Implications of Lack of Maintenance of motorcycles on Ambient Air Quality

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Abstract. This paper reported the results of the investigation of motorcycle emissions in selected roads in Abeokuta, Nigeria. Five roads: Ijaye, Kuto, M.K.O. Abiola way, Olabisi Onabanjo, and Olorunsogo roads were considered with five different motorcycle types (Bajaj, Day Long, Frajend, Hajue Suzuki and Honda) on each road. Motorcycles were parked 8.0m away from the main road in downwind direction. The motorcycle exhaust emissions monitored were CO_2, O_2, CO, and HC emissions. The total mean concentration of measured CO_2emission from motorcycle exhaust on all the roads, ranged between 18800ppm for Frajend and 37400ppm for Bajaj, while O_2ranged between 139200ppm for Honda and 171800ppm for Frajend, also CO ranged between 14500ppm for Hajue Suzuki and 30700ppm for Bajaj, and HC ranged between 674ppm for Honda and 3289ppm for Day Long. It could be noted that the air pollutants are high for almost every type of the motorcycles, and significantly higher than the National standards. This implies that these motorcycles, which are mostly used for commercial purposes are poorly maintained. This study therefore concluded that motorcycle pollution in Abeokuta is significant with possible serious environmental and health consequences.
Keywords: motorcycle; emission; carbon II oxide, pollution

1. Introduction

Transportation is a significant part of development, which provides the economic, social and political interaction, (Button and Hensher, 2001) and serves as compartment for passengers and goods. Vehicle ownership is low, and the dependency on public transport is high in developing countries. Financial conditions and efficiency of the government-organized public transport is discouraging and declining (Kumar, 2011). Hence a resort to motorcycles either for personal mobility or for public transportation. However, transportation a major source of air pollution contributes to greenhouse gas emissions that cause climatic change (Button and Hensher, 2001).

Emissions by automobiles which includes motorcycles results in air pollution which causes a reduction in the air quality thereby resulting in eye irritation, cardiac, respiratory disorders smog, acid rains, and other diseases (Narayanan, 2007). An average motorcycle is known to pollute as much as 15 times per mile than passenger car or high truck (Carpenter, 2008). The environmental friendliness of motorcycles depends on the age, engine capacity and the maintenance (Owate*et al*., 2005).

The environment is daily endangered by motor bikes which is majorly used for commercial purposes. Hence the importance of annual exhaust emission test and awareness (Peters, 2000) for environmental friendliness.

This has brought about the need to assess motorcycle emissions along Ijaye, Kuto, M.K.O. Abiola way, Olabisi Onabanjo, and Olorunsogo roads in Abeokuta by measuring the exhaust concentrations of pollutants from the exhaust pipes of different kinds of motorcycles plying the roads to determine the levels of emissions released into the ambient air.

2. Sampling of vehicular emission/pollutants

The exhaust emission tests were carried out at five different locations within Abeokuta. The Portable**,** Hand-Held, battery operated Kane automotive 4-gas analyzer with detector tube (Model Auto 4-1) was used to measure the vehicular emission. The machine is capable of measuring CO (a resolution of 0.01 % with an accuracy of $\pm$ 0.5% volume). HCs (a range of 1.0 ppm), CO_2 (a resolution of 0.1 % with an accuracy of $\pm$ 0.5% volume), and O_2 (a resolution of 0.1% with an accuracy of $\pm$ 0.5% volume). The Kane Automotive 4-Gas analyzer model Auto 4-1 has been designed to be used on petrol, LPG or CNG powered engines. All measured and calculated parameters can be printed on the optional infrared printer or saved to the analyzer's memory.

The analyzer was switched on and allowed to fully initialize to display zero setting, then the main menu was accessed and fuel type selected (diesel, petrol, CNG, and LPG). Having done these, the analyzer was returned to the zero settings with the main button, to check if the setting was within the allowable range (especially oxygen, O_2 which should be between 20.9 % and 21%). At an idle state, the exhaust was observed for a while to ensure that the smoke was steady, then the analyzer's probe was completely inserted into the exhaust pipe and clamped. During the analysis, CO was recorded at the maximum level and stored as soon as it started reducing, after which the probe was removed from the exhaust pipe.

Idle method was used for this work. Five motorcycle types were selected for this paper: Bajaj, Day Long, Frajend, Hajue Suzuki and Honda.Emissions from their exhaust were reported in concentration units (parts per million (ppm) or percent (%) where 1% = 10,000ppm). Also, raw exhaust samples were taken from each of the motorcycles.

Fig.1The study locations in Abeokuta, Ogun State, Nigeria (Google map)

3. Results and Discussion

The mean concentrations of measured motorcycle exhaust emissions at sampling points on all the selected roads are summarized in Tables1 to 5. The chart representations of the measured emissions are shown in Figures 1 - 6. At the sampling point on Ijaye Road, the mean concentrations of CO_2ranged between 19000ppm for Honda and 35000ppm for Bajaj, while the mean concentrations of O_2ranged between 139300ppm for Hajue Suzuki and 178300ppm for Honda, also the mean concentrations of CO ranged between 15100ppm for Honda and 37600ppm for Hajue Suzuki, and the mean concentrations of HC ranged between 157ppm for Day Long and 1643ppm for Hajue Suzuki.

At the sampling point on Kuto Road, the mean concentrations of CO_2 ranged between 13000ppm for Frajend and 51000ppm for Bajaj, while the mean concentrations of O_2 ranged between 123600ppm for

Bajaj and 184600ppm for Frajend, also the mean concentrations of CO ranged between 7600ppm for Honda and 28200ppm for Bajaj, and the mean concentrations of HC ranged between 541ppm for Honda and 2622ppm for Day Long, while at the sampling point on M.K.O. Abiola way, the mean concentrations of CO_2 ranged between 10000ppm for Frajend and 33000ppm for Honda, while the mean concentrations of O_2 ranged between 135600ppm for Bajaj and 181400ppm for Frajend, also the mean concentrations of CO ranged between 3000ppm for Hajue Suzuki and 38900ppm for Honda, and the mean concentrations of HC ranged between 590ppm for Honda and 3246ppm for Day Long.

At the sampling point on Olabisi Onabanjo road, the mean concentrations of CO_2 ranged between 11000ppm for Frajend and 66000ppm for Honda, while the mean concentrations of O_2 ranged between 179700ppm for Frajend and 92100ppm for Honda, also the mean concentrations of CO ranged between 6000ppm for Hajue Suzuki and 38600ppm for Honda, and the mean concentrations of HC ranged between 630ppm for Honda and 5050ppm for Day Long, while at the sampling point on Olorunsogo Road, the mean concentrations of CO_2 ranged between 26000ppm for Honda and 49000ppm for Hajue Suzuki, while the mean concentrations of O_2 ranged between 133300ppm for Day long and 150200ppm for Frajend, also the mean concentrations of CO ranged between 16600ppm for Hajue Suzuki and 38700ppm for Honda, and the mean concentrations of HC ranged between 1073ppm for Honda and 5370ppm for Day Long.

The total mean concentrations of measured vehicular exhaust emissions from all Roads, the total mean concentrations of CO_2 ranged between 18800ppm for Frajend and 37400ppm for Bajaj, while the total mean concentrations of O_2 ranged between 139200ppm for Honda and 171800ppm for Frajend, also the total mean concentrations of CO ranged between 14500ppm for Hajue Suzuki and 30700ppm for Bajaj, and the total mean concentrations of HC ranged between 674ppm for Honda and 3289ppm for Day Long.

All the ranges of each emission for every type of motorcycle are greatly high. The adverse implication of these emissions is so much. The results of tables 1-6 (in ppm) did not compare favorably with Table 7, as the values of tables 1-6 are higher compared to the National standards. This shows that most of the motorcycles on Nigerian roads pose a great risk to the environment.

Table 1: The Mean Concentrations of Measured Motorcycle Exhaust Emissions from Ijaye Road.

Motorcycle Type	Mean Concentrations of Motorcycle Exhaust Emissions			
	CO_2 (ppm)	O_2 (ppm)	CO (ppm)	HC (ppm)
Bajaj	35000	148100	22900	1002
Day Long	21000	169300	17600	157
Frajend	23000	163000	20600	197
Hajue Suzuki	25000	139300	37600	1643
Honda	19000	178300	15100	534

Table 2: The Mean Concentrations of Measured Motorcycle Exhaust Emissions from Kuto Road.

Motorcycle Type	Mean Concentrations of Motorcycle Exhaust Emissions			
	CO_2 (ppm)	O_2 (ppm)	CO (ppm)	HC (ppm)
Bajaj	51000	123600	28200	1015
Day Long	29000	167700	10700	2622
Frajend	13000	184600	12000	583
Hajue Suzuki	49000	145400	9300	1960
Honda	39000	143400	7600	541

Table 3: The Mean Concentrations of Measured Motorcycle Exhaust Emissions from M.K.O. Abiola way.

Motorcycle Type	Mean Concentrations of Motorcycle Exhaust Emissions			
	CO_2 (ppm)	O_2 (ppm)	CO (ppm)	HC (ppm)
Bajaj	32000	135600	37500	1135
Day Long	26000	160600	17900	3246
Frajend	10000	181400	20200	623
Hajue Suzuki	30000	177400	3000	2049
Honda	33000	138900	38900	590

Table 4: The Mean Concentrations of Measured Motorcycle Exhaust Emissions from Olabisi Onabanjo Road.

Motorcycle Type	Mean Concentrations of Motorcycle Exhaust Emissions			
	CO_2 (ppm)	O_2 (ppm)	CO (ppm)	HC (ppm)
Bajaj	36000	155800	32800	1348
Day Long	43000	135900	27500	5050
Frajend	11000	179700	18600	1290
Hajue Suzuki	29000	162600	6000	2098
Honda	26000	143100	38700	1073

Table 5: The Mean Concentrations of Measured Motorcycle Exhaust Emissions from Olorunsogo Road.

Motorcycle Type	Mean Concentrations of Motorcycle Exhaust Emissions			
	CO_2 (ppm)	O_2 (ppm)	CO (ppm)	HC (ppm)

Bajaj	33000	140100	32300	1402
Day Long	47000	133300	28600	5370
Frajend	37000	150200	16800	3172
Hajue Suzuki	49000	136700	16600	2424
Honda	26000	143100	38700	1073

Table 6: The Total Mean Concentrations of Measured Motorcycle Exhaust Emissions from all Roads

Motorcycle Type	Mean Concentrations of Motorcycle Exhaust Emissions			
	CO_2 (ppm)	O_2 (ppm)	CO (ppm)	HC (ppm)
Bajaj	37400	140600	30700	1180
Day Long	33200	153400	20500	3289
Frajend	18800	171800	17600	1173
Hajue Suzuki	36400	152300	14500	2035
Honda	36600	139200	27800	674

Table 7: National Standards for Exhaust Emissions

Emission Standard	CO (ppm)	HC (ppm)
New model	35000	600
Existing model	45000	800

Source: NAC, 2011

Table 8: Effect of Pollutants on environmental and health.

Pollutants	Environmental	Health
CO (carbon II oxide)	Greenhouse gas contributing to global warming.	At the blood flow, oxygen flow decreases but the likelihood increases to exercise that are related to heart pain for heart disease (coronary) people. Neurobehavioral function and impair concentration can occur when the doses are low.
CO_2 (carbon IV oxide)	The global warming are resulted from the gases of green house	Non

NO$_X$ (nitrogen oxide)	Ozone (smog) are formed which causes corrosion to crop by destroying them. Also leads to global warming as acid rain are formed through greenhouse gases.	Causes asthma, cough, and respiratory disorder.
HC (unburned hydrocarbon)	Ozone level compound	Causes cough, irritates the eyes. Carcinogenic comes by weight compound of high molecule
SO$_2$ (sulfur oxides)	Causes mainly acid rain	Respiratory disorder and irritates the eyes

(Source: Ghio et al. 1999; Pooley et al. 1999).

4. Conclusion

This study has shown that the concentration of pollutants from motorcycles with poor maintenance is much higher than the National standards (see Table 7), this implies that such motorcycles are very harmful to the environment and climate (see Table 8).

5. Recommendation

This study suggests the following:

- Government should provide mass transit transportation such as good train system, and big busses.

- Strict adherence to standard regulations should be a must.

- Motorcycle owners should be made to understand why they should regularly go for checks and maintenance, so that exhaust emissions could be reduced.

If these measures are properly put in place, greenhouse gases and other harmful substances will be reduced and Nigeria will be making a move towards a green economy.

Acknowledgment

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