Implementation of Supercharging on SI Engine Using Naturally Rammed Air

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Abstract- *Supercharger is a device introduced in two wheelers. The leading problem seen in the bikes nowadays is less mileage and high exhaust emissions. This problem can be overcome by the implementation of Supercharger in bikes. The main problem of the carburetor is it supplies more fuel at high speed, which is not at all required. The next problem is that the carburetor contains a venture, which is provided to increase the velocity of the air-fuel mixture, but this ultimately leads to decrease the pressure of the mixture and moreover also decreases the density of the air-fuel mixture. Because of the reduction in the density, the fuel in the combustion chamber does not burn properly and leads to reduce the mileage of the vehicle and also in addition increases the emission to great extent. These two disadvantages lead to reduce the efficiency and increase the emissions. This project aims to solve the inherent drawbacks of simple carburetor by increasing the amount of air supplied to the A/F mixture. The results indicate that using supercharging along with biofuel has increased the efficiency of vehicle with reduction in emission.*

Keywords- 4 stroke IC engine, simple carburetor, exhausts gas analyzer.

I. INTRODUCTION

One of the reasons for high exhaust emission and poor mileage in the vehicles is insufficient air in the mixture. Mostly simple carburetors are used in two wheelers where in a rich mixture is attained during high throttle opening. This problem is effectively solved in four wheeler by sophisticated techniques. However, these devices cannot be implemented in the two wheelers because of the space available and also because it is uneconomical. Two wheeler consists of a carburetor for the proper mixture of Air and fuel which is required by the engine to generate the power. The problem of low density of charge entering into the engine can be solved by supplying pressurized air to the flowing charge. This can be done by providing an air vent to the carburetor. According to the requirement and space availability a hole is drilled in the carburetor. The flow of pressurized air in the carburetor is supplied via U-tube.

II.RESEARCH ELABORATION

[1]said that, In search of a suitable fuel alternative to fast depleting fossil fuel and oil reserves and in serious consideration of the environmental issues associated with the extensive use of fuels based on petrochemicals, research work is in progress worldwide. Researchers have been re-directing their interests in biomass based fuels, which currently seem to be the only logical alternative for sustainable development in the context of economic and environmental considerations. Renewable bio resources are available globally in the form of residual agricultural biomass and wastes, which can be transformed into liquid bio-fuels. However, the process of conversion, or chemical transformation, could be very expensive and not worth-while to use for an economical large-scale commercial supply of bio-fuels. Hence, there is still need for much research to be done for an effective, economical and efficient conversion process. Therefore, this article is written as a broad overview of the subject, and includes information based on the research conducted globally by scientists according to their local socio-cultural and economic situations.

[8] said that traditionally regulated gas emissions of the three fuels are also measured and discussed in this work, including the nitrous oxides (NOX), unburned and partially burned hydrocarbons (HC) and the carbon monoxide (CO). The results reveal burning M10 blend fuel causes increase in NOX emissions. However, opposite impact are found for E10 blend fuel. At 1200 rpm, 5.8% and 4.4% higher NOX emissions are produced from M10 compared with E10 and gasoline, respectively.

[2]Introduced that Variation of NOX emissions with engine speeds is very similar to the in-cylinder peak temperature and pressure curves. In general, the formation of NOX increases exponentially with in-cylinder combustion temperature. The in-cylinder combustion analysis clearly shows the highest computed peak temperature for M10 resulting from its lower enthalpy of vaporization and carbon/hydrogen ratio (0.5 for ethanol and 0.2 for MF, which tends to form more amount of CO2 and less water. However, the mass specific heat capacity of CO2 is lower than that of water; therefore the higher flame temperature is achieved by

M10. That can also help to explain the drawback of NOX for M10 blend fuel. Due to the significant cooling effect of ethanol, E10 blend fuel produces the lowest amount of NOX. The indicated specific HC emissions for each fuel at various engine speeds. It is noticeable that both of the two blend fuels have advantages on the HC emissions compared with neat gasoline. At 1200 rpm, M10 and E10 produce about 10.3% and 14.3% lower HC emissions relative to gasoline, respectively. Above results have shown that M10 and E10 have higher in-cylinder peak temperature, which leads to easier post oxidization of unburned hydrocarbons, thus reducing the HC emissions. Additionally, fuel with more oxygen element tends to produce lower HC emissions.

[4]Proposed that Ethanol has the highest oxygen content, which is the main reason for the lowest HC emissions of E10 blend fuel. The indicated specific CO emissions of each fuel at various engine speeds. Generally, gasoline has the highest CO emissions compared with E10 and M10 within the speed range. CO emissions for both M10 and E10 decrease by about 2.4% relative to gasoline at 1200 rpm. Similar to unburned hydrocarbons, CO emission is also a product of incomplete combustion. Therefore, in-cylinder air-fuel equivalence ratio can dramatically influence CO emissions. Although all the experiments are conducted at stoichiometric air-fuel ratio, the actual homogenous level for each fuel in the combustion chamber differs due to their different inlet fuel film evaporation characteristics. Poor volatility property of ethanol tends to form relatively lean air-fuel mixture during the intake stroke, thus helping reduce CO emissions of E10 blend fuel.

[3]Described that Study has demonstrated the heat trapping effect of the recuperative catalytic converter. For a given space velocity that is typical for the operation of a natural gas powered vehicle, it has been seen that the combustion of added methane is able to elevate the reactor temperature to a level sufficiently high to achieve catalytic combustion of methane. The actual performance will depend on factors such as the real catalyst activity and the size of the unit. To explore further the feasibility of using such a device, a more detailed parametric study should be conducted based on a specific catalyst. The results should be compared for efficiency with the design where a separate reactor and heat exchanger are used, to determine which design offers the most promise. Metal foil substrates are being promoted as the substrates of choice for automotive catalytic converters in the European market. Thinner walls are seen to offer both lower flow restrictions and improved catalytic performance, while metal's thermal characteristics are seen to benefit both performance and durability. AC Rochester has been investigating the advantages and disadvantages of metal foil monoliths for some time and recently developed a unique low cost design that is now in low volume production for el. An extensive test was recently conducted to compare the aged performance of various metal foil and ceramic monolith converter designs. The herringbone-corrugated ACR metal units outperformed equivalent plate-fin metal and conventional ceramic units and approached the performance of 25% larger ceramic converters. However, metal's thermal characteristics may require the addition of insulation to compensate for rapid cooling during the ten minute shut-down and hot restart portion of the 23 cycle USFTP test. It was also found that tailpipe emission numbers and converter efficiencies may not accurately judge converter performance. When the pollutant levels from the test engine are not constant, but vary with converter type.

From the literature review we studied about supercharging of various engines and also studied various biofuels used in it. And, we finally concluded that supercharging system had never been implemented on SI engine. And also we came to know as we used different kind of biofuels with exact proportion then we will able to get less amount of emission from the exhaust of two wheeler manifold.

Primary objectives of a carburetor-

1) To achieve proper combustion of A/F mixture in the combustion chamber.
2) To increase the mileage of the vehicle.
3) To reduce emission of vehicle.
4) To reduce the harmful emissions from the exhaust of a S.I engine.
5) To provide an environment friendly fuel.

Objectives of supercharging:

1) To increase the power output for a given weight and bulk of the engine, which is important for the aircraft and marine engines where weight and space is of importance.
2) As the altitude increases, the density of air decreases and normal I.C. engine when operated at high altitude gives less power output due to decrease in density of intake air. Therefore to compensate the loss of power due to altitude of aircraft supercharging is done. There is 1% loss of power per 100m of altitude.
3) To generate the more power from existing engine.

Effects of supercharging:

1) A supercharged engine has air supplied to it at a pressure and density higher than the atmosphere. This increases the volumetric efficiency.
2) The mechanical efficiency of supercharged engine is more than that of naturally aspired engine when both are running at the same speed.
3) The specific fuel consumption of a supercharged engine is less due to proper combustion achieved by better turbulence.

III.SYSTEM DESIGN

The problem of low density of charge entering into the engine can be solved by supplying pressurized air to the flowing charge. This can be done by providing an air vent to the carburetor. According to the requirement and space availability a hole is drilled in the carburetor which lies between the throttle and the slider of the carburetor as shown in the figure. The flow of pressurized air in the carburetor is supplied via U-tube assembly as shown in the fig. The purpose of U-tube is to convert the velocity head of air entering into U-tube into pressure head. Thus, the reduced density of charge is increased and proper combustion of charge is achieved. The dimensions of U-tube and funnel are according to the space available.

Figure 1- Modified System

IV.RESULTS

The experiment was carried out on a 4-stroke single cylinder engine of a bike and the mileage and emission were measured. Following are the result tables of it-

Table for Emission Readings-

Table 1- Without Supercharging

Fuel / Emi.	Petrol	Petrol+Alcohol (90+10)	Petrol+Alcohol (80+20)
CO (%)	0.98	0.90	0.87
HC (PPM)	980	950	970

Table 2- With Supercharging

Fuel / Emi.	Petrol	Petrol+Alcohol (90+10)	Petrol+Alcohol (80+20)
CO (%)	0.87	0.65	0.79
HC (PPM)	900	860	900

Table for Mileage Readings-

Table 3-Without Supercharging

Mileage (KMPH)		
Petrol	Petrol+Alcohol (90+10)	Petrol+Alcohol (80+20)
48	54	55

Table 4-With Supercharging

Mileage (KMPH)		
Petrol	Petrol+Alcohol (90+10)	Petrol+Alcohol (80+20)
52	73	63

V.CONCLUSION

Due to increase of amount of air entering into system proper compression will occur**.** When proper combustion occurs amount of emission reduces.Addition of bio-fuels provides a platform for alternative fuels which able to meet requirement of gasoline or conventional fuels.Use of biofuel which are traditionally prepared can be use into internal combustion engine because of having similar properties as gasoline. By providing such supercharger system to IC engine we can able to get proper amount of air-fuel mixture ration by providing extra amount of air into carburettor. As there is proper combustion in IC engine there's reduced amount of pollutants exhausted through manifold.

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