CHAPTER

5

EFFECT OF METHYL ESTER ON COMPRESSION-IGNITION ENGINE FUELLED WITH DIESEL-ETHANOL BLEND

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5.1 INTRODUCTION

In recent years, researchers are investigating the usage of alternative fuels that are compatible with the behaviour of internal combustion engine (ICE) due to the uncertainty of diesel and gasoline fuels global pricing and the issue associated with exhaust gas emissions from the engine. The main aim of the research is to ensure that ICE technology is going to be more fuel economy, sustainable, and capable for robust and extensive operations (Mohd Perang, 2017). This investigation revealed the use of methyl ester (ME) concentration in alcohol mixed fuel as an alternative fuel for use in the conventional compression ignition (CI) engines. In CI engine, or can be referred as a diesel engine, fuel is directly injected into the combustion chamber. Ethanol is one of alcohol-based fuel type that has gained a lot of acceptance either mixed as additives or blends with diesel fuels (Szwaja & Naber, 2010; Bayraktar, 2008). Ethanol was generated by fermentation method using existing enhanced and establish technology, which from subsistence crop of renewable raw material such as sugar cane, cassava, corn, barley, molasses, sorghum, waste biomass materials, etc. (Prasad et al., 2007; De Caro et al., 2001). The methyl ester/biodiesel, which acts as the additive is added to a mixture of conventional diesel fuel and ethanol fuel in order to stabilize the blended fuel for use in CI engine (Wojciech et al., 2015). The cost and the demand of crude oil on the global market are the two main factors that influenced day-by-day fluctuations in diesel and petrol fuel prices. Thus, many researchers and the transportation vehicle industry have developed technology of alternative fuels that fulfils with the features of conventional diesel fuel and can be comparable or greater efficiency of CI engine and less emission emitted. The exhaust gas emissions from the engine also contribute to the air pollution that demonstrating yearly aggravation causes from transportation sources such as passenger cars, light-duty truck and medium/heavy vehicle which burnt lots of fossil fuels. The extensive utilisation of fossil fuels can contribute to the gradual escalation of global warming problem and climate change issue (Giakoumis et al., 2013).

Additionally, ethanol belongs to the category of biofuels, which can be produced from agricultural goods and can lessen dependence on the import of crude oil while simultaneously boosting farming revenues (European Parliament, 2009). Incomplete respiratory particles (such as hydrocarbon which can enhance the formation of photochemical smog) and oxides of nitrogen (NOx) that are hazardous to human health and the environment are mostly released by the CI or diesel engines (Wojciech et al., 2015). NOx also can cause smog when interacting with hydrocarbon molecules during the sunlight (Heywood, 1988).

In this study, one of the promising solutions to the challenges associated with fuel prices and air pollution is the use of ethanol blended fuel, a sustainable energy source, in the research engine. The benefits of using ethanol blended fuel in CI engines are produced better efficiency, lower emissions into the atmosphere, economical fuel consumption and the engine will not depending on the fossil fuel resources.

This experimental work employs the following fuels: (1) Conventional diesel (D100) fuel, (2) Conventional diesel-ethanol (D-

E) blended fuel, and (3) Conventional diesel-ethanol-methyl ester (D-E-ME) blended fuel. The research objectives are to investigate the effects of the additional of fixed concentration of ME as blending additives to D-E blended fuel operated on the unmodified conventional CI engine, which the performance, emissions, and combustion characteristics of the tested engine have been determined.

5.2 DATA COLLECTION METHOD FRAMEWORK

An extensive experimental program covered the installation of sensors, instrumentations, measurement apparatus and attachment between the engine and the dynamometer.

5.2.1 Engine Testing Setup

A conventional four-stroke, 320 cc, direct injection, compression-ignition, air-cooled system, single-cylinder YANMAR-L70N engine is used for engine testing activity. Table 5.1 shows the specifications of the engine and Figure 5.1 illustrates the diagram of engine test setup.

Table 5.1 YANMAR-L70N engine specifications

Models	L7ON
Number of Cylinder	1
Compression Ratio	20
Bore × Stroke	78 mm × 67 mm
Displacement	320 cc
Start of Injection	30° BTDC
Continuous Rated Output	4.1 kW at 3600 rpm
Max, Rated Output (Net)	4.9 kW at 3600 rpm