

Effects on Emission using CaCO₃ based Catalytic Converter on Four Stroke Single Cylinder Petrol Engine

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Abstract— Petrol engines are widely used automobile application for private and commercial transportation use because of its good fuel efficiency and durability. But, petrol engine emissions are extremely harmful to human health and to the environment and are at targets for its reduction, especially in city & urban area because most of the petrol engines are used in human populated areas. There are many reports of oxidation catalysts in the exhaust system of petrol engines, which had proven significant reductions in HC, PM and CO with oxidation catalysts. However, its advantages depend upon engine loads / exhaust temperatures and periodical cleaning of converter cell. Normally these converters have 5-6 years of life and the performance deteriorates with impurities deposition on basic metal surface. Calcium carbonate is naturally available good resource for its chemical reactivity and performance for exhaust gas treatment.

Key words: Calcium Carbonate, Catalytic Converter, Four Stroke Petrol Engine, Single Cylinder

I. INTRODUCTION

Heavy oil exploration from earth and its usage has created a threatening problem of emission of pollutants in the world environment to such an extent that lives of all living beings on earth are on dangerous threat. All the pollutants coming out from an automotive tail pipe have affected human beings and all other living creatures with its adverse effect on air environment, especially levels of carbon dioxide (CO₂), carbon monoxide (CO) and oxides of nitrogen (NO_x) in the air.

II. EXPERIMENTAL SET-UP

A variable load – constant speed experiment was conducted on four stroke single cylinder air cooled petrol engine. In this experiment exhaust system was modified. Modification was on structure and catalyst of catalytic converter.

A. List of instrument:

- (1) Single cylinder four stroke petrol engine.
- (2) Flat belt type band brake dynamometer
- (3) Burette
- (4) Tachometer
- (5) Temperature sensors(0-400°C K-type thermo couple Cr-Al)
- (6) U-tube manometer
- (7) Exhaust gas analyser (3 gases CO, HC, CO₂)

B. Test Procedure

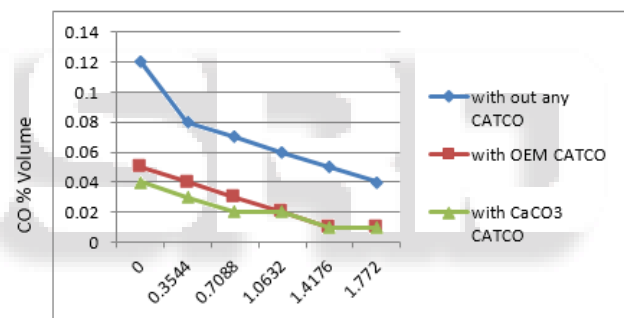
- Check fuel level.
- As engine is air cooled external cooling fan was provided for external cooling.
- Start the engine. Run for 15 minutes to stabilize the parameters.

- First, measure the speed of the engine with the help of Tachometer. Apply the load in increment of 1 kg. Accelerate engine to reach speed of 1500 r.p.m.
- Then, measure the time required for consumption of fuel with the help of burette and stop watch.
- Take the reading of exhaust gas temperature and gas analyser.
- Take all these reading by increasing load by 1 kg increment up to 5 kg load.

A probe is mounted at exhaust of engine which will supply sample of exhaust gas to the exhaust gas analyser. Amount of HC, CO & CO₂ present in exhaust can be read at indicator panel of exhaust gas analyser.

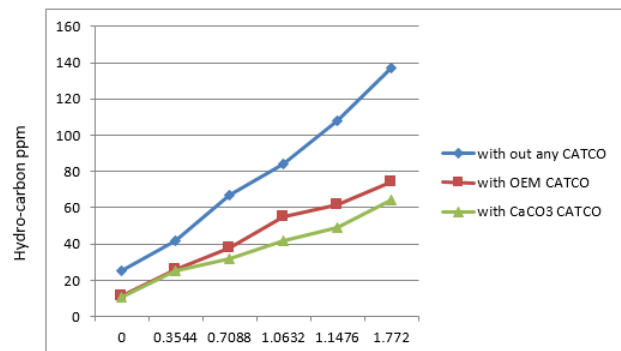
III. RESULTS

A. Effects of Brake Power on CO Reduction



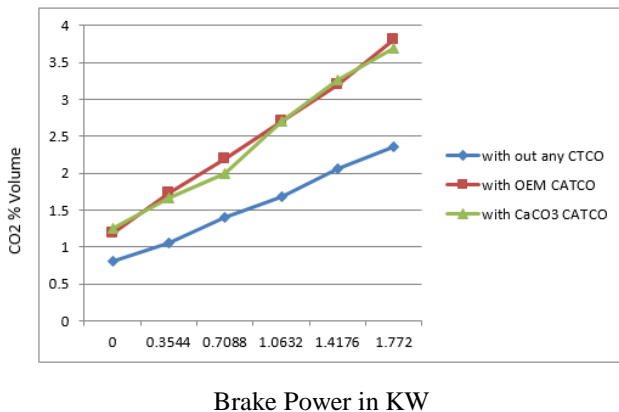
Brake Power in KW

B. Effects of Brake Power on HC Reduction



Brake Power in KW

C. Effects of Brake Power on CO₂ Production



Brake Power in KW

IV. CONCLUSION

The reduction of the CO is measured by the CaCO₃ based catalytic converter is reduced 66.66% than the without catalytic converter. As the exhaust temperature was increased the CO is decreased at the higher 278°C.

The reduction of the HC is measured by the CaCO₃ based catalytic converter is 58% reduced than the without catalytic converter. As the exhaust temperature was increased the HC is also increased.

The CO₂ is increased by 36% with the CaCO₃ based catalytic converter than without catalytic converter and it keeps increasing with the increasing in the temperature.

The break thermal efficiency of CaCO₃ based catalytic converter with petrol engine is 2.5% higher than without any catalytic converter and 2.6% lower than OEM catalytic converter at 5kg load.

The cost of CaCO₃ based catalytic converter is lower than the OEM catalytic converter.

As the layer is of CaCO₃ catalyst is not trapping CO₂ but leaves it to atmosphere. During experiment no dust particles observed.

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