CHAPTER 5

CONCLUSIONS AND SCOPE FOR FURTHER STUDY

5.1 Conclusions

Euro norms and BS norms are forcing the researchers and manufacturers to create innovative ideas to improve the performance to meet the emission standards. Therefore, the novel method of using inlet manifold modified using Orifice control and varying percentage of cooled exhaust gas recirculation in a two-stroke gasoline engine would contribute to the extent of minimizing the emission of harmful exhausts and maximizing the efficiency of the engine and the vehicle.

A comparison of Carbon Monoxide emission at optimum brake power for all configurations discussed have shown that maximum reduction in Carbon Monoxide emission is obtained with 2SD6 configuration at 10 % cooled EGR.

A comparison of carbon dioxide emission at optimum brake power for all configurations have shown that carbon dioxide emission is maximum for 2SD6 configuration with 10 % cooled EGR due to the maximum output produced.

A comparison of hydrocarbon emission at optimum brake power for all configurations have shown that maximum reduction in hydrocarbon emission is obtained with 2SD6 configuration with 10 % cooled EGR.

A comparison of nitrogen oxides emission at optimum brake power for all configurations have shown that maximum reduction in nitrogen oxides emission is obtained with 2SD6 configuration with 10 % cooled EGR.

A comparison between the engine performance obtained with gasoline engine without Orifice and EGR and a gasoline engine with Orifice and EGR has highlighted a

very significant increase in brake thermal efficiency and considerable reduction of both unburned hydrocarbons and specific fuel consumption.

Out of the various combinations of the orifice and percentage recirculation, it has been found out that the following combination would give the maximum efficiency and minimum emission.

- Orifice dimension 6 mm
- Percentage recirculation 10 %
- Exhaust condition required: Cooled gas through the heat exchanger

Performance improvement and Emission reduction obtained with the above modifications in the two-stroke gasoline engine as per the test results:

- Brake thermal efficiency : 41.35 %
- Specific Fuel Consumption : 202 g/kWh
- Mass Flow Rate : 16.384 kg/h
- Scavenging efficiency : 20.1 %
- Trapping Efficiency : 68.8 %
- HC emission : 2566 ppm
- CO emission : 0.165 %
- CO_2 emission : 11.9 %
- NOx emission : 700 ppm

EGR dilution is a promising way to improve the fuel economy of Spark-Ignited (SI) gasoline engines. At high load, it is very efficient in a mitigating knock at low speed and to decrease exhaust temperature at high speed so that fuel enrichment can be avoided.

With turbulent exhaust entry before fresh charge into the combustion chamber leads to rising in pressure and results in an improved rate of evaporation and combustion of fuel. The NOx emission and combustion temperature tend to increase limits, and smoke emission tend to decrease.

Mixing of the EGR and fresh air mixture is very important since by controlling the EGR stratification, the combustion timing can be controlled. In a homogeneous cooled EGR, fresh air and EGR gases are mixed upstream of the intake port and thus well mixed before injection. Homogeneous EGR supply is more advantageous for overall performance improvement namely combustion efficiency, fuel economy and a significant reduction in NOx emissions. The use of these technologies ensures rapid combustion of the fuel in the combustion chamber, lower emissions and thereby an increase in the fuel efficiency.

It can be concluded that the application of these techniques in the present-day two-wheelers with two-stroke engines will give the present generation what they want, i.e., power bikes with fuel efficiency. Since these technologies also minimise the fuel consumption and harmful emission levels, they can also be considered as one of the solutions to overcome increasing fuel costs and global warming.

We can hope for more creative technologies, which can achieve still better results because there is no end to innovation.

5.2 Scope for Further Study

The above observations in the study suggests that there is a vast scope for improving the performance of a two-stroke gasoline engine and reducing the harmful emissions to the atmosphere. The performance of the proposed modifications can be further improved by studying the effects of modern control units and state of the art accurate sensors. Apart from EGR, selective catalytic reduction (SCR) is another technique that can be pursued to meet emission norms and contribute to the greener environment.

Customer awareness on maintenance and operation of the engine is another key area of study and further research can be taken up towards this direction to achieve

optimum service timing and period and frequency of maintenance. Start-Stop system is another key area of research that can be taken up to obtain optimum economy by way of fuel saving and running-cost reduction.

Alternative fuels and fuel blending are the other major areas of study for improvement in mobility development and growth. Further study should also be aimed towards deployment of alternative energy sources and avoid hydrocarbon fuels altogether.