Effects of fuel additive to the fuel economy and emission in gasoline engine

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ABSTRACT – One of the methods to improve the combustion behavior in internal combustion engine is by introducing additive to the base fuel. However, some additive resulted in higher Brake Specific Fuel Consumption (BSFC) and emission of CO and NOx. The objective of this study is to examine the effects of fuel additives quantity to the fuel economy and engine emission. The tests were carried out at different engine speeds (1500rpm-3000rpm) and different engine loads (40Nm - 100Nm) using a four stroke gasoline engine. The additive was blended with gasoline (RON95) in composition of 5, 10 and 15 milliliter per liter accordingly. BSFC was measured using Pro V2 software and exhaust emission was measured using MRU AIR gas analyzer. Results showed that gasoline blended with 5ml fuel additive lead to a significant improvement on (BSFC) and higher carbon dioxide (CO_2) in its emission. Base fuel blended with 10ml/l and 15ml/l additive showed increasing in BSFC.

1. INTRODUCTION

In current economy crisis, requirement to develop high technologies for securing usage of lower fuel consumption with higher ambient air quality improvement, green house gas reduction and energy security becomes highly important in automotive industries. Considering stringent emission regulations, as well as increasing shortage of primary energy resources, the development of new highly efficient and environment friendly combustion systems, associated with alternative fuels becomes increasingly important and hence research need to be carried out in this domain. One of the best method to improve the combustion behaviour is by blending base fuel with additives [1-3] Eventhough fuel additive shows a positive result, it also has several problems including higher octane number that lead to engine damage due to knocking. There are two objectives of this study:

i. To examine the effect of various ratios fuel additives blended with gasoline to the brake specific fuel consumption and exhaust emission of spark ignition engine.
ii. To compare the effect of various quantity of fuel additive to the fuel economy and exhaust emission.

2. METHODOLOGY

Experimental work is carried out by using a four stroke gasoline engine attached with the dynamometer and fuel measuring system. Engine was run at various engine loads (40-100 Nm) and speeds (1500-3000 rpm). During each test, the engine was warm up with base fuel for 15 minutes to stabilize the engine temperature. The detail of the engine specification is shown in Table 1.

Table 1 Engine specification.

Powertrain Engine and Performance	
Gasoline Engine	4 Cylinder, DOHC 16V
Injection Type	Fuel system multi-point injection (MPI)
Configuration	In-line
Bore (mm)	76
Displacement (mm)	1597
Stroke (mm)	88

Test fuel used in this study is Gasoline (RON95). Every one liter of gasoline was blended with 5, 10 and 15ml of additive. Two important parameters namely engine speeds and loads were control during the test. Pro V2 software is used to communicate with engine and dynamometer. The data from the dynamometer sent to DaTAQ Pro V2 for analysis and Gas analyzer MRU AIR is used to measure the CO emissions.

3. RESULTS AND DISCUSSION

Figure 1 shows the pattern of brake specific fuel consumption (BSFC) for RON 95 at various engine speeds and constant engine load (40 Nm). From the figure, reduce the additive tend to reduce the amount of BSFC. This was believed due to improvement of combustion process through the increments of efficiency of the combustion. From the literature, the reduction in BSFC is reported due to the ability of additive to reduce the friction in combustion chamber [1, 4].

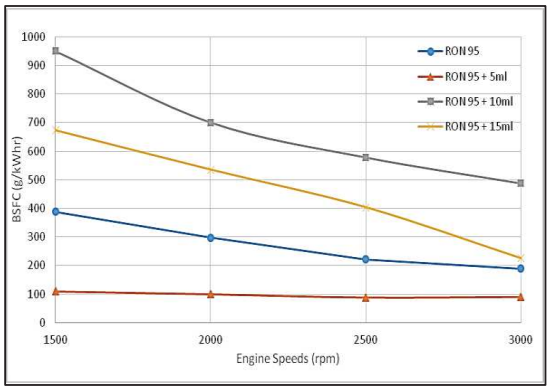

Figure 1 Engine speed versus BSFC

Figure 2 shows the percentage of carbon dioxide (CO_2) emissions for RON 95 at various engine speeds at constant engine load (100 Nm). The result proves that by adding additive, it tends to increase the carbon dioxide. Increases of carbon dioxide are due to the effect increases of oxygen that contribute to increase the rate of complete combustion [1]. Increase of oxygen in combustion will result more carbon able to be converted to carbon dioxide [5, 6].

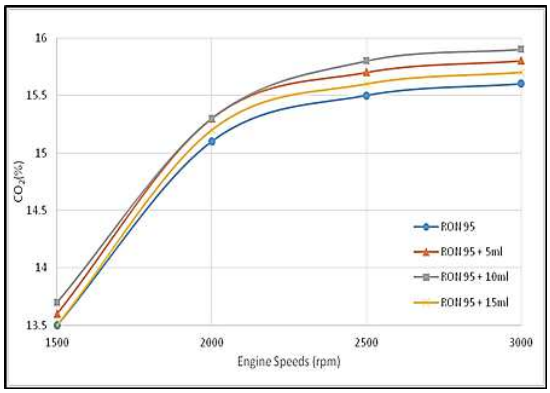

Figure 2 Engine speed versus carbon dioxide.

4. CONCLUSIONS

The results found that base fuel blended with additive improved the BSFC and reduce in CO emissions. The study proved that base fuel (RON 95) without additive resulted in lower engine performance and higher exhaust emission compare to base fuel with additive. The comparison between constant speed with variable loads and constant load with variable speeds of engine performance and exhaust emission are listed below:

1. Base fuel blended with 5ml/l of additive resulted in decreasing of brake specific fuel consumption by approximately 8% but show the increasing of carbon dioxide by approximately 5% compare with base fuel without additive.
2. Base fuel blended with 10ml/l of additive resulted in increasing carbon dioxide by approximately 7% and BSFC by approximately 12% compare with base fuel without additive.
3. Base fuel blended with 10ml/l of additive resulted in increasing carbon dioxide by approximately 3% and brake specific fuel consumption by approximately 6% compare with base fuel without additive.

In conclusion, the base fuel blended with additive show higher brake specific fuel consumption and lower in CO emissions. This is due to the properties of additive that act as a lubricant and oxidizing agent.

5. ACKNOWLEDGEMENT

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