbon dioxide emitted due to the combustion of fossil fuels. On the average, the data show higher values of carbon dioxide concentration for heavily congested area.

According to Greiner [8], this quantities are not high enough to cause health hazard but as vehicular traffic grows in number and age, the quantity of carbon dioxide that will be released in the near future in these cities will be enough make the government of the day worry. Nigeria can no longer affords to continue ignoring the potential impacts of the global climate change response measures on its oil-based economy. Also, it is of interest to begin to introduce measures to reduce its greenhouse gas emission, due to the negative impacts of climate change on its economic, social and environmental resources.

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