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# REDUCING CO/HC EMISSIONS IN TWO STROKE TWO WHEELERS

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## ABSTRACT
*Mopeds and motorcycles are popular in many countries due to the one of the cheapest transportation vehicles, limited space, the easy operation and maintenance. However, the exhausts from gasoline two wheelers cause serious environmental pollution in every country. A number of countries have implemented some policies to reduce air pollution. Therefore, many manufactures have taken some measurements on engine design to reduce exhaust emissions. Our aim is maximize the performance and reduce emissions by design modifications. This paper presents some design modifications on two stroke moped for decreasing exhaust emissions and results are examined with an illustrative example.*
**Keywords:** Moped, motorcycle, two wheeler, two stroke, emission.

## 1. INTRODUCTION
Air pollution is increasing in many parts of the world, and is responsible for estimated 3-6 million deaths annually [1] around 15,000 each day. The overall health impact of air pollution falls disproportionately on women and children in the developing world, and exceeds the burden of such major health hazards as malaria, tuberculosis, tobacco, AIDS, heart disease, and cancer [2].

The environment friendly manufacturers seeks to improve health by reducing 2-stroke emissions in the world, thereby eliminating millions of tons of carbon monoxide, unburned hydrocarbons, particulates, and greenhouse gases. Over the past three decades, emissions levels in the U.S. and Europe have been reduced dramatically. Until recently, however, less effort has been focused on addressing the soaring levels of emissions in the developing world.

Typical 2-stroke engines lose approximately 35% of their fuel in the process of “scavenging” the engine. Scavenging of a 2-stroke engine involves using pressurized air or an air/fuel mixture to flush the exhaust products from the cylinder. During the scavenging process, approximately 35% of the scavenging air or air/fuel mixture “short-circuit” through the engine and are lost. In the simple “crankcase-scavenged” engines used in most small vehicles, air and fuel are mixed in a carburetor before entering the engine, and scavenging is performed with this air/fuel mixture, resulting in the loss of approximately 35% of the fuel. These scavenging fuel losses are responsible for the high emissions and high fuel consumption of simple crankcase-scavenged 2-stroke engines [3]. In this study, the performance and reduce of the emissions are maximized by taken some design modifications with catalyst and the testing results show that Hydrocarbon and Carbon Monoxide emissions are reduced.

## 2. EMISSIONS FROM 2-STROKE ENGINES

The inherent geometric configuration of a 2-stroke engine gives rise to high levels of certain exhaust pollutants. High hydrocarbon emissions result in part from the scavenging process used by 2-stroke engines. Scavenging refers to the process by which the burned 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 transfer 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 [4]. 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 fuel rich condition, there is insufficient air to oxidize all of the fuel present, leading to high CO emissions [5] and further exacerbating the UHC (Unburned Hydrocarbons) problem.

Finally, high particulate emissions result from unstable combustion, excessive lubrication (typical in small two stroke engines), and a lubrication system which allows lubricating oil to be dissolved in the fuel. In a typical 2-stroke, oil is pre-mixed with the fuel or mixes with fuel at the carburetor. As the air/fuel/oil mixture transfers into the crankcase, the fuel dissolves the oil. This action reduces the amount of oil deposited on the crankshaft bearings (or other critical components) as it is essentially 'washed' out of the engine by the fuel [6].

## 3. AIR POLLUTION PREVENTION

A catalyst that cleans toxic elements from the exhaust. Besides, the platinum and rhodium of a conventional oxidation type catalyst, an additional coating of palladium enables the exhaust to be cleaned with a smaller surface area of catalyst. In this way, outstanding exhaust cleaning performance is achieved, including a large reduction in the HC (Hydrocarbons) that has been one of the primary concerns in achieving cleaner 2-stroke exhaust.

The effect achieved by this system is a reduction of CO (Carbon Monoxide) by up to one half and HC (Hydrocarbons) by up to two thirds compared to existing models. After being coated with the usual precious metals platinum (Pt) and rhodium (Rh), the catalyst surface of the Tube is given an additional coating of palladium (Pd) in order to better oxidize the HC (Hydrocarbons) and CO (Carbon Monoxide) components of the exhaust gas as it passes through the defuser. The addition of the palladium coating particularly contributes to the catalyst's ability to clean hydrocarbons out of the exhaust.

Honeycomb structures having a catalyst component loaded thereon have been used in an exhaust gas purifier of an internal combustion engine, a reforming unit of a liquid fuel or a gaseous fuel, and the like. It is known that honeycomb structures are also used as a filter for capturing and removing the particulate matter contained in a dust-containing fluid such as exhaust gas emitted from an engine. There is provided a honeycomb structure having a large number of through-holes formed in the axial direction and defined by partition walls, wherein slits are formed so as to be exposed to at least part of the outer surface of the honeycomb structure along the axial direction.

The density of the cells surrounded by partition walls is preferably 0.9 to 311 cells/$cm^2$, more preferably 7.8 to 62 cells/$cm^2$. When the cell density is less than 0.9 cell/$cm^2$, the resulting honeycomb segments are insufficient in strength and effective GSA (Geometrical Surface Area); when the cell density is more than (311 cells/$cm^2$), the resulting honeycomb segments show a large pressure loss when a gas flows there through [7].

*Figure 1. The catalyst structure*

These advanced catalysts designed and developed exclusively by manufacturers neutralize the harmful effects of HC-CO and NOx. It is shown the model of the catalyst in Figure 1.

The basic element of the carburetor's adjustment, at full power and for wide throttle openings, is the main jet, which controls the calibration of fuel delivered from the main system. The main jet is mounted in the lowest part of the float chamber to ensure that it is always covered with liquid, even when the motorcycle makes excessive maneuvers. Main jet makes it possible to adjust to a leaner fuel-air mixture once the engine is running. There is an important role on emission.

Furthermore, the system also features a digital timing advance system that provides optimum ignition timing based on actual engine rpm. The combined effect of these factors produces both cleaner exhaust gas and better fuel economy.

## 4. THE TEST RESULTS

By using honeycomb structure of catalyst having a size of 35 mm (diameter) and 100 mm (length), a partition wall thickness of 0.3 mm and a cell density of 31 cells/cm$^2$ and by blocking given proportions of the through-holes at one end and the remaining through-holes at other end, there were produced honeycomb structures each as a particulate filter for purification of engine exhaust gas.

Emissions from a vehicle can be gathered based on two modes of operation; drive cycle emissions or steady-state emissions. Drive cycle emissions are preferred for vehicle standards as they provide the most realistic representation of transient engine operation. This form of analysis typically reports data in units of mass/distance, i.e. grams per kilometer (g/km.) of each pollutant. In order to measure the emissions from the 2 stroke engine in its without catalyst and with catalyst forms, a dynamometer ("dyno") test stand was used. Due to the small size of the engine, a low inertia dyno was required. This dyno has a capacity of less than 22 kW. A «Horiba» gas analyzer was used to record emissions.

The results obtained using drive cycle approximation of the ECE47 was compared with published data from a same engine measured over the ECE47. The published data was generated by the gas analyzer (Table 1) on a <99cc motorcycle and included tests of both catalyst and without catalyst configurations. The data showed a 53% reduction in CO, 62% reduction of HC and a 16% reduction of NOx.

*Table1.The comparison of systems*

| (g/km) | without catalyst | with catalyst | reduction (%) |
|---|---|---|---|
| **CO** | 4,3 | 2 | 53 |
| **HC** | 4,5 | 1,7 | 62 |
| **NOx** | 0,031 | 0,026 | 16 |

## 5. CONCLUSION

Using this drive cycle testing, the performance of the catalyst system was evaluated. Results showed that, hydrocarbon emissions were reduced by 62%, and CO emissions were reduced by 53%. We believe that catalyst system has a unique opportunity to make a huge impact on health and the environment.

The implementation of clean air legislation has been proposed to eliminate all without catalyzed 2-stroke moped and motorcycles, but the drivers are dissatisfied with the cost of new catalyzed exhaust systems.

The ambition of manufacturer is to offer advanced products to reduce environmental pollution. We owe it to our children, and our children's children to preserve a clean, healthy atmosphere. Pollution prevention- to prevent the pollution is better than cleaning up afterwards.

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