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Exhaust Hydrocarbon Emission Concentration Level in Abeokuta Metropolis, Ogun State, Nigeria: A Case Study of Commercial Motorcycles (Okada)

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Abstract

Transportation, especially the use of 2-stroke motorcycles has been a key contributor to air pollutants, hydrocarbons and carbon monoxide alike, mostly in the developing countries. High rate of unemployment amongst the teeming youth population in Nigeria have led to the use of different "model/makes" of motorcycles for commercial purposes, not minding the health and environmental implications of its uses. The direct exhaust hydrocarbon emission tests carried out on the different models/makes of motorcycles mostly used for commercial transportation in Abeokuta Metropolis, Ogun State, Nigeria revealed that the average exhaust concentrations of the 900 motorcycles are very high for as much as 1921 parts per million (ppm), with some emitting between 6000-9000ppm, confirming that a motorcycle could emit as much hydrocarbons as 30-50times that of motor car.

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Keywords: 2-stroke; commercial motorcycles; emissions; total petroleum hydrocarbons.

1. Introduction

Emissions of many air pollutants have been shown to have variety of negative effects on public health and the natural environment. Emissions that are principal pollutants of concern include: carbon monoxide (CO), nitrogen oxides (NO_x), particulate matter, sulphur oxides (SO_x), hydrocarbons (HC) and other volatile organic compounds (VOCs) [1]. According to a working paper by the World Bank Clean Air Initiative in Sub-Saharan African Cities 1998-2002, air pollution generated by motorised transport has become an increasing threat in Sub-Saharan towns and cities due to the following factors namely: fast growing population, high rate of urbanisation which is said to be at 4% to 8% and low income levels have been an incentive to import older and used vehicles, use two-wheel (2-stroke) vehicles like motorcycles and tricycles, and use cheap fuel and to postpone vehicle maintenance. All these conditions multiply many times the emissions per kilometre travelled. The threat from exhaust emissions from vehicles and generators are two-fold – health and economic. The World Bank Clean Air Initiative carried out a series of studies between 1998 and 2002 in Dakar, Ouagadougou, Cotonou, Abidjan and Douala. These studies indicate that urban air pollution negatively impacts the economy by 1.8% to 2.7% of GDP (Gross Domestic Product). Therefore if nothing is done, this impact is expected to increase significantly given the effects of population growth, increase in car and generator ownership and vehicular traffic [2].

Vehicle emissions significantly pollute air and require control [3]. With increasing concern for air toxics and climate modification caused by exhaust emissions, the need for tighter control increases in importance. It was reported that some chemicals found in polluted air could cause cancer, birth defects, brain and nerve damage and long-term injury to the lungs and breathing passages in certain circumstances. The concentrations of such chemicals beyond a certain limit and an exposure over a certain period are extremely dangerous and can cause severe injury or even death.

1.1 Hydrocarbons (HC)

Hydrocarbons are toxins and are major contributor to smog, which can be a major problem in urban areas. This class of compounds, otherwise called volatile organic compounds (VOCs) consists of thousands of species, such as alkanes, alkenes, and aromatics. They are normally stated in terms of equivalent methane, CH_4 content [4].

Hydrocarbons have harmful effects on environment and human health. With other pollutant emissions, they play a significant role in the formation of ground-level ozone. Vehicles are responsible for about 50% of the emissions that form ozone. Hydrocarbons are toxic with the potential to respiratory tract irritation and cause cancer [5, 6].

1.2 Total Petroleum Hydrocarbon (TPH)

Health effects from exposure to TPH depend on many factors. These include the types of chemical compounds in the TPH, how long the exposure lasts, and the amount of the chemicals contacted. These factors include the

dose (how much), the duration (how long), and how you come in contact with it. One must also consider the other chemicals one is exposed to and age, sex, diet, family traits, lifestyle and state of health.

The compounds in different TPH fractions affect the body in different ways. Some of the TPH compounds, particularly the smaller compounds such as benzene, toluene, and xylene (which are present in gasoline), can affect the human central nervous system. If exposures are high enough, death can occur. Breathing toluene at concentrations greater than 100 parts per million (100ppm) for more than several hours can cause fatigue, headache, nausea, and drowsiness. However, on prolonged exposure for a long time, permanent damage to the central nervous system can occur. n-hexane, a TPH compound can affect the central nervous system, causing a nerve disorder called "peripheral neuropathy" characterized by numbness in the feet and legs and, in severe cases, paralysis. Swallowing some petroleum products such as gasoline and kerosene causes irritation of the throat and stomach, central nervous system depression, difficulty breathing, and pneumonia from breathing liquid into the lungs. The compounds in some TPH fractions can also affect the blood, immune system, liver, spleen, kidneys, developing foetus, and lungs [7].

Transport is a main sector which causes the environmental pollution and climate change. Emissions from transport, and especially motor vehicles, add considerably to the levels of greenhouse gases in the atmosphere.[8] Owing to the rapid increase of motor vehicles and very limited use of emission control technologies, transport emerges as the largest source of urban air pollution, which is an important public health problem in most cities of the developing world. Air pollution in developing countries accounts for tens of thousands of excess deaths and billions of dollars in medical costs and loses productivity every year [9,10]. The World Health Organization estimated that around 2.4 million people die every year due to air pollution [11].

Ogun State, Southwest, Nigeria, according to her State Environmental Protection Agency (OGEPA) Law, No. 2 of 2003 established an Emission Control and Monitoring Regulations (ECMR) as amended in 2012 to control, regulate and supervise the enforcement of the ECMR and shall develop an action plan for the control and management of air pollution from motor vehicles, motorcycles, power generating sets and other industrial equipment**. The Vehicular Exhaust Emission Standards for motorcycle is set at 5500ppm for the hydrocarbons, HC and 4.0% for the carbon monoxide, CO.

1.3 Commercial Motorcycle Operations (CMOs)

The use of motorcycles for transportation, especially for commercial purposes began about the mid-eighties as a result of the inadequacy in the scope, coverage and services rendered by the public transport system. With the increasing incidents of unemployment among the youths, the use of motorcycles for commercial purposes became an attraction and this was further reinforced by the deplorable and worsening conditions of most Nigerian roads and other incidental challenges like traffic jams and ‘go-slows’ on highways. In recognising the importance of CMOs to socio-economic activities, some of the advantages identified in their use include easy manoeuvrability, their ability to travel on bad roads and also their demand responsiveness.

Perhaps by far the most important consideration for people, especially the youths, to get involved in CMO is the

employment opportunities it provides. The recent upsurge in the unemployment rate among youths coupled with the poor economic situation in Nigeria has greatly influenced the rise in the use of motorcycles as means of commercial transportation. It had also being noted that CMO has created business opportunities for millions of Nigerians, especially the youths, the retired and the retrenched persons, as well as the educated and even the uneducated in the society [12].

1.4 Motorcycles as Two Stroke Engines

The power of a two-stroke engine is usually double that of a four-stroke engine of comparable size.

While the 2-stroke engines are powerful and reliable, they are a major source of air pollution. Current estimates are that at least 50million of these have the potential to emit some species of air pollution in quantities roughly equivalent to 2.5 billion modern automobiles. Emissions from these vehicles 2-stroke engines are characterized by high levels of unburnt hydrocarbons (UCHs), carbon monoxide (CO) and particulate matters (PM).

The inherent geometric configuration of a 2-stroke engine gives rise to high levels of certain exhaust pollutants. High hydrocarbon emission result in part from the scavenging process used by 2-stroke engines. Scavenging refers to the process by which the burnt exhaust is flushed from the engine. In a conventional “carbureted” 2-stroke engine, the fuel is entrained in the intake air stream before the combustion air enters the crankcase. The charge is compressed in the crankcase by the underside of the piston and enters the cylinder when the piston uncovers the transport ports. Combustion products from the previous cycle are forced or “scavenged” from the cylinder with this new air/fuel charge. Unfortunately, the exhaust ports are also open at this time, allowing 30%-40% of the fuel to be lost directly into the exhaust stream. At idle conditions the losses can be as high as 70%. Carbureted 2-stroke engines are also plagued with high carbon monoxide emissions, primarily as a result of unstable combustion. This instability is often “remedied” by operating the engine at rich air/fuel ratios, but this is also problematic as it produces high CO emissions. In a rich fuel condition, there is insufficient air to oxidize all of the fuel present, leading to high CO emissions and further exacerbating the unburnt hydrocarbons.

1.5 Study Area

Abeokuta is the largest city and capital of Ogun State in southwest Nigeria. It is situated on the east bank of the Ogun River, near a group of rocky outcrops in a wooded savanna; 77 kilometres north of Lagos by railway, or 130 kilometres by water. With the geographical coordinates of 7°9’39’’N and 3°20’54’’E, an elevation of 67m (217 ft) above the sea level and a city population estimate of 888, 924 while the metro population is estimated to be 1, 117, 000 and according to 2012 population figures [13, 14, 15] and still counting.

2. Materials and Methods.

The exhaust emission tests on six major “make” of motorcycles that were frequently used for commercial transportation namely: Bajaj, Suzuki, Honda, Jincheng, Lifan and Qlink were carried out using hand-held KANE Automotive 4-Gas Analyser with detector tube, capable of measuring carbon monoxide CO, hydrocarbons, HC (with a specified range of 0-2000ppm and an over range of 20,000ppm with an accuracy

volume of ±12ppm), carbon dioxide CO_2 and oxygen O_2. The calibration of the analyser was performed after every test was conducted before another in an ambient air and after which the analyser was "zero checked" to return the setting to the allowable range, especially the O_2 to be 20.9-21%.

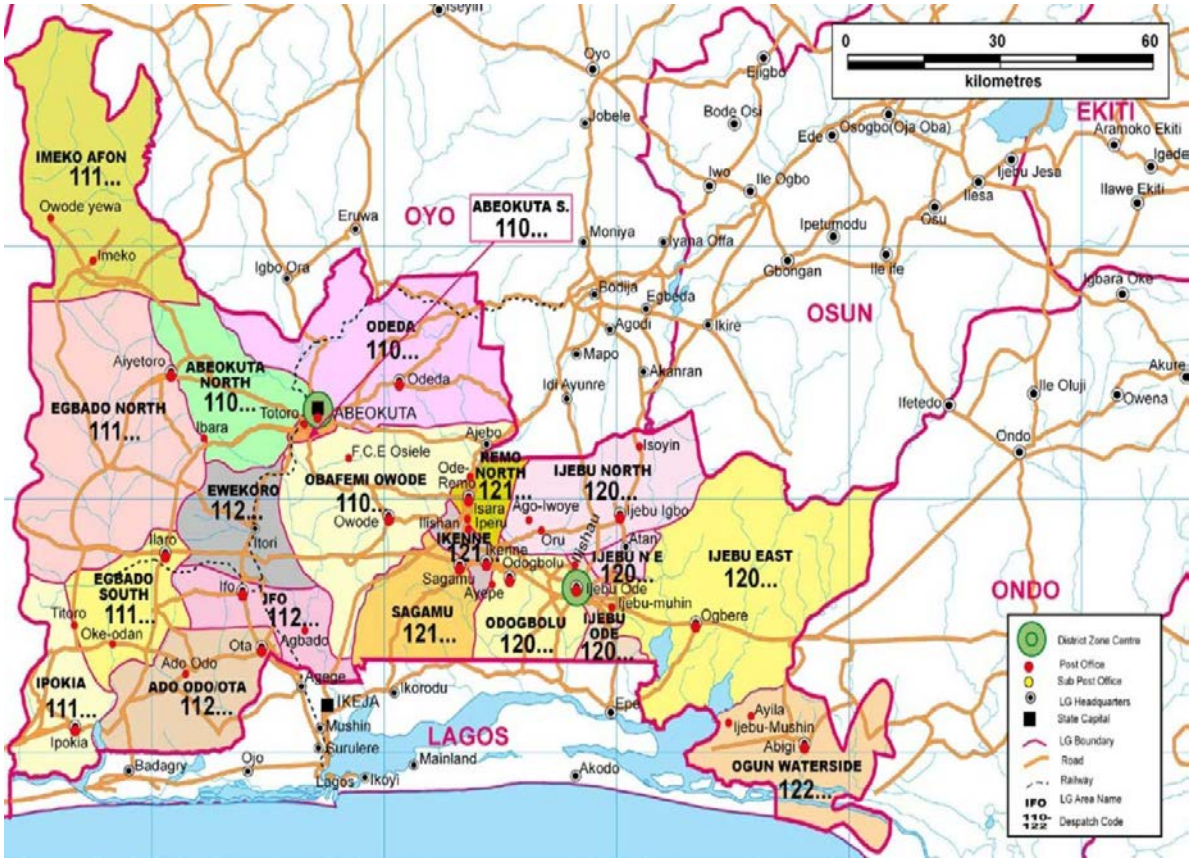

Figure 1: The Map of Ogun State, Southwest Nigeria, where Abeokuta, the Study area, **"numbered 110s"** is the Capital City.

The study was conducted in Abeokuta City, Nigeria at various places during the month of April to July 2013 using a total of nine hundred motorcycles (one hundred and fifty each) for each "make/model", randomly selected at different parks and garages covering areas marked **"110s"** in Figure 1. The motorcycles used were relatively new (2010-2013 model years).

The No–Load Short Tests commonly called the idle tests were used for this work. This term denotes all tests during which no external load is exerted and the vehicle or motorcycle operates with the transmission in neutral position. Emissions from these tests are reported in concentrated units (parts per million (ppm) or percent (%) where 1% = 10,000ppm). Also raw exhaust samples were taken from each motorcycle.

Analysis of variance (ANOVA) between models and line graph presentation of result were carried out using Statistical Package for Social Science (SPSS), Software Version 20.0, while Microsoft Excel version 2010, was used for Bar and Pie Chart presentation of results.

3. Results

Figure 2 shows that of the total population of motorcycles tested (result obtained and attached in Appendix), 7.11% have their emitted exhaust hydrocarbon values beyond that of the OGEPA. While the OGEPA standard may still be termed high as compared to the prevailing situation and incidences of hydrocarbon concentration impact to human health and environment in general, it is seen that commercial motorcycle operations in the state should be properly monitored. This is due to the fact that exhaust hydrocarbon emissions from one motorcycle could be as much as that emitted by 30-50 motor vehicles altogether.

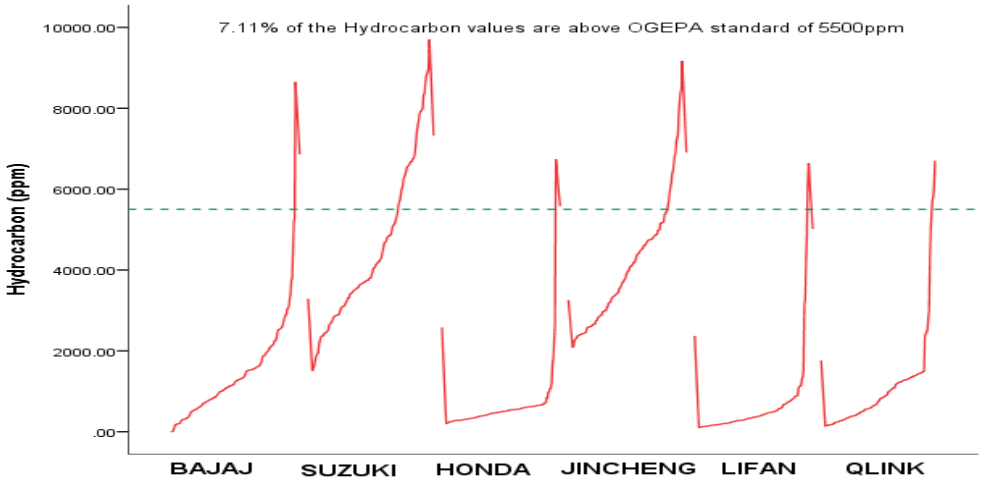

Figure 2: Percentage exhaust hydrocarbon concentration of each model according to OGEPA standard (in broken lines).

Since these motorcycles are used for commercial purposes, reference [16] concluded that with respect to hydrocarbons, a percentage increase in number of trips due to the presence of trucks induces twice as high a percentage increase in emissions. The additional trips decrease average speed on the network causing a disproportional increase in emissions because of the non-linearity in the relationship between link speed and emissions. They further stated that the presence of trucks was shown to produce a dramatic increase in particulate matter emissions as well. The analysis indicates that this increase is mainly due to combustion exhaust emissions from trucks. Overall, a 4.4% increase in vehicle miles traveled because of the presence of trucks can produce a 111% increase in particulate matter emissions. This statement could also be related to the commercial motorcycles in Nigeria such that an average commercial motorcycle operator uses the motorcycle for an average of 9-11 hours continuously daily. Furthermore, about 98% commercial motorcycles uses cheap, fairly-used (called “tokunboh”) and sub-standard plugs alongside with cheap road-side and sub-standard engine oils to lubricate their engines in addition to postponing vehicle maintenance in order to maximise profits as usually observed in many vehicular breakdown and accidents experienced on the roads. This corroborated the statement made by [17] who also reported that low income levels have been an incentive to using cheaper fuel and also postponing vehicular maintenance. Such conditions result in an increase in the emissions per kilometre travelled.

Table 1: Analysis of variance between the models and Hydrocarbon values

MODEL	BAJAJ	SUZUKI	HONDA	JINCHENG	LIFAN	QLINK
MEAN	1417±94.3[i]	4279±167[j]	534±50.2[a b]	3772±141.2[n]	554±76.6[a]	978±97.1[b]

Groups with similar superscript are not statistical significantly different at p =0.05

Groups with different superscript are statistical significantly different at p=0.05

The ANOVA test was carried out so as to ascertain if there is statistical significance difference between the statistical means of hydrocarbon emitted by each model. Furthermore, a Post Hoc test was done to ascertain which model differs from the other in terms of overall hydrocarbon value.

From the Table 1, it is evident that there was a statistical significance difference between the motorcycle models. Albeit there was no statistical significance difference between Honda and Lifan models and between Honda and Qlink models. These results corroborated the outcome from the line graph in Figure 2.

Table 2: Percentage of each model hydrocarbon value greater or equals to OGEPA standard of 5500ppm

MODEL	BAJAJ	SUZUKI	HONDA	JINCHENG	LIFAN	QLINK
% ≥ OGEPA	0.67	25.33	0.667	12.00	1.33	2.68

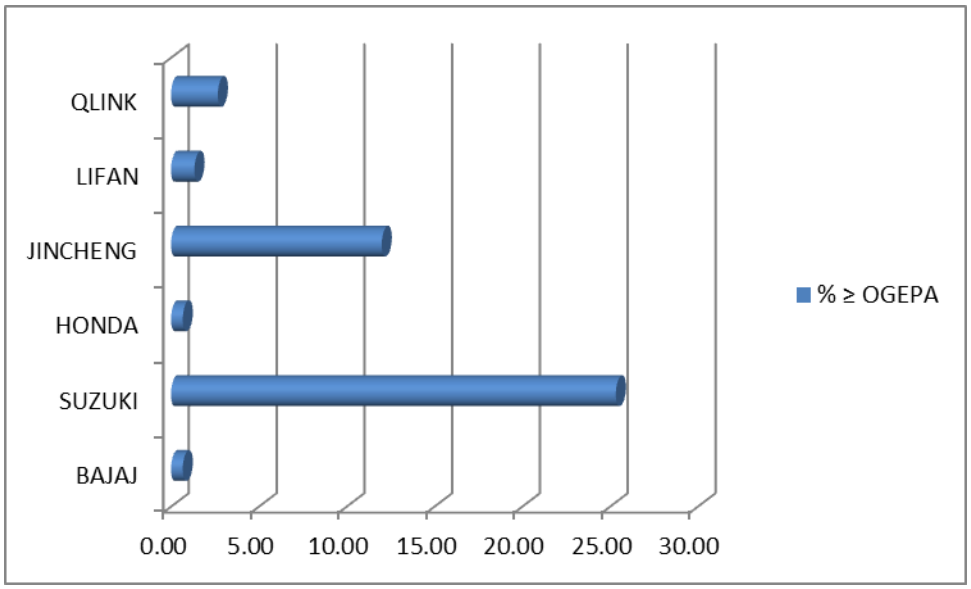

Figure 3: Bar chart showing the Percentage of each model hydrocarbon value greater or equals to OGEPA standard of 5500ppm

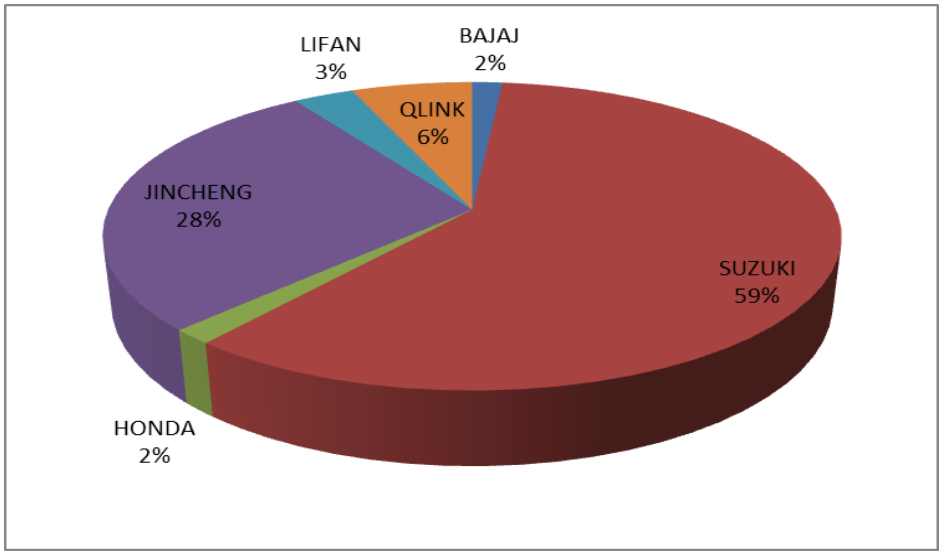

Figure 4: Percentage contribution of each model to gross hydrocarbon pollution (GHP) based on OGEPA standard of 5500ppm

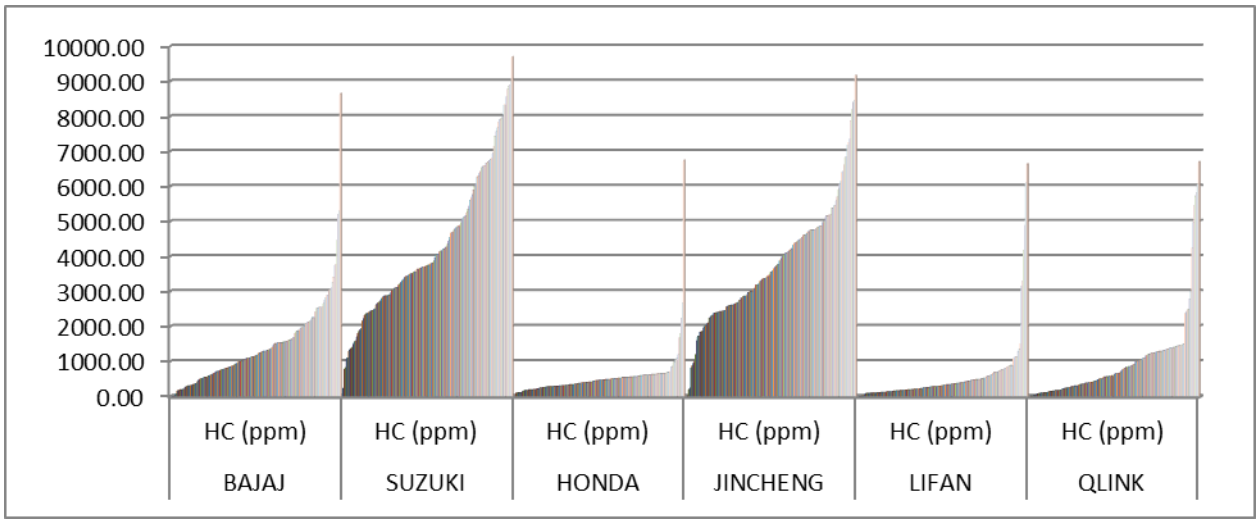

Figure 5: The trends of the exhaust hydrocarbon emission for each motorcycle make/model

Tables 2, Figures 3, 4 and 5 outlined the contribution of each motorcycle brand to hydrocarbon pollution where it was seen that Suzuki have the highest hydrocarbon pollution contribution while Bajaj and Honda have the lowest. While Honda is of Japanese origin, Suzuki is from China of which the model specification mostly used for commercial activities in Nigeria is AX100. The low percentage contribution of Honda motorcycles to GHP could be attributable to the high energy efficiency of vehicles produced by Japanese car manufacturers. According to [18], data from the U.S. government show that car fleets from Japanese firms, Toyota and Honda have consistently been above the Corporate Average Fuel Economy (CAFE) standards that manufacturers are supposed to meet.

4. Conclusion

Despite that the trends and sources of transport air pollution vary between cities, the impact on the society are the same and such impact includes health problems mostly for children, aged and the poorest, reduction in productivity, poorer quality of life, and degradation of the environment.

Thus, the results of this investigation could be summarized as follows:

* Exhaust hydrocarbon emission from most commercial motorcycles in Abeokuta City, Southwest Nigeria and some other cities in the country (as they are use major brands/makes of motorcycles for commercial purposes) is very high compared to International Admissible level, though still within the limit stipulated by her State Environmental Protection Agency, OGEPA.
* The concentrations of the exhaust hydrocarbon emission measured within Abeokuta City, Southwest Nigeria are now on the increase due to the increasing number of commercial motorcycles operation as a result of the increasing unemployment especially amongst the youth, which could increase incidences of respiratory illnesses and other associated environmental health impacts in the city.

5. Recommendation

While there are numerous transportation policies, the effective implementation of such policies on the part of the Government at all levels should be carried out as it is usually seen that Government lacks the will-power to implement most transport-related policies due to both internal and external politics. Having established the level of polluting exhaust hydrocarbon from 2-stroke motorcycles and its associated health incidences, systematic phasing-out of 2-stroke motorcycles coupled with replacement with 4-stroke motorcycles should be adequately put in place. Furthermore, strict adherence to standard regulations should be a must, as most imported components of motorcycles into the country are usually called to question.

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APPENDIX (source [19]).

BAJAJ HC (ppm)	SUZUKI HC (ppm)	HONDA HC (ppm)	JINCHENG HC (ppm)	LIFAN HC (ppm)	QLINK HC (ppm)
1.00	239.00	1.00	1.00	1.00	9.00
1.00	782.00	101.00	14.00	1.00	10.00
1.00	834.00	102.00	211.00	4.00	11.00
34.00	1098.00	102.00	257.00	5.00	29.00
97.00	1121.00	104.00	832.00	15.00	35.00
167.00	1307.00	106.00	900.00	51.00	44.00
171.00	1350.00	132.00	951.00	78.00	74.00
192.00	1386.00	143.00	1014.00	90.00	76.00
193.00	1421.00	167.00	1200.00	91.00	90.00
196.00	1504.00	169.00	1604.00	91.00	91.00
201.00	1583.00	171.00	1729.00	94.00	98.00
208.00	1600.00	188.00	1731.00	94.00	104.00
268.00	1716.00	192.00	1847.00	97.00	105.00
283.00	1824.00	192.00	1865.00	98.00	108.00
301.00	1881.00	193.00	1883.00	98.00	109.00
308.00	1927.00	195.00	1963.00	98.00	116.00
312.00	1945.00	196.00	2022.00	102.00	126.00
318.00	2163.00	201.00	2027.00	106.00	141.00
320.00	2245.00	208.00	2093.00	108.00	142.00
342.00	2331.00	212.00	2101.00	109.00	149.00
345.00	2362.00	214.00	2251.00	116.00	156.00
370.00	2371.00	230.00	2273.00	118.00	157.00
397.00	2373.00	247.00	2311.00	120.00	170.00
433.00	2420.00	248.00	2322.00	128.00	171.00
491.00	2441.00	249.00	2376.00	128.00	173.00
500.00	2444.00	253.00	2380.00	134.00	175.00
512.00	2463.00	262.00	2393.00	135.00	177.00
522.00	2490.00	268.00	2397.00	136.00	183.00
544.00	2519.00	272.00	2406.00	138.00	212.00
550.00	2665.00	279.00	2427.00	147.00	234.00
560.00	2683.00	283.00	2430.00	150.00	238.00
586.00	2712.00	283.00	2439.00	157.00	242.00
596.00	2748.00	283.00	2449.00	161.00	244.00
612.00	2811.00	285.00	2461.00	162.00	251.00
616.00	2841.00	286.00	2564.00	164.00	268.00

645.00	2870.00	287.00	2580.00	165.00	272.00
659.00	2873.00	293.00	2592.00	166.00	277.00
664.00	2873.00	295.00	2599.00	166.00	279.00
709.00	2876.00	301.00	2599.00	175.00	294.00
714.00	2895.00	308.00	2601.00	176.00	294.00
716.00	2903.00	310.00	2620.00	177.00	302.00
736.00	2976.00	310.00	2646.00	177.00	310.00
748.00	3030.00	312.00	2654.00	187.00	337.00
764.00	3078.00	318.00	2667.00	190.00	345.00
770.00	3094.00	320.00	2669.00	190.00	346.00
784.00	3104.00	323.00	2740.00	195.00	349.00
800.00	3106.00	330.00	2751.00	201.00	365.00
806.00	3134.00	333.00	2810.00	202.00	377.00
807.00	3195.00	336.00	2838.00	203.00	382.00
826.00	3218.00	337.00	2857.00	206.00	384.00
840.00	3275.00	342.00	2864.00	207.00	391.00
842.00	3317.00	345.00	2879.00	208.00	392.00
869.00	3318.00	357.00	2900.00	217.00	400.00
869.00	3405.00	358.00	2971.00	221.00	403.00
896.00	3426.00	361.00	2976.00	223.00	411.00
928.00	3427.00	370.00	2990.00	226.00	436.00
948.00	3459.00	383.00	2992.00	245.00	436.00
966.00	3478.00	384.00	2996.00	248.00	454.00
998.00	3502.00	391.00	3079.00	250.00	456.00
1002.00	3513.00	391.00	3088.00	254.00	490.00
1013.00	3551.00	397.00	3193.00	259.00	499.00
1037.00	3558.00	400.00	3197.00	265.00	505.00
1044.00	3566.00	405.00	3249.00	276.00	507.00
1058.00	3624.00	409.00	3311.00	276.00	554.00
1089.00	3638.00	409.00	3328.00	277.00	560.00
1092.00	3649.00	420.00	3354.00	279.00	561.00
1097.00	3658.00	423.00	3359.00	280.00	563.00
1105.00	3679.00	433.00	3371.00	282.00	563.00
1134.00	3683.00	441.00	3400.00	286.00	574.00
1134.00	3697.00	452.00	3424.00	289.00	590.00
1141.00	3705.00	454.00	3431.00	290.00	590.00
1153.00	3732.00	458.00	3477.00	299.00	592.00
1154.00	3743.00	459.00	3550.00	314.00	621.00
1165.00	3745.00	465.00	3571.00	317.00	647.00

1206.00	3750.00	467.00	3603.00	321.00	650.00
1241.00	3794.00	468.00	3659.00	332.00	653.00
1252.00	3806.00	468.00	3706.00	334.00	666.00
1266.00	3808.00	478.00	3717.00	334.00	679.00
1273.00	3877.00	479.00	3768.00	336.00	703.00
1290.00	3961.00	486.00	3785.00	343.00	755.00
1293.00	4040.00	486.00	3877.00	355.00	761.00
1299.00	4046.00	488.00	3913.00	358.00	800.00
1315.00	4077.00	491.00	3976.00	358.00	825.00
1320.00	4137.00	500.00	3977.00	363.00	827.00
1335.00	4151.00	500.00	4046.00	368.00	851.00
1346.00	4172.00	507.00	4090.00	368.00	851.00
1382.00	4207.00	509.00	4095.00	381.00	855.00
1415.00	4210.00	512.00	4123.00	384.00	881.00
1488.00	4252.00	512.00	4142.00	388.00	890.00
1506.00	4275.00	521.00	4189.00	392.00	906.00
1507.00	4350.00	522.00	4193.00	395.00	911.00
1528.00	4557.00	541.00	4323.00	415.00	994.00
1530.00	4670.00	541.00	4380.00	420.00	1012.00
1532.00	4678.00	542.00	4381.00	434.00	1027.00
1534.00	4711.00	544.00	4413.00	437.00	1044.00
1549.00	4774.00	549.00	4450.00	444.00	1062.00
1550.00	4817.00	549.00	4482.00	461.00	1083.00
1567.00	4842.00	550.00	4496.00	465.00	1089.00
1574.00	4852.00	552.00	4522.00	471.00	1092.00
1587.00	4852.00	552.00	4531.00	475.00	1162.00
1602.00	4891.00	554.00	4606.00	480.00	1179.00
1616.00	4974.00	560.00	4609.00	484.00	1204.00
1621.00	5073.00	561.00	4615.00	484.00	1206.00
1628.00	5109.00	566.00	4668.00	485.00	1216.00
1679.00	5130.00	568.00	4700.00	490.00	1234.00
1707.00	5179.00	582.00	4728.00	505.00	1238.00
1807.00	5257.00	586.00	4745.00	507.00	1240.00
1864.00	5343.00	591.00	4751.00	514.00	1254.00
1883.00	5447.00	596.00	4753.00	517.00	1271.00
1886.00	5615.00	603.00	4756.00	539.00	1278.00
1914.00	5676.00	604.00	4767.00	569.00	1283.00
1959.00	5757.00	611.00	4790.00	574.00	1283.00
1971.00	5903.00	612.00	4825.00	574.00	1289.00

1999.00	6021.00	613.00	4846.00	578.00	1291.00
2015.00	6067.00	616.00	4865.00	615.00	1311.00
2080.00	6251.00	619.00	4865.00	622.00	1316.00
2095.00	6295.00	620.00	4887.00	679.00	1327.00
2123.00	6362.00	625.00	4980.00	681.00	1345.00
2128.00	6429.00	630.00	4981.00	686.00	1350.00
2148.00	6539.00	630.00	5000.00	688.00	1351.00
2188.00	6561.00	630.00	5160.00	711.00	1378.00
2253.00	6578.00	630.00	5161.00	733.00	1382.00
2289.00	6654.00	645.00	5177.00	757.00	1395.00
2426.00	6683.00	651.00	5197.00	758.00	1403.00
2511.00	6683.00	654.00	5378.00	770.00	1425.00
2528.00	6750.00	658.00	5387.00	801.00	1430.00
2538.00	6764.00	659.00	5448.00	811.00	1441.00
2550.00	6810.00	659.00	5460.00	828.00	1447.00
2569.00	6952.00	664.00	5599.00	841.00	1454.00
2590.00	7164.00	666.00	5705.00	880.00	1455.00
2665.00	7436.00	695.00	5916.00	886.00	1482.00
2761.00	7573.00	695.00	6071.00	890.00	1484.00
2827.00	7679.00	705.00	6163.00	891.00	1492.00
2884.00	7831.00	727.00	6396.00	1084.00	2374.00
2905.00	7911.00	846.00	6428.00	1123.00	2418.00
3042.00	7924.00	850.00	6633.00	1131.00	2475.00
3048.00	7956.00	980.00	6830.00	1139.00	2508.00
3115.00	8008.00	992.00	6870.00	1300.00	2795.00
3274.00	8329.00	1073.00	7194.00	1357.00	3018.00
3413.00	8361.00	1073.00	7259.00	1516.00	4240.00
3750.00	8582.00	1208.00	7373.00	3154.00	4965.00
3775.00	8776.00	1702.00	7888.00	3295.00	5455.00
4454.00	8849.00	1804.00	8197.00	4178.00	5727.00
5205.00	8903.00	2225.00	8406.00	4902.00	5821.00
5300.00	9000.00	2673.00	8455.00	6104.00	6066.00
8646.00	9700.00	6743.00	9171.00	6642.00	6705.00