



## Research Paper

## Investigation of the effects of iso-butanol additives on spark ignition

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Hazim Sharudin<sup>a</sup>, Nik Rosli Abdullah<sup>a,\*</sup>, G. Najafi<sup>b</sup>, Rizalman Mamat<sup>c</sup>, H.H. Masjuki<sup>d</sup><sup>a</sup> Faculty of Mechanical Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Malaysia<sup>b</sup> Tarbiat Modares University, Tehran, Iran<sup>c</sup> Faculty of Mechanical Engineering, Universiti Malaysia Pahang, 26600 Pekan, Malaysia<sup>d</sup> Centre for Energy Sciences, Faculty of Engineering, University of Malaya, Department of Mechanical Engineering, 50603 Kuala Lumpur, Malaysia

## HIGHLIGHTS

- Iso-butanol additive on methanol-gasoline blends improved the brake power.
- BSFC was increased for alcohol-gasoline blends compared to the base fuel.
- Additive of iso-butanol improved BTE and was slightly higher than base fuel.
- CO and HC emission decreased for methanol-gasoline blends with iso-butanol.
- NO<sub>x</sub> and CO<sub>2</sub> were higher for all methanol-gasoline blends with iso-butanol.

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## ABSTRACT

Alternative fuels on internal combustion engine (ICE) recently has become an attention due to the concern for environmental protection, and needs on reducing dependency on fossil fuels and meeting the current stringent regulation. Alcohol fuel is one of the attractive alternative fuels as it can be produced from renewable resources and is oxygenated. Methanol fuel is a well-known alcohol fuel that can be blended at the lower blending ratio with gasoline and produce better engine operation in spark ignition engine. However, there is a problem related to its methanol properties, especially on its energy content and vapour lock characteristics. Alcohol with higher carbon number such as iso-butanol has high energy content and is able to displace more petroleum gasoline compared to the methanol-gasoline blended fuel. In this study, the focus on the effect of the iso-butanol additive in the methanol-gasoline fuel of unmodified spark ignition engines. A lower ratio of methanol-gasoline blends (M5) was blended with the iso-butanol additive for 5 to 15% with 5% increment compared with base gasoline fuel. Tests were conducted at constant load (100%) with a variable of lower engine speed range from 1000 rpm to 2500 rpm. The results indicate that as for engine performance, M5B15 displayed improvement in engine brake power, BTE (brake thermal efficiency), and EGT (exhaust gas temperature) compared to other blended fuels. Nevertheless, there is a higher fuel consumption was recorded for all methanol-gasoline blended fuels with iso-butanol additive compared to base gasoline fuel. In terms of engine emissions, M5B15 gives a significant reduction in CO and HC emissions compared to base gasoline fuel. However, the increasing trend projected by NO<sub>x</sub> and CO<sub>2</sub> emissions had been recorded in all iso-butanol additive in methanol-gasoline fuels with M5B15 exerting the highest emissions. It can be concluded that iso-butanol additives are a viable option to be blended with existing lower ratio of methanol-gasoline for spark ignition engine operation as an alternative fuel.