

# A STUDY OF PETROL VEHICLE EMISSION LEVELS IN SRI LANKA

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## INTRODUCTION

Air pollution from vehicles especially petrol (gasoline) vehicles is a big environmental problem in urban areas worldwide. With urbanization, the number of vehicles on the road is gradually increasing mainly in developing countries. Some people personally suffer from air pollution on the road because they have to travel up and down every day at the traffic time on highways (Steven *et.al*, 2006).

Present Status of Petrol Vehicle Testing Process in Sri Lanka:

There are two vehicle emission testing agencies in Sri Lanka. They use four or five types of gas analyzers for testing. The mean emission levels reflect the state of the testing process. Mean Hydrocarbon and Carbon monoxide levels of each petrol vehicle category show that the testing process is in a satisfactory manner as a whole. All the data can be interpreted scientifically and according to the emission principles because of the accuracy of emission testing process. Some of these principles are;

1. Vehicles with catalytic converters have low CO and HC levels but high CO<sub>2</sub> levels.
2. Vehicles without catalytic converters have higher CO and HC levels but low CO<sub>2</sub> levels.

When current (2013) Sri Lankan petrol vehicle emission standards are compared with those of other countries, it can be seen that the other countries had lower standard levels even 10 to 15 years before. Sri Lanka is far back according to these figures (Table 1) ( Asif Faiz *et al*, 1996).

**Table 1 : Emission standard levels of petrol vehicles in selected countries**

Country	Year	CO % (V/V)	HC (ppm)
USA	2004	1.7	1250
EU	2000	2.7	2000
Argentina	1999	2	3000
Australia	2000	2.1	2600
Brazil	1997	2	3000
Canada	1988	2.1	2500
EU	2006	1.0	1000
Sri Lanka	2013	6.0	9000

Therefore, this may be the time to establish suitable and stricter standards (with lower standard levels than present) for Sri Lanka. This research has given guidance for that. The other aspect is that Sri Lanka does not have NO<sub>x</sub> standards. We also need NO<sub>x</sub> standards because it is a powerful global warming gas. As per Euro 4 standards, Sri Lanka too needs

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standards for Particulate Matter (PM), Hydro carbons (HC), Nitrogen Oxide (NO<sub>x</sub>), Sulphur Oxide (SO<sub>2</sub>) and Carbon Monoxide (CO). Sri Lankan standards have only two parameters (HC & CO).

This study attempts to compare Sri Lankan emission standards with those of other countries. This research further proposes more suitable standards for petrol vehicles with suitable measuring tools and recommends necessary steps to improve Vehicle Emission Testing process in Sri Lanka.

## METHODOLOGY

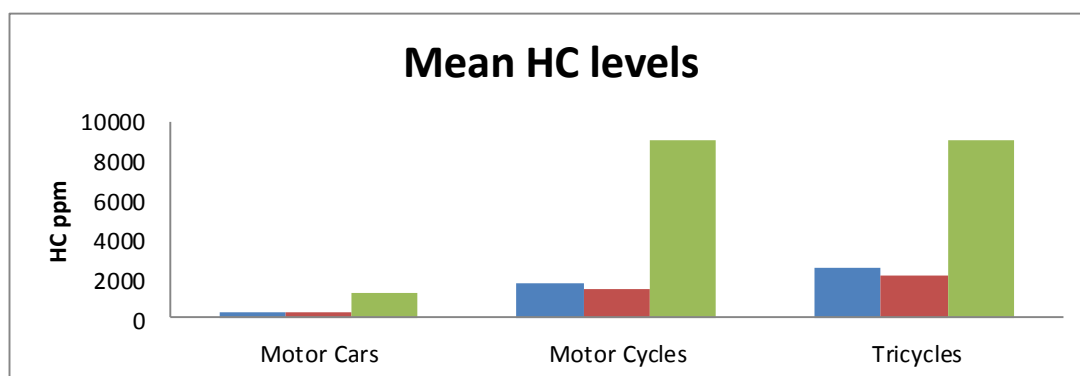
Vehicle emissions and their health effects, five gasoline vehicle emission parameters and the development of Sri Lankan standards were studied in this research. It further collected the data on petrol vehicle emission standards in developed and developing countries. Data were collected directly from emission certificates and from two agencies authorized to carry out emission testing in Sri Lanka. There were three categories of certificates. They were for motor cars, motor cycles and tricycles. This research analyzed 1200 local petrol emission certificates from Sri Lanka, obtained mean emission levels and compared them with emission standards in Sri Lanka. Out of 1200 certificates, each vehicle category had about 400 certificates. Three important emission levels (HC, CO, CO<sub>2</sub>) were indicated in those certificates. These parameters were given in the certificates at two different rpm levels (Idle rpm and 2500 rpm) of the engine. So there were six emission levels for the analysis. The values given for those three parameters in the tested certificates were analyzed according to three types of petrol vehicles.

## RESULTS AND DISCUSSION

Three types of emission test certificates were analyzed and mean emission levels were calculated. They are given below (Table 2).

**Table 2– CO & CO<sub>2</sub> (% v/v) and HC ( ppm v/v) of different vehicle types at idling and Accelerated**

Vehicle Type	Idle HC	Idle CO	Idle CO <sub>2</sub>	Acc HC	Acc CO	AccCO <sub>2</sub>
Motor Cars	288.5	1.03	13.47	216.41	0.95	13.86
Motor Cycles	1748.11	2.48	7.08	1456.67	2.55	7.13
Tricycles	2492.05	2.67	7.59	2091.63	2.75	7.80



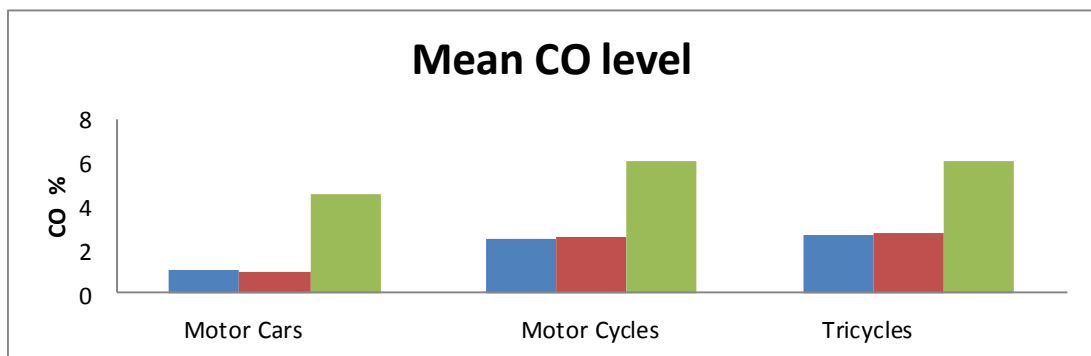
**Fig 1 - HC levels of three types of vehicles with standards**

Figure 1 shows the Hydrocarbon levels of the three types of petrol vehicles in January 2013. The main reason to low levels of HC emissions (288 – 216ppm) in petrol motor cars is that most of the cars contain catalytic converters. Catalytic converters convert Hydro Carbon into Carbon Dioxide. Motor cycles and Tricycles showed high levels of HC (1748 – 2492ppm)

and this may be due to not having such converters in those vehicles. However, Sri Lankan emission standard levels for gasoline vehicles are very high as indicated in Table 1.

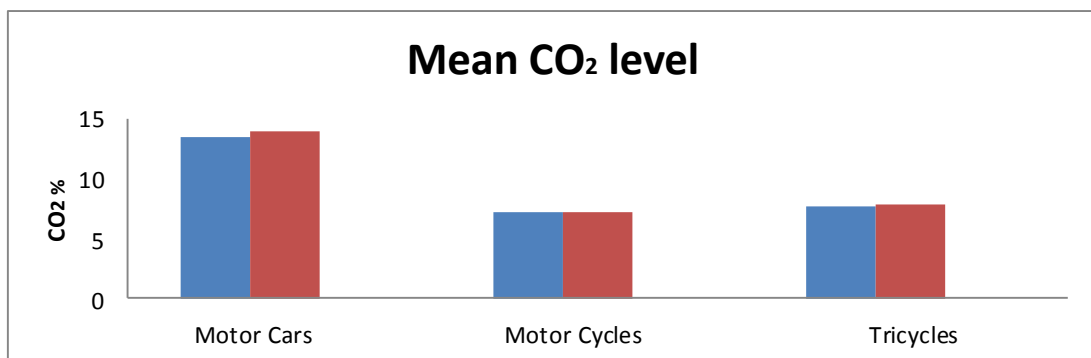
Therefore, these standards may not be useful or may not be helping to detect any pollution due to vehicular emissions even from a bad vehicle. Further, the tricycles and motor cycles owners may not take any interest in minimizing emissions as their levels are still within the permissible levels due to these high values indicated in the standards. Therefore, any rule on bad vehicles could be imposed only after reconsidering the existing standards.

Figure 2 shows the Carbon monoxide levels of the three types of gasoline vehicles in January 2013. The main reason for low levels of CO emission (1.3-0.95%) in gasoline motor cars may be the same reason that most of the cars contain catalytic converters. But motor cycles and tricycles have high levels of CO levels (2.48- 2.75%). Even though, the emission of CO is bad for the environment, it is not detected as present standard levels are very high (4.5 for cars and 6 for motor cycles and tricycles) and the findings do not reach even half of the standards.



**Fig 2 - CO levels of three types of vehicles with standards**

Figure 3 shows the mean Carbon dioxide levels of the three types of gasoline vehicles in January 2013. The main reason for higher Carbon dioxide levels in gasoline motor cars is that most of the cars contain catalytic converters and they have converted Hydrocarbons and Carbon monoxide to Carbon dioxide. Carbon dioxide is not a vehicle emission parameter in Sri Lanka. The CO<sub>2</sub> levels in motor cycles and tricycles show a low level because they don't have any type of catalytic converters. Catalytic converter decreases CO and HC levels while increasing CO<sub>2</sub>.



**Fig. 3 - CO<sub>2</sub> levels (%) of three types without standards**

## RECOMMENDATIONS

- i. **Improving the emission standards:** This can be implemented by improving present standards as proposed by this research to achieve better outcome of smoke test. As a

developing country Sri Lanka should impose not only HC and CO, but also NO<sub>x</sub> which is easily detectable and an important emission.

- ii. **Using advanced technology:** Chassis Dynamo meter should be used to get meaningful and accurate measurements. However it is difficult to introduce such advanced and expensive device instantly in Sri Lanka. So it is better to introduce a roller belt set with gas analyzer in order to get accurate measurements. Such roller sets can be manufactured locally. Such a set with a gas analyzer can be calibrated with a standard Chassis dynamo meter and emission measuring unit can be converted from percentage (%) or ppm to g/km
- iii. **Improving the quality of testing process:** It has been reported sometimes that emission certificates are issued without checking the vehicles. Such illegal offenses should be prevented by introducing strict legislations and random checking by police environment protection units using portable gas analyzers.
- iv. **Implementing awareness programs:** Most people think diesel emissions are worst but petrol emissions are not harmful. People should be educated regarding this. Vehicle repair technicians should be trained about vehicle emissions.
- v. **Use alternative methods:** More environmentally friendly vehicles such as electric vehicles, solar powered vehicles and hybrid vehicles should be promoted. Using public transport system is a good step to minimize vehicular emissions as well as economic for the countries like Sri Lanka.
- vi. **Using Portable Gas Analyzers:** These can be introduced by the police environmental protection units for random checking of emission levels of the vehicles on the road. .
- vii. **Implementing strategic environmental policy:** Environmental protection police, Central Environmental Authority, Department of Motor Traffic and the Department of Environment should work together to minimize these issues.
- viii. **Introducing Catalytic converters for brand new three wheelers and motor cycles:** Based on the present study, the main reason to high emission levels in these vehicle types is lack of catalytic converters. Many types of catalytic converters have been designed to use as an accessory with three wheelers and motor cycles. Such converters can be fixed to outlet line of the engine and emission levels can be reduced. They should be promoted and introduced to the market. Catalytic converters should be compulsory for all petrol vehicle types in Sri Lanka.

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