

EFFECT OF AMBIENT TEMPERATURE ON THE PERFORMANCE OF A DIESEL ENGINE OPERATING WITH BIOFUEL

Akasyah M Khathri^{1,a}, Rizalman Mamat^{1,b}, Adam Abdullah², Amir Aziz¹, Hafizil Mat Yassin¹

¹Faculty of Mechanical Engineering, University Malaysia Pahang,
26600 Pekan, Pahang, Malaysia

Email: ^aakasyah.mk@gmail.com, ^brizalman@ump.edu.my

²Automotive Engineering Centre, Universiti Malaysia Pahang,
26600 Pekan, Pahang, Malaysia

ABSTRACT

Biofuel is an alternative fuel source for diesel engines. This resource is said to have the potential to make diesel engines more efficient and economical. The aim of this paper is to study the effect of ambient temperature on combustion and performance of a diesel engine when using biofuel. The one-dimensional numerical analysis uses the GT-Power software program to simulate a commercial 4-cylinder diesel engine. The diesel engine is simulated in order to study the characteristics of engine performance when the engine is operating with ethanol and methanol as alternative fuels. The simulations were conducted at full-load condition for the engine operating with diesel, ethanol, and methanol. Ambient temperatures used for each test were 30, 40, and 50 degrees Celsius. The simulation results show that the in-cylinder pressure for ethanol is higher than for methanol and for diesel at different ambient temperatures. In other tests, methanol was found to yield a higher rate of heat release compared to ethanol and diesel fuel. It can be concluded that biofuels are excellent fuel alternatives to replace diesel fuel in the future.

Keyword: Ambient temperature, diesel engine, performance, biofuel, in-cylinder pressure

INTRODUCTION

The internal combustion engine is a machine that converts the chemical energy in a fuel into mechanical work. The chemical energy of the fuel is converted to thermal energy through combustion with the help of oxygen in combustion engines. Strong release of thermal energy will result in a piston pushed down and a crank rotated at a speed proportional to the kinetic energy received. There are two types of internal combustion engines that are very popular at present: gasoline and diesel engines (Hindren A. Saber, 2013). Typically, a diesel engine is good for moving heavy machinery in rough conditions. Many studies have found that diesel engines are more efficient than gasoline engines in terms of thermal efficiency (A. S. Kumar, Maheswar, & Reddy, 2009). Diesel engines are also more economical as well as more durable.

However, the increased use of petroleum fuels today has resulted in the dwindling of natural resources. Consequently, surveys for alternative fuel sources have been performed by many researchers. Biofuels are transportation fuels such as ethanol and methanol that are produced from biomass materials. Usually this fuel will be blended with the petroleum fuels, namely with diesel and gasoline fuel (Komninos & Rakopoulos,