

Performance of Petrol Engine using Gasoline–Ethanol–Methanol (GEM) Ternary mixture as Alternative Fuel

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Abstract. Bioethanol fuel produced from biomass and bioenergy crops has been proclaimed as one of the feasible alternative to gasoline in internal combustion engines. In this study, the effect of gasoline–ethanol–methanol (GEM) ternary blend on performance characteristics of petrol engine was studied. Three different fuel blends, namely, E0 (gasoline), G75E21M4 (75% gasoline, 21% hydrous ethanol and 4% methanol) and E25 (25% anhydrous ethanol and 75% gasoline) were tested in a 1.3-l K3-VE spark-ignition engine having four cylinders, dynamic variable valve timing, and electronic fuel injection. The experimental results revealed that using G75E21M4 fuel blend increased the air-fuel ratio, engine power, torque, brake thermal efficiency, and mean effective pressure compared to E0 and E25, however, fuel consumption also increased.

Introduction

The increasing demands of petroleum fuels together with the greenhouse gas emission have stimulated the efforts on discovering new alternative fuels. The most significant alternative for replacing petroleum fuels in internal combustion engines are biofuels (biodiesel and bioethanol). Many researches have investigated the effect of ethanol and gasoline blends in petrol engines. Most of the researchers noticed, when ethanol blended gasoline was used, increase in engine brake power, engine torque, brake thermal efficiency, mean effective pressure, and volumetric efficiency, moreover, specific fuel consumption also increased. During bioethanol fuel production from lignocellulosic biomass, while using the normal column type distillation, a maximum of 96% ethanol was obtained with 3.7% methanol and 0.3% water content from the fermented bioethanol in our previous study [1]. A high energy and cost is required to separate the methanol and water from bioethanol after distillation. This ternary (ethanol–methanol) mixture of lignocellulosic bioethanol can be used in petrol engine together with gasoline. Turner *et al.* [2] recommend using ethanol–methanol–gasoline ternary blend to flexi-fuel vehicles after examining the iso-stoichiometric properties of ternary blends. They also investigated the effects of ternary blends (85% ethanol–methanol content rate) on flexi-fuel vehicles. Recently, Elfasakhany [3] investigated the effect of ethanol–methanol–gasoline ternary blends in single cylinder SI engine at lower content rate of ethanol–methanol blend (3-10 Vol. %). Moreover, Sileghem *et al.* [4] studied the effect of ethanol–methanol–gasoline ternary blends in four cylinders SI engine with port fuel injection at high content rate of ethanol–methanol blends (60 Vol.%). The objective of this study is to investigate the effect of gasoline–ethanol–methanol (GEM) blend on the performance characteristics of K3-VE petrol engine at variable engine speed and full load condition. In this experiment, three different fuel blends, such as E0 (gasoline), G75E21M4 (75% gasoline, 21% hydrous ethanol and 4% methanol), and E25 (25% anhydrous ethanol and 75% gasoline) were tested. Hydrous ethanol contains 95% ethanol and 5% water in Vol. %. This is the first study to investigate the effect of GEM fuel blend in