ABSTRACT

A single cylinder Briggs and Stratton experimental SI engine is used to test its performance with both petrol and LPG as fuels. This engine is provided with three replaceable cylinder heads with three different compression ratios. These are measured to be 4.5:1, 5.3:1 and 9.3:1. In order to use LPG fuel in this engine three gas carburettors are designed and fabricated with three different jet angles of 30°, 45° and 60°. An experimental set-up is then designed and developed to carry out the performance evaluation tests for both petrol and LPG fuels. The variables for the tests with petrol fuel are five selected levels of engine speed and three available levels of compression ratios with no-load and load. For test with LPG, in addition to the above variables, three different levels of jet angles are also included. Thus, there are fifteen tests with petrol and forty five with LPG. The selected levels of engine speeds are 1000, 1050, 1100, 1150 and 1200 rev/min. For the load, the initial level is 500 Watts. This is increased at steps of 500 Watts till a desired speed level could be maintained by manipulating the fuel flow to the engine. An Asymmetrical Factorial Randomised Block Design is used for the experiments. In each test with petrol, initially the desired level of speed is set and the exhaust gas temperature is allowed to reach a steady value. Then the fuel consumption is measured accurately and the flow rate is evaluated. Similarly, the air-flow rate is evaluated and the steady value of exhaust gas temperature is recorded. From the data obtained, the brake power, brake specific fuel consumption, brake specific energy consumption,

brake thermal efficiency, air-fuel ratio and volumetric efficiency are evaluated. Same procedure is followed for the forty five tests with LPG fuel. The results obtained from the tests with both the fuels are statistically analysed and ANOVA tables are prepared. A second order regression equation is used to obtain the coefficients of the three variables. These are engine speed, compression ratio and brake power/brake specific fuel consumption/brake thermal efficiency. From the values of the coefficients a high degree of fit is observed. From the data a mathematical model is also developed. The results obtained are also graphically illustrated.

From the results it appears that, with the increase in compression ratio the brake power and brake thermal efficiency increase significantly for both the fuels. Further, comparable results as that of petrol are obtained with LPG when the jet angle of the gas carburettor is 30°. From the cost analysis, it is observed that the cost of operating the engine with LPG is lower than that of petrol. Thus, within the present level of development, it appears the use of LPG in a low speed low output SI engine is a viable proposition.

Key Words :

SI engine; LPG carburettor; jet angle; engine speed; compression ratio; dynamometer; performance evaluation; brake power; brake specific fuel consumption; brake specific energy consumption; brake thermal efficiency; air-fuel ratio; volumetric efficiency; exhaust gas temperature; regression equation; mathematical model; cost analysis.