EMISSION TESTING IN FOUR STROKE BIKE ENGINE BY INSTALLING TURBOCHARGER

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ABSTRACT

The main aim of this project is to reduce the engine exhaust emission. This is achieved by diverting exhaust energy from the combustion process to run the turbine. As the turbine is being driven by the exhaust energy, the other side of the turbo compresses fresh intake air and drives it into the engine's intake. This results in a greater mass of air entering the cylinder, which helps to achieve complete combustion. This is done by installing a turbocharger which is connected directly to the carburetor inlet. The main components that are required for installing the turbocharger are mild steel tube, flange coupling, turbocharger and a four stroke bike. The emission test is done before and after the installation of the turbocharger. It is done to check whether the installation of turbocharger in the bike helps to reduce the emission of the main emission gases which are HC, CO. The main application of this project is to reduce the engine emission gases by trying to achieve complete combustion in the engine.

Keyword: - *Turbocharger , Four stroke bike*

1. INTRODUCTION

A turbocharger consists of a compressor and a turbine linked by a shared shaft so if the turbine rotates, the compressor also rotates. The turbine inlet receives exhaust gases from the engine causing it to rotate. This rotation in turn drives the compressor, which compresses the ambient air and delivers it to the intake manifold of an engine at higher pressure, resulting in greater amount of air entering the cylinder. There are two ways of increasing the power of an engine. One of them would be to make the fuel-air mixture richer by adding more fuel. This will increase the power but at the cost of fuel efficiency and increase in pollution levels prohibitive. The other would be to increase the volume of air entering into the cylinder and increasing the fuel intake proportionately, increasing power and fuel efficiency without hurting the environment or efficiency. This is the function of the turbochargers.

1.1 Components required

Turbocharger:

A turbocharger known as turbo is a turbine-driven forced induction device that increases an internal combustion engine's efficiency and power output by forcing extra compressed air into the combustion chamber. The turbine used is a radial inflow turbine and the compressor used is a centrifugal compressor.

Fig 1: Turbocharger

Mild steel tube:

A tube is a tubular section or hollow cylinder, not necessarily of tubular cross-section, used mainly to convey substances which can flow such as liquids and gases, slurries, powders and masses of small solids. The mild steel tube connects exhaust to the turbocharger. It is used because it can withstand the high temperature and pressure.

Fig 2: Mild steel tube

Four stroke bike:

A spark ignition engine runs on an Otto cycle. This cycle uses a homogeneous air-fuel mixture which is combined before entering the combustion chamber. Once in the combustion chamber, the mixture is compressed, and then ignited using a spark plug. The SI engine is controlled by limiting the amount of air allowed into the engine. This is accomplished through the use of a throttling valve placed on the air intake.

Fig 3: Four stroke bike

Flange coupling:
Flange coupling is a driving coupling between rotating shafts, that consists of a flanges one of which is fixed at the end of each shaft, the two flanges being bolted together with a ring of bolts to complete the drive.

Fig 4: Flange coupling

2. TURBOCHARGER SPECIFICATION

2.1 Compressor wheel

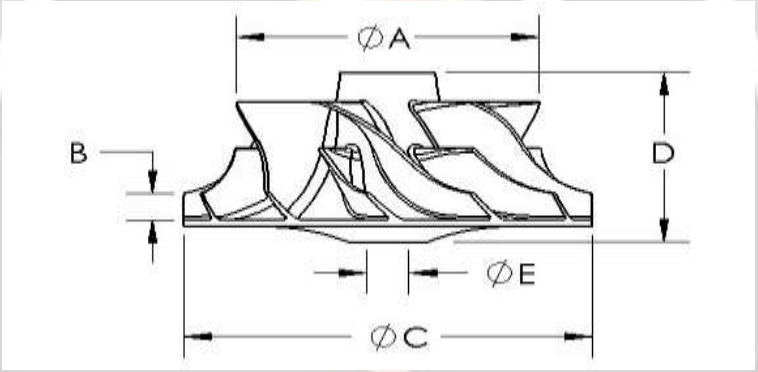

Fig 5: Compressor wheel

Inducer "A"=27.4mm
Tip Height "B"=4.3mm
Exducer "C"=37mm
Hub Length "D"=22mm
Bore "E"=4.1mm
No. of blades:5/5

2.2 Turbine wheel

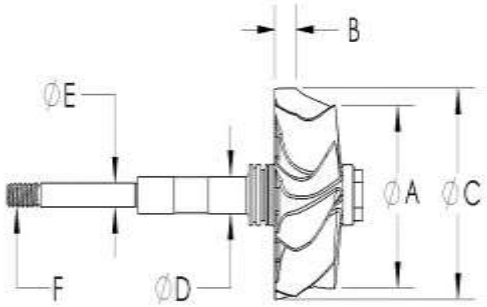

Fig 6: Turbine wheel

Exducer "A" =29.2mm
Tip Height "B"=4.96mm
Inducer "C"=34.7mm
Journal "D"=6.0mm
Stem "E"=4.1mm
Blades=9

3. BASIC LAYOUT

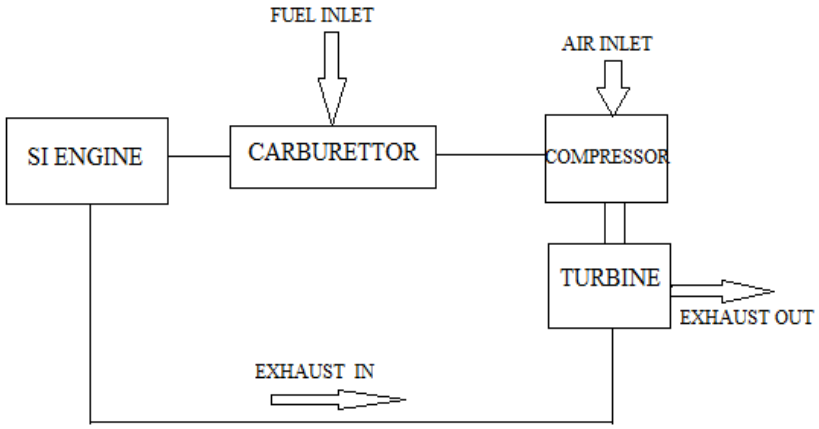

Fig 7: Basic layout

4. WORKING PRINCIPLE

In normal engines, intake gases are drawn or pushed into the engine by atmospheric pressure filling the volumetric void caused by the downward stroke of the piston which creates a region of low pressure. The amount of air actually inspired, compared with the theoretical amount is called volumetric efficiency. The objective of a turbocharger is to improve an engine's efficiency by increasing density of the intake gas allowing more power per engine cycle. The turbocharger's compressor draws in ambient air and compresses it before it enters into the intake manifold at increased pressure. This results in a greater mass of air entering the cylinders on each intake stroke. The power needed to spin the centrifugal compressor is derived from the kinetic energy of the engine's exhaust gases.

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5. RESULT

The emission test is taken in the four stroke bike before the installation of the turbocharger and after the installation of the turbocharger. The test results are as follows:

5.1 Hydrocarbon emission

The hydrocarbon emission reduced from about 842 ppm to 547 ppm. Thus, a reduction of about 300 ppm of hydrocarbon emission is achieved.

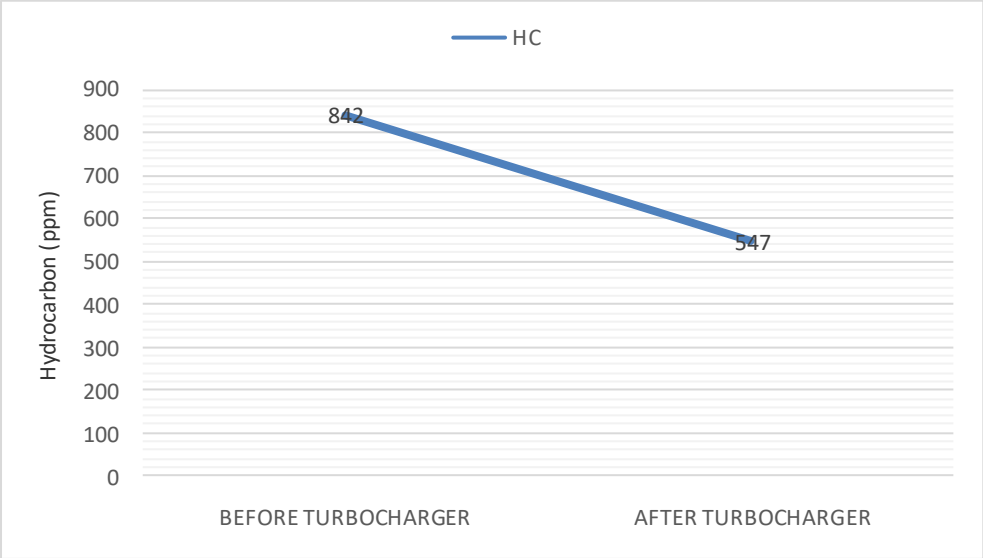

Chart 1: Hydrocarbon emissions

5.2 Carbon monoxide emission

The carbon monoxide emission reduces from about 0.671% to 0.436%. Thus a 0.24% reduction in carbon monoxide emissions is achieved.

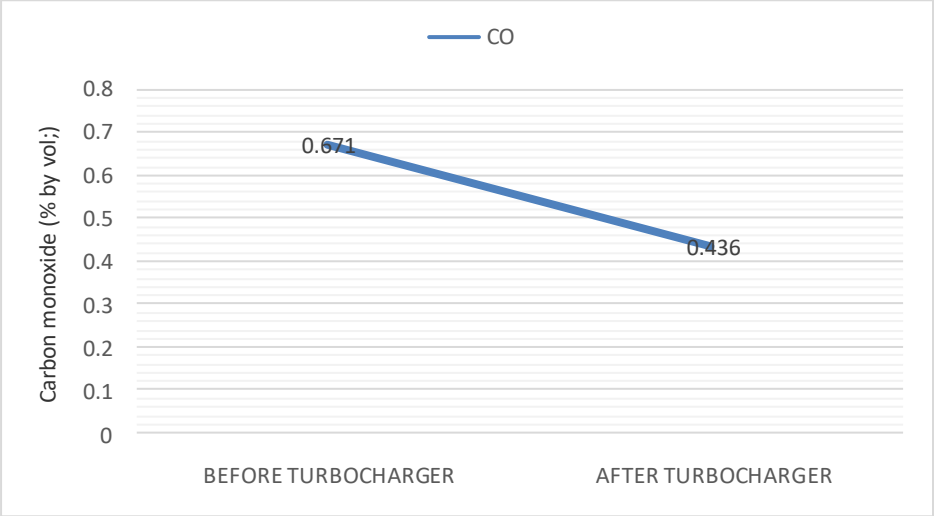

Chart 2: Carbon monoxide emissions

6. CONCLUSIONS

We have installed prototype of a Turbocharger for the Two-wheeler application. With the analysis of exhaust gas emissions it is found that the there is a slight reduction in CO and HC emissions after the installation of the turbocharger which indicates a better combustion of fuel due to the added air density during induction. This work is an attempt to install a turbocharger for a single cylinder, spark-ignition engine of a two-wheeler. The Hydrocarbon emission decreases by about 300 ppm. The Carbon monoxide gas emission decreases by about 0.24% from 0.671% to 0.436%. Hence, we conclude our project by saying that the installation of turbocharger in a two wheeler helps to reduce the emission of carbon monoxide and hydrocarbon emissions.

7. REFERENCES

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