ABSTRACT

Increasing petroleum prices combined with depleting natural resources and increasing environmental degradation has led to the implementation of stringent Government regulations on emission norms. The scenario, however, does not affect the increasing demand for energy sources, particularly in the transport sector.

A brief literature review revealed the current scary scenario in automobile field and the urgency to consider two-wheeler engine design for global acceptance from the viewpoint of improved performance and pollution mitigation.

The poor performance of two-stroke gasoline engines as compared to four-stroke gasoline engines and Government regulations on emission norms pose a threat to the market for two-stroke engines. Short-circuiting of fresh charge is an important contributing factor for reduction in performance in two-stroke engines. This research is aimed to reduce short-circuiting of fresh charge by admitting hot and cooled exhaust gas with a simple orifice control device in the inlet modified manifold.

Impressed by the Taguchi methods and Design of Experimentation reported for simultaneous optimisation of responsible parameters and variables under many similar applications in the field, it was decided to carry out experiments on selected engines to confirm their behaviour and help in identifying a robust and efficient two-stroke gasoline engine that gives the desired performance, meets the emission norms with optimum engine efficiency and fuel economy.

A standard two-stroke gasoline engine was taken for improvement using Exhaust Gas Recirculation (EGR), and further modifications were considered to improve its performance to match a similar four-stroke gasoline engine. Different orifice diameters were used to enhance the recirculation and its effect on

performance. Percentage of exhaust gas recirculated was varied to study the performance trend and emission characteristics with variation.

The results are analysed with performance plots for the selected design parameters and the EGR provision in the two-stroke gasoline engine and shown to improve its performance with reduced emission.

Varied design parameters considered for testing are

(i) Orifice diameters 4 mm, 6mm and 8 mm respectively
(ii) Percentage recirculation 5 %, 10 % and 15 % respectively
(iii) Hot (H) and cooled (C) exhaust gas recirculation respectively.

It is finally concluded that with 10 % exhaust recirculation through cooling heat exchanger and 6 mm orifice control device gives an optimum performance matching that of an equivalent rated four-stroke gasoline engine.

The overall results of this study are:

(i) Enhanced engine performance using cooled exhaust gas recirculation.
(ii) Reduced emission of CO, NOx, and HC.
(iii) Improved scavenging and trapping efficiency.
(iv) Improved engine life through reduced cylinder temperatures.
(v) Reduced specific fuel consumption and fuel savings.