The effect of different alcohol fuels on the performance, emission and combustion characteristics of a gasoline engine

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The effect of different alcohol fuels on a gasoline engine was investigated. The tests were performed at full load and varied engine speeds. BTE, BSFC, and combustion efficiency increased while HRR and emissions decreased with alcohols. The cylinder gas pressure and heat release rate occurred earlier.

In this experimental study, the effect of alcohol (ethanol and methanol) use on the performance, emissions and combustion characteristics of a low power single-cylinder engine described the rated power output of the engine e.g. 2 kW were investigated and the results were compared with conventional gasoline operation. The tests were performed at full-throttle valve opening and variable engine speeds. The results show that the use of alcohol fuels increased the engine torque, brake specific fuel consumption (BSFC), thermal efficiency and combustion efficiency. In addition, the cylinder gas pressure and heat release rate occurred earlier; carbon dioxide (CO2) emission increased while hydrocarbon (HC), carbon monoxide (CO) and nitrogen oxides (NOx) emissions decreased.

1. Introduction

Today, low power gasoline engines (LPGEs) are commonly used in many fields. In the areas such as horticultural machineries, generators, off-road vehicles, irrigation systems, etc., LPGEs are preferred as driving power. The engine's being air-cooled and having carburetor causes negative effects in terms of efficiency and environmental pollution. Due to the fact that their dimensions are small and in terms of covering the costs, the applicability of the technologies used at the today's contemporary automobiles (fuel injection system, EGR, catalytic converter, etc.) on these engines gets more difficult [1–4]. Even if the machines on which the LPGEs are used seasonally, once in a week or for a couple of hours in a day, their exhaust emissions have important effects on the environmental pollution. Also, as these engines work with light rich mixture, their BSFCs and exhaust emission values are high [5].

LPGEs which can also be used as power sources in the forklift, generator and band transmission systems available in the closed environments such as warehouse, apartment and factory have low emission levels is very important in terms of human health [5]. In the gasoline engines, as alternative to gasoline; alcohol fuels such as ethanol, methanol, butanol and gaseous fuels such as liquefied petroleum gas are used. The usage of methanol and ethanol in engines as alternative fuel dated back to 1894. At the beginning of 19.century, the studies decelerated and after the oil crisis in 1970, the studies made on the alternative fuels accelerated again [6]. The alcohol fuels are used as pure or making mixtures with gasoline at engines.

In the literature, many experimental studies dealing with the effects of alcohol usage in the internal combustion engines on the engine performance, exhaust emissions and combustion characteristics have been made. In one study [7] realized on an