TEST Engineering & Management

January - February 2020
ISSN: 0193 - 4120 Page No. 3559 - 3565

Numerical study of combustion characteristic, performance and emissions of a SI engine running on gasoline, ethanol and LPG

Mohanad Aldhaidhawi[1*], Muneer Naji[1], Kassy A. Subhi[2]
[1]Al-Furat Al-Awsat Technical University, Technical Institute of Kufa, Iraq
[*]Email: mohanadhamazah@gmail.com
Phone: +9647808376181
[2]Al-Furat Al-Awsat Technical University, Technical Collage/ Al-Mussaib, Iraq

Article Info
Volume 82
Page Number: 3559 - 3565
Publication Issue:
January-February 2020

Article History
Article Received: *18 May 2019*
Revised: *14 July 2019*
Accepted: *22 December 2019*
Publication: *20 January 2020*

Abstract:
A numerical study has been carried out to determine the combustion characteristics, engine performance and emissions of a spark ignition engine. In this work, a four-cylinder,four-stroke indirect injection engine fueled with gasoline, LPG and ethanol was used. The results were collected at a constant engine speed of 2500 rpm with variable compression ratios of 8.5:1, 10.5:1, 12.5:1 (original), 14.5:1 and 16.5:1. Calculations focused on how the parameter of compression ratio could affect variables such as emissions, peak fire temperature, peak fire pressure, specific fuel consumption, effective torque, and brake power. In the findings, it was established that under various compression ratios, LPG and ethanol exhibit superior or better combustion and performance characteristics. It was established further that on all the selected compression ratios, when ethanol is used as the engine fuel, there tends to be a notable decrease in the emissions of unburned hydrocarbon, nitrogen oxide, and carbon monoxide.

Keywords: *ethanol, LPG, performance, combustion, numerical*

I. INTRODUCTION

It is necessary to reduce undesirable emissions from internal combustion engines that have a negative influence on the environment causing various problems such as respiratory hazards, acid precipitation, global warming and ozone depletion. Several studies have reported that passenger car emissions using fossil fuels contribute around 18% of CO, 20% of CO_2, 14% of black carbon and 37% of NOx [1-5]. Therefore, it is very important to use clean alternative fuels, such as Natural Gas (NG), biodiesel, ethanol, Liquefied Petroleum Gas (LPG) and Hydrogen. Moreover, these types of fuels have several advantages including, but not limited to, their high octane number, clean combustion, high availability and attractive price compared to fossil fuels [6,7].

In the study by Warade and Lawankar [8], the objective was to examine how blends of LPG and ethanol affect the emissions and performance of engines. The experimental conditions involved different engine loads and a constant speed. In the findings, it was avowed that when the blends are employed, there tends to be a reduction in the emission of unburned hydrocarbons and carbon monoxide while yielding an improvement in thermal efficiency. Thus, the blends were found to outperform gasoline fuel. In a similar study, Chaichan et al. [9] strived to investigate the impact posed by liquefied petroleum and natural gas usage on the brake power of engines, as well as the thermal efficiency and fuel-consumption of