Global Journal of researches in engineering
Automotive engineering
Volume 12 Issue 1 Version 1.0 February 2012
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

The Implications of Importation of Used Vehicles on the Environment

By O.S. Udeozor, A.N. Nzeako
University of Nigeria, Nsukka, Enugu State, Nigeria

Abstract - This study investigates the impact of used vehicles on the environment by sampling a number of such vehicles and carrying out exhaust emission measurements using the Exhaust Gas Analyzer. The exhaust emissions **(CO, CxHy, NOx, CO2, SO2)** were analyzed to ascertain the level of its concentration.

Keywords : Imported Used Vehicles, Pistons and Piston Rings, and Harmful exhaust emissions.

GJRE-B Classification: FOR Code: 889805

Strictly as per the compliance and regulations of:

© 2012 O.S. Udeozor, A.N. Nzeako. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncommercial 3.0 Unported License http://creativecommons.org/licenses/by-nc/3.0/), permitting all non commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

The Implications of Importation of Used Vehicles on the Environment

O.S. Udeozor[α], A.N. Nzeako[α]

Abstract - This study investigates the impact of used vehicles on the environment by sampling a number of such vehicles and carrying out exhaust emission measurements using the Exhaust Gas Analyzer. The exhaust emissions (CO, C_xH_y, NO_x, CO_2, SO_2) were analyzed to ascertain the level of its concentration.

Keywords : Imported Used Vehicles, Pistons and Piston Rings, and Harmful exhaust emissions.

I. Introduction

Thousands of used vehicles are imported into Nigeria each year. Some of these are not supposed to be allowed into the country, having passed the age of serviceability. Many of these vehicles pack up finally after a few years of service on Nigeria roads, Thereby, turning the country into a scrap yard. Worst still, in the absence of appropriate recycling facilities, these vehicles degrade our environment [3]. They pollute the air with harmful exhaust emissions caused by the wear of piston rings, valve seals, valve guides and cylinder bore [4, 5, &7]. The pollutants include: CO, COx, NOx, SOx, Benzene, Chlorinated Organic Compounds, Ozonides and Peroxides. CO_2 has greenhouse effects, NO_2 (oxidizes to HNO_3) and SO_2 (oxidizes to H_2SO_4), which eventually fall as acid rain or mist or fog.

In Europe, numerous studies have been undertaken by the European Fuel Oxygenates Association (EFOA) to determine the impact of car emissions on human health and the environment. The results were alarming as the findings of EFOA [10] showed that;

- Long-term exposure to air pollution from cars in adults of over 30 years of age caused an extra 21,000 premature deaths per year resulting from respiratory or heart disease. This was more than the total annual deaths of about 9,900 recorded from road traffic accidents,
- Each year, air pollution from cars causes 300,000 extra cases of bronchitis in children, plus 15,000 hospital admissions for heart disease. 395,000 asthma attacks in adults and 162,000 attacks in children.

The 1999 WHO report on health-costs due to road traffic-related air pollution also showed that car-related pollution kills more people than car accidents in the three European countries where the study took place (Austria, France, and Switzerland).

Ajayi carried out analysis of study to shows the increase in used vehicles imported into Nigeria between the periods of 1988 – 2005 using time-series analysis. Although there were reduction of these used vehicles in 1994 and 1998, he however pointed out that the high rate of pollution on the environment was majorly caused by this increased importations [1].

In this study, a practical approach was adopted to investigate the impact of imported used vehicles on the environment by measuring and analyzing certain exhaust pollutants from used vehicles, the measured pollutants include; Nitrogen Oxides, Sulphur Dioxide, Carbon Monoxide, Carbon Dioxide and Unburned Hydrocarbons (NO_x, SO_2, CO, CO_2, C_xH_y).

II. Materials and Method

Measurements on the concentration of harmful exhaust emissions from a number of vehicle engines were taken at some motor parks in both Edo and Delta States of Nigeria. An Exhaust Gas Analyzer with model number "Testo 350 XL" was used to carry out the measurements, by inserting the probe into the vehicle exhaust. The graphical representations and tabular results of measured pollutants from vehicle engines using Premium Motor Spirit (PMS) and Automotive Gas Oil (AGO) are discussed in the next section.

III. Results

(i) The graphical representations of measured pollutants from vehicle engines using Premium Motor Spirit (PMS) between the ages of 4-20 months are shown in Figures 3(a) – 3(c) below.

Author[α] : Department of Electronic Engineering, University of Nigeria, Nsukka, Enugu State, Nigeria. E-mail : ogcafe@yahoo.com

© 2012 Global Journals Inc. (US)

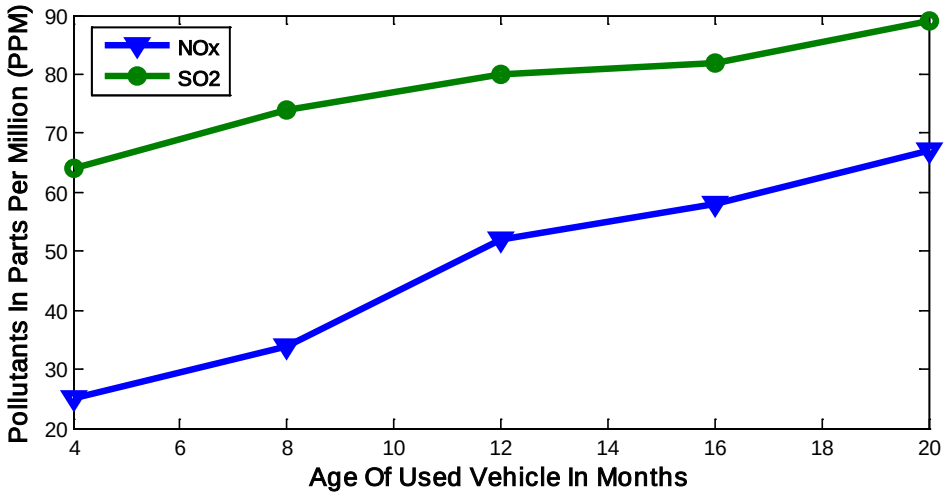

Fig 3(a) : Graph of NO_x & SO_2 pollutants from relatively new vehicles using (PMS).

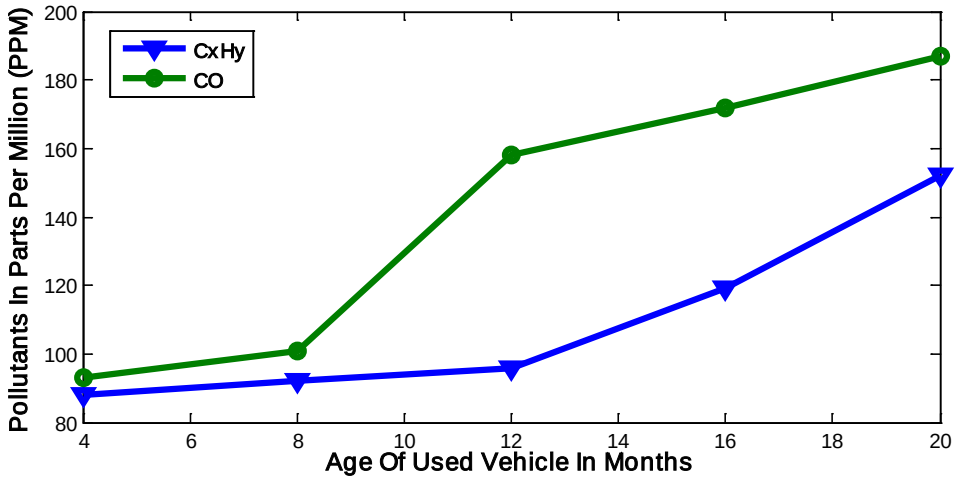

Fig 3(b) : Graph of CO & C_xH_y pollutants from relatively new vehicles using (PMS)

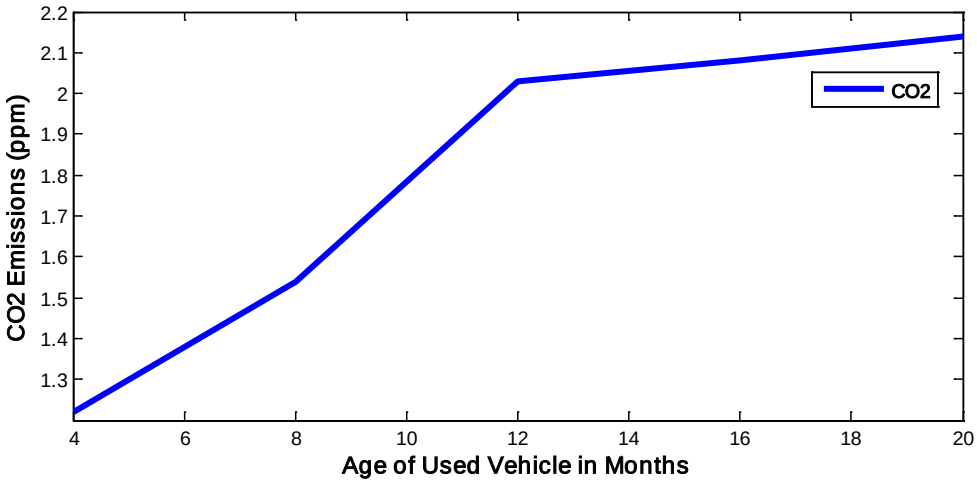

Fig 3(c) : Graph of CO_2 emission from relatively new vehicles using (PMS)

© 2012 Global Journals Inc. (US)

(ii) Graphical representations of measured pollutants taken from Vehicle exhaust using Automotive Gas Oil (AGO) between the ages of 4-20 months are shown in Figures 4(a) – 4(c).

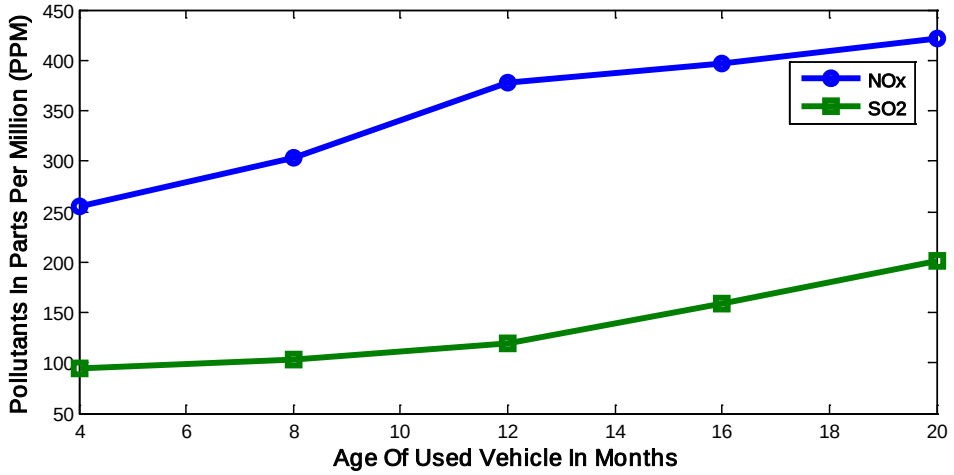

Fig. 4(a) : Graph of NO_x & SO_2 emissions from relatively new vehicles using (AGO)

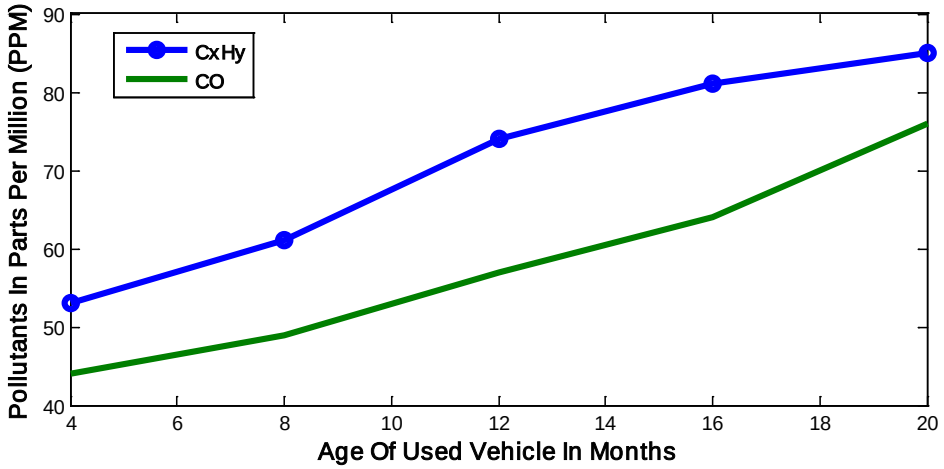

Fig 4.0(b) : Graph of C_xH_y & CO from relatively new vehicles using (AGO)

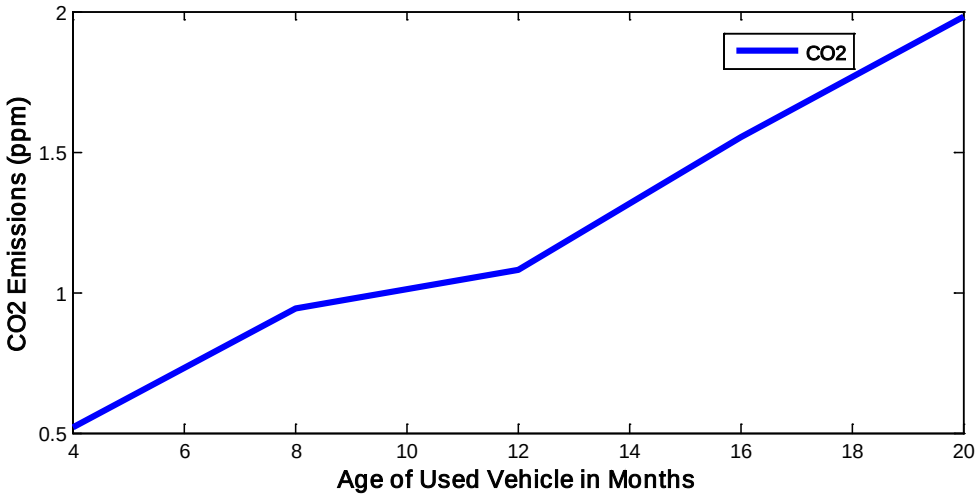

Fig 4(c) : Graph of CO_2 emission from relatively new vehicles using (AGO)

© 2012 Global Journals Inc. (US)

(iii) The graphical representations of measured pollutants from vehicle exhaust using Premium Motor Spirit between the ages of 5-25 years are shown in Figures 5(a) – 5(c)

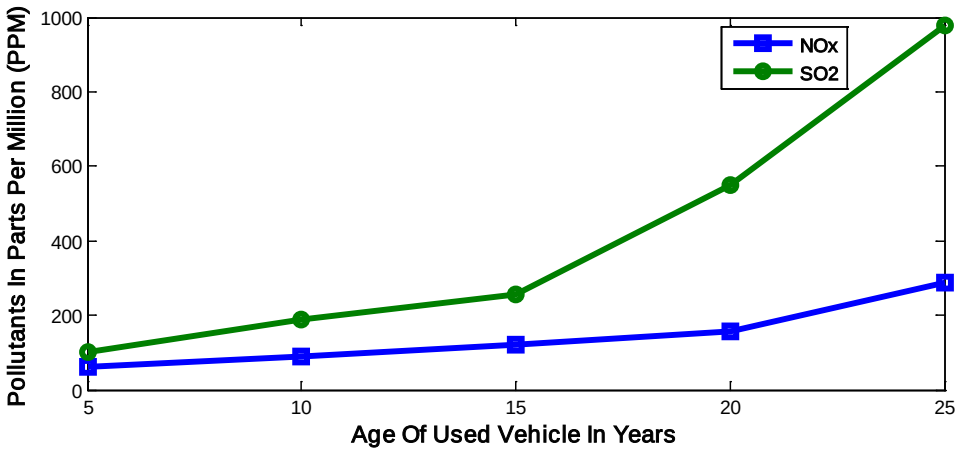

Fig 5(a) : Graph of NO_x & SO_2 pollutants from vehicles using (PMS)

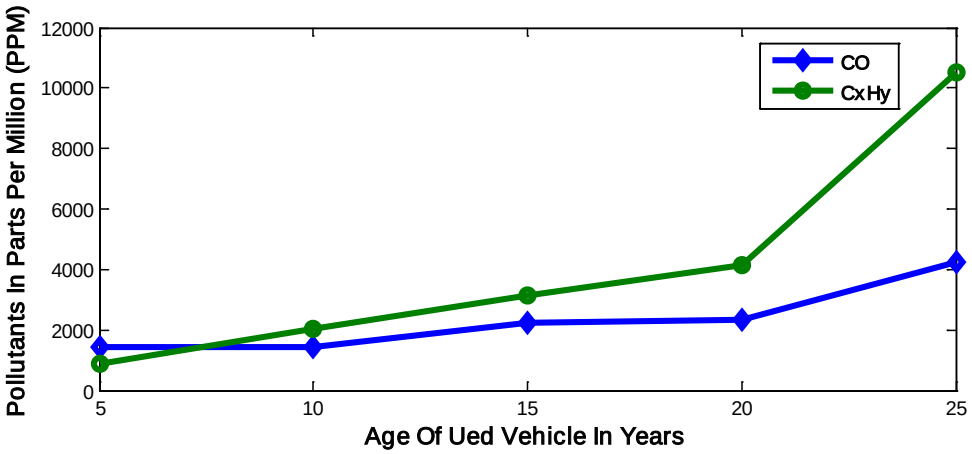

Fig 5(b) : Graph of CO & C_xH_y pollutants from vehicles using (PMS).

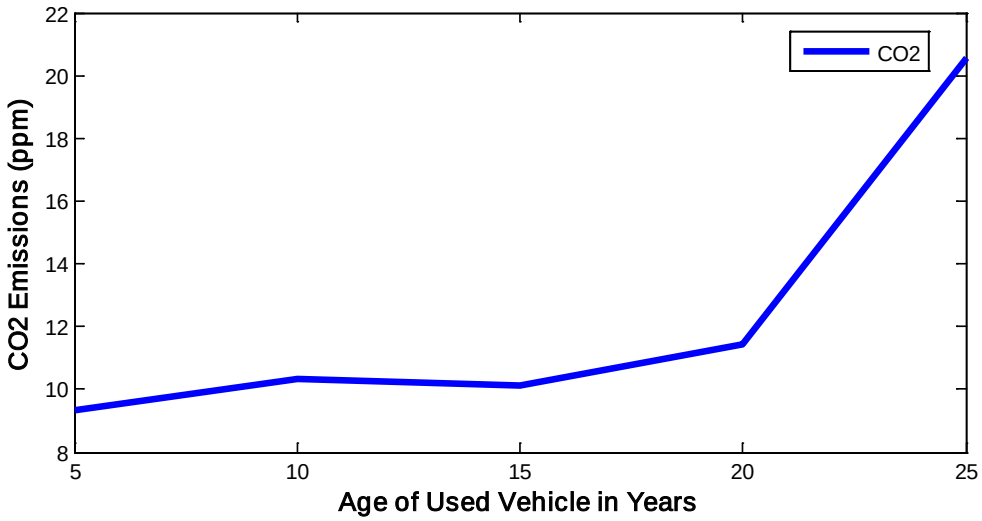

Fig 5(c) : Graph of CO_2 emission from vehicles using (PMS)

© 2012 Global Journals Inc. (US)

(iv) Graphical representations of measured pollutants taken from vehicle exhaust using Automotive Gas Oil (AGO) between the ages of 5-25 years are shown in Figures 6(a) – 6(c).

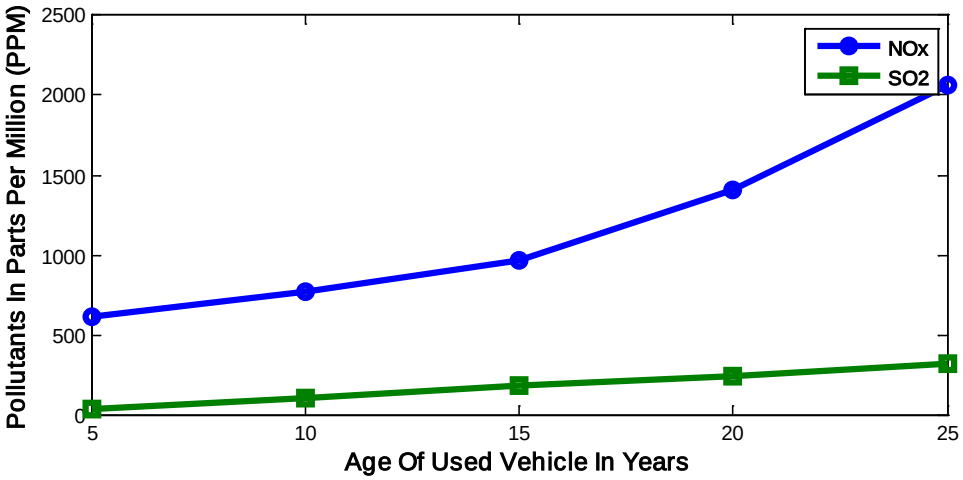

Fig 6(a) : Graph of NO_x & SO_2 emissions from vehicles using (AGO)

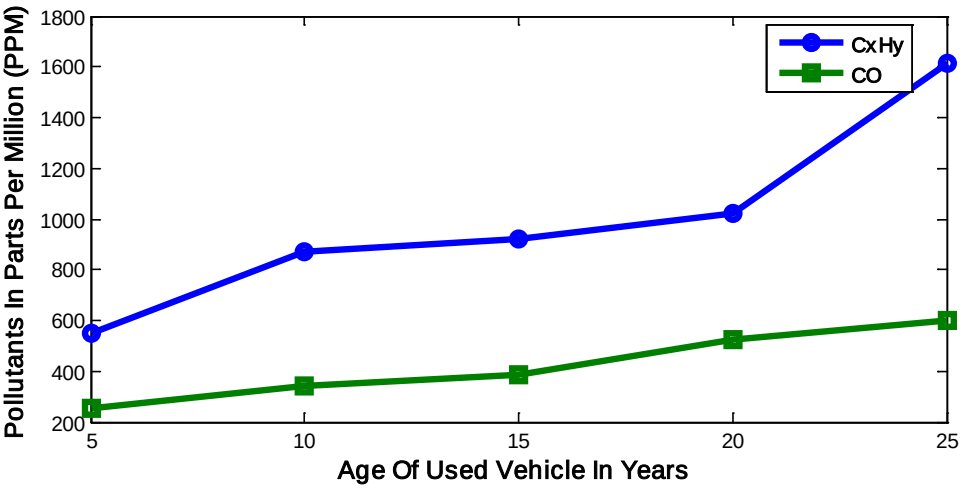

Fig 6(b) : Graph of C_xH_y & CO pollutants from vehicles using (AGO).

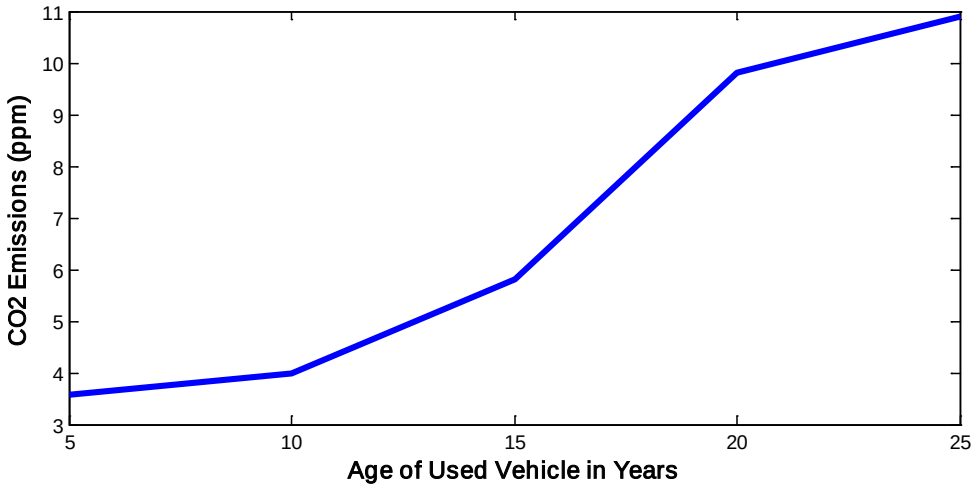

Fig 6(C) : Graph of CO_2 emission from vehicles using (AGO).

© 2012 Global Journals Inc. (US)

(v) The tabular readings for vehicles using (PMS) and (AGO) for the period of 5-25 years is shown in Table 1 & 2.

Table 1 : Results of exhaust emissions from vehicles using (PMS)

Age of Used Vehicle (Yrs)	CO_2 in %	Parts Per Million (PPM)			
		NO_x	C_xH_y	CO	SO_2
5	9.33	60	890	1442	103
10	10.33	89	2040	1446	189
15	10.10	120	3132	2228	254
20	11.44	156	4159	2347	550
25	20.56	288	10500	4228	980

Table 2 : Results of exhaust emissions from vehicles using (AGO)

Age of Used Vehicle (Yrs)	CO_2 in %	Parts Per Million (PPM)			
		NO_x	C_xH_y	CO	SO_2
5	3.57	615	550	251	36
9	4.0	765	870	344	102
14	5.8	967	920	386	178
16	9.8	1406	1020	523	245
25	10.9	2067	1615	597	314

IV. Discussion

The graphs (Figs 3a-Fig 4c) of both Premium Motor Spirit and that of Automotive Gas Oil show a rise in concentration of pollutants released from vehicles older than six months and above, this is known as the 'running-in' period of the engine. At this period the concentration of pollutants are quite low. The second stage, which is known as the 'normal' period in the life of the engine spans from 5- 15years. At this stage the pollutant concentration is relatively high; while the sharp rise from 15- 25years is the disaster stage of the engine. This last stage needs serious attention, as it is characterized by very high emissions from the exhaust.

It is also observed that the graph of (PMS) for NO_x emission shows less concentration when compared to the graph of (AGO) with the same pollutant. The reason could be that most of the vehicles using PMS probably have "Three-Way Catalytic Converters" in their exhaust system, which makes the release of NO_x minimal because most of the Nitrogen Oxide has been broken down into Nitrogen and Oxygen by this catalytic converter. This is unlike vehicles of AGO that probably uses the "Two Way Catalytic Converters", whose main function in diesel engines is to reduce hydrocarbon and carbon monoxide emissions.

The results of Table 1 & 2 (in PPM) did not compared favourably with Table 3, as the values of Table 1 & 2 happens to be higher when compared to the Hourly Mean, Daily Average, and Annual Mean values (in PPM) of the National Air Quality Guidelines for Maximum Exposure (EGASPIN) of Table 3. This is a clear indication that most of these vehicles on the Nigerian roads pose a great risk to the environment.

© 2012 Global Journals Inc. (US)

Table 3 : National Air Quality Guidelines for Maximum Exposure (EGASPIN) [2]

Pollutant	1-Hour Mean ($\mu g/m^3$)	8-Hour Mean ($\mu g/m^3$)	Daily Average Mean ($\mu g/m^3$)	Annual Mean ($\mu g/m^3$)
Suspended Particulate matter (SPM)				
Black Smoke				40 - 60
Total (SPM)	150 - 230		60 - 90	
Carbon Monoxide (CO)	30 26.09ppm		10 8.70ppm	
Sulphur Dioxide (SO_x)	350 0.14ppm		100 – 150 0.04 – 0.06ppm	40 – 60 0.016 – 0.24ppm
Nitrogen Dioxide (NO_x)	400 0.02ppm		150 0.08ppm	
Lead				0.5 – 1.0

The potential harmful effects of these automobile exhaust pollutants on human health and the environment are summarized as follows:

Table 4 : Pollutants and their Health and Environmental Effects [8-10]

Pollutants	**Health Effects**	**Environmental Effects**
Carbon Monoxide (CO)	Reduces the flow of oxygen in the blood stream and increases the likelihood of exercise-related heart pain in people with coronary heart disease. At low doses it can impair concentration and neurobehavioral function.	Greenhouse gas contributing to global warming.
Carbon Dioxide (CO_2)	Non	Major greenhouse gas contributing to global warming
Nitrogen Oxides (NO_x)	May exacerbate asthma and possible increase susceptibility to infections. It could also lead to coughing, shortness of breath and decreased lung function	Formation of ground-level ozone or "smog," which is highly corrosive and damages crops and forests. It contributes to acid rain and is a greenhouse gas that contributes to global warming.
Unburned Hydrocarbons (HC)	Low molecular weight compounds cause eye irritation, coughing and drowsiness. High molecular weight compounds can be mutagenic or carcinogenic	Ground level ozone precursor
Sulfur Oxides	It irritates the eyes and increases the frequency and severity of respiratory symptoms and lung disease.	It is a major precursor of acid rain

© 2012 Global Journals Inc. (US)

V. Conclusion and Recommendation

This study has shown that the concentration of pollutants of imported used vehicles within the ages of 5 – 25years are much higher than the emission standards set by the "National Air Quality Guidelines for Maximum Exposure" (See Table 3), implying that such vehicles are very harmful to the environment and climate (See Table 4).

This study suggests that the following measures be put in place;

- Used vehicles entering the country must pass an approved emission test to demonstrate that their emission control equipment is functioning as intended,
- Public and consumer awareness campaigns should be created on the havoc of used vehicles on the environment,
- Vehicle inspection centers should be set up to test and certify compliance,
- Vehicle 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 observed, greenhouse gases and other harmful substances will be reduced and Nigeria will be making a shift towards a green economy.

References Références Referencias

1. Ajayi, B.A., and Dosunmu O.O., (2002) *"Environmental Hazards of Importing Used vehicles Into Nigeria"*. Proceedings of International Symposium on Environmental Pollution Control and Waste Management. p. 521-532.
2. Egaspin., (2002) *"Environmental Guidelines and Standards for the Petroleum Industry in Nigerial"*, issued by department of petroleum resources Lagos. Revised Edition. p.57
3. Femi, A., (2001) *"Review Policy on Importation Of Used Cars"* Niger Delta Congress Review.
4. Furuhama, S., Takigachi, M., and Tomizawa, K., (1981) *"Effect of Piston and Piston Ring Designs on the Piston Friction Forces in Diesel Engines"*. SAE Transactions, 810977.
5. Ohmori, T., Tohyama, M., Yamamoto, M., Akiyama, K., Tasaka, K., and Yoshihara, T., (1993) *"Influence Of Engine Oil Viscosity on Piston Ring and Cam Face Wear"*. SAE 932782.
6. Taylor, R.I., Kitahara, T., Satto, T., and Coy, R.C., (1995) *"Piston assembly Friction and Wear: The Influence of Lubricant Viscometry"*. Proceedings of the International Tribology Congress, Yokohama.
7. Douglas, J.W.B., and Waller, R.E., (1966) "*Air Pollution and Respiratory infection in Children"*, Brit. J. Prevent. Soc. Med., 20. Pp. 1-8.
8. Petrilli, R. L., Agnese, G., and Kanitz, S., (1966*), "Epidemiology Studies of Air Pollution Effects in Genoa, Italy,"* Arch. Environ. Health, 12, Pp. 733-740.
9. Winkelstein, W., (1967) *"The Relationship of Air Pollution and Economic Status to Total Mortality and Selected Respiratory System Mortality in man"*. Arch. Environ. Health, 14. Pp. 162-169.
10. The European Fuel Oxygenates Association; *"Automobiles and pollution". http://www.efoa.org/air-quality.htm*

© 2012 Global Journals Inc. (US)