The Effect of Electromagnetization Fuel using Bioethanol-RON 90 Blends on Exhaust Emission Engine 125 CC

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Abstract: Research related to using bioethanol as a renewable energy that can be fuel substitution for gasoline with hopefully can decreasing exhaust emission has been carried out by researchers. Beside that, most of the researchers using magnetic fields to improve the quality of combustion for decreasing exhaust CO emission. Therefore, the objective of this research was to determine the effect of electromagnetization fuel using Bioethanol-RON 90 blends on exhaust emission engine 125 CC. The independent variable of the study is the variation of the fuel composition based on percent volume and engine speed (RPM) while the dependent variable is the exhaust gas emissions. Giving the electromagnetic effect causes the combustion efficiency which is shown by the the reduced amount of incomplete combustion gas emissions. The combustion efficiency occurs due to the effect of the phenomenon of fuel magnetization in the combustion chamber causing polarization (due to magnetic induction) on hydrocarbon molecules. The results of this study is E20 (20% Bioethanol blend with 80% RON 90) is the best composition fuel. Using E20 with exposure electromagnet at 3000 rpm can decrease approximately 47.37% carbon monoxide emission, increase approximately 26% carbon dioxide, and decrease approximately 33.2 % oxygen emission.

1 INTRODUCTION

The incomplete combustion process is a problem encountered in efforts to improve the performance of gasoline engines. Poor fuel quality is one of the factors causing imperfections the combustion system. Various methods are used to solved that problems, one of the method is by using environmentally friendly biofuels such as bioethanol. The characteristics of bioethanols as a fuel have the advantages, it is low greenhouse effect, it can decrease gas emission by up to 50% compared to fossil fuel, ability to blend with gasoline homogenously (Alper et al. 2015). Using the bioethanol blended with gasoline was better than pure gasoline because its renewability, less toxicity. (Wibowo et al. 2019). Despite all those benefits, bio-ethanol has some drawbacks due to its high viscosity and octane number where the combustion process on standard/gasoline engines cannot run completely. The solution to this problem can be done by mixing gasoline with bioethanol at certain levels and utilizing electromagnetic fields.

The electromagnetic field installed on the fuel pipe before the injector can improve the quality of combustion which is indicated by decreasing the emission levels of CO, NO and HC exhaust gases (Nufus, Praeko, Setiawan, & Hermawan, 2017; Kolhe, Shelke, & Khandare, 2014; Chaware 2015; Okoronkwo et al. 2010). The electromagnetic field on Hydrocarbon fuel can pulling away and stretching the bond between molecules, even though the bonds between H-C atoms are not separated from each other, the strength of the bonds will be slightly weakened due to stretching bond so that the hydrogen and carbon atoms will be more easily attracted to oxygen in the combustion process. Resulting in more complete combustion and reduced levels of exhaust emissions (Faris *et al*. 2012).

Based on those explanations, the objectivity of this research is to study the effect of electromagnetization fuel using Bioethanol-RON 90 blends on exhaust emission engine 125 CC. The independent variable in this research is variation composition fuel to analyze the ideal composition of the mixture of bioethanol and RON 90 in order to obtain optimal gasoline engine combustion

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performance, refer to the result of exhaust gas emissions from engines which is affected by electromagnetic field treatment in the fuel line.

2 RESEARCH METHOD

The engine that used for the research is a gasoline motorcycle with a 125 cc cylinder capacity injection system, engine specifications shown in Table 1. The strong magnetic field used was 1419 Gauss. While the fuels used are E0 (100% RON 90), E10 (10% bioethanol and 90% RON 90), E15 (15% bioethanol and 85% RON 90), E20 (20% bioethanol and 80% RON 90), E25 (25% bioethanol and 75% RON 90) and E30 (30% bioethanol and 70% RON 90). The fuel specifications used are presented in Table 2. The test were performed at different engine speeds of 1500, 2000, 2500, and 3000 rpm.

The research begins by calibrating the equipment needed, examining gasoline engine components such as lubricating oil, lubricating oil filters and material filters. Next, all the instruments are strung together as shown in Figure 1. Gas emission from mixed fuel combustion will be characterized using gas analyzer Stargas 898.

Table 1. Gasoline Engine Specifications (Yamaha, 2020)

Engine Type	4 Stroke, SI Engine, DOHC, Air Cooled
Bore x Stroke	52.4 x 57.9 mm
Volume	125 cc
Compression Ratio	9.5 : 1
Maximum Power	7 kW / 8000 rpm
Maximum Torque	9.6 Nm / 5500 rpm
Ignition System	TCI/ Fuel Injection

Table 2. Fuel Specifications (Agathou & Kyritsis, 2012)

Property	RON 90	Bioetanol
Formula (liquid)	C_8H_{18}	C_2H_5OH
Molecular weight (g/mol)	11.15	46.07
Density (kg/m3)	765	785
Heat of vaporization (kJ/kg)	305	840
Stoichiometric air-fuel ratio by mass	14.6	9
Research octane number	90	108.6

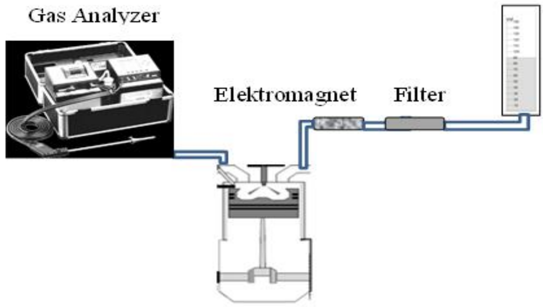

Figure 1 Installation the Instruments

3 RESULTS AND DISCUSSION

Clusters in hydrocarbons (due to non-polar) cause the phenomenon of incomplete combustion due to the difficulty of oxygen entering the hydrocarbons, thus producing CO gas and carbon residues both in exhaust gas and in the combustion chamber walls.. Therefore, one way to analyze the effectiveness of perfect combustion due to the effects of fuel magnetization is by emission testing. Based on Figure 2, it can be seen that the effect of the fuel magnetization phenomenon on the combustion chamber causes polarization (due to magnetic induction) on hydrocarbon molecules, so that what used to be a cluster (non-polar) becomes a decluster.

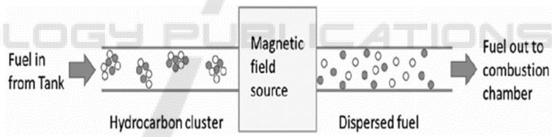

Figure 2. Fuel Magnetization Process in the Combustion Chamber

Declusterization of hydrocarbon molecules due to the effect of magnetic induction will cause a reduction in exhaust emissions from incomplete combustion, such as (CO, CO_2, HC, and O_2). Emission test results on the combustion of gasoline RON 90 with the variation of bioethanol blended 0%, 10%, 15%, 20%, 25%, and 30%, with the phenomenon of electromagnetization in the combustion chamber are shown in Figure 3, 4, 5, and 6.

Figure 3 showed the value emission of carbon monoxide from the engine. It can be seen that the increase of engine speed cause increasing emission of carbon monoxide. The effect of electromagnetization fuel is a reduction in CO emissions. According to the chart above , the maximum value emission of carbon monoxide is using E20 without exposure electromagnet at 3000 rpm. On the other side, using E20 with exposure electromagnet at 3000 rpm can decrease approximately 47.37% carbon monoxide. The increasing percentage bioethanol in the fuel can decrease emission of carbon monoxide from engine, it proved by the lowest value emission of carbon monoxide in 3000 rpm with E30 with or without exposure electromagnet.

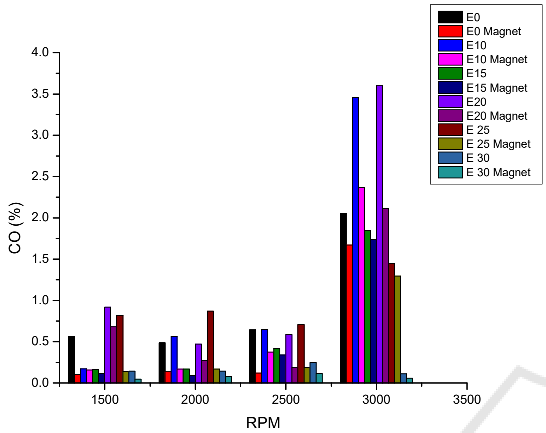

Figure 3 Carbon Monoxide Emission Testing Results

Figure 4 showed the value emission of carbon dioxide from the engine. It can be seen that the effect electromagnetization of fuel is a increasing carbon dioxide emissions, this phenomenon indicates that increasing complete combustion reaction. According to the chart above, the best increasing emission of carbon dioxide is using E20 with exposure magnet at 3000 rpm, that can increase approximately 26% carbon dioxide.

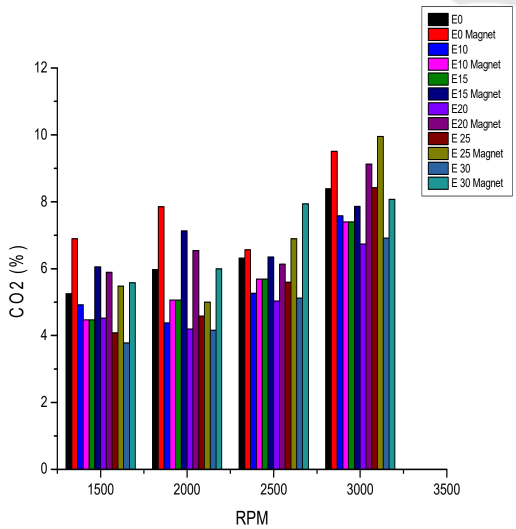

Figure 4 Carbon Dioxide Emission Testing Results

Figure 5 showed the value emission of hydro carbon from the engine. It can be seen that the increase of engine speed cause increasing emission of hydro carbon, except at 3000 rpm. The effect of electromagnetization fuel is a reduction in HC emissions. According to the chart above , the maximum value emission of hydro carbon is using E10 without exposure electromagnet at 2500 rpm. On the other side, using E10 with exposure electromagnet at 2500 rpm can decrease approximately 61.16 % hydro carbon. The lowest value emission of hydro carbon in 3000 rpm with E30 with exposure electromagnet.

Figure 6 showed the value emission of oxygen from the engine. It can be seen that the effect magnetization of fuel is a decreasing oxygen emissions, this phenomenon indicates that increasing complete combustion reaction. According to the chart above, the lowest emission of oxygen is using E20 with exposure magnet at 3000 rpm, that can decrease approximately 33.2 % oxygen emission.

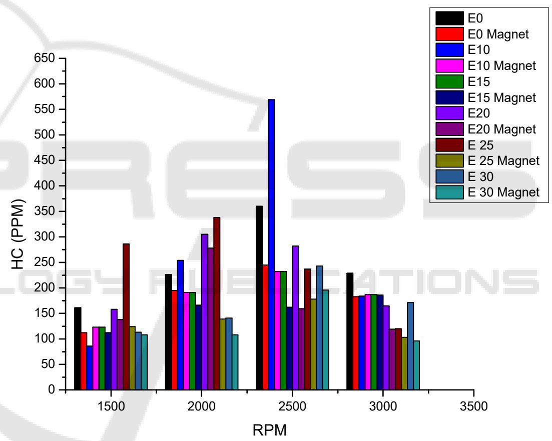

Figure 5 Hydro Carbon Emission Testing Results

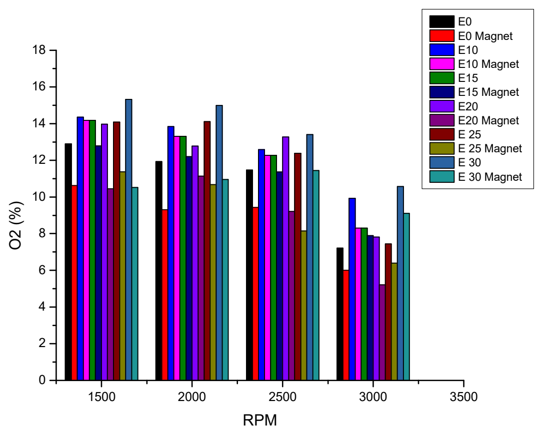

Figure 6 Oxygen Emission Testing Results

4 CONCLUSION

Based on the results of electromagnetization testing of RON 90 fuel types with bioethanol mixture variations, the following results are obtained:

1. There is a decrease in exhaust emissions (CO and HC) from engines that use a mixture of RON 90 + bioethanol which is affected by the treatment of electromagnetic fields (magnetization) of the fuel.
2. The effect of electromagnetization can increased combustion efficiency which is shown by the increase in emission carbon dioxide and decrease in emission oxygen from engine.
3. The best composition of fuel and engine speed to produce complete combustion with low exhaust emission is E20 (20% Bioethanol with 80% RON 90 at 3000 rpm), the effect of electromagnetization fuel E20 at 3000 rpm can decrease approximately 47.37% carbon monoxide emission, increase approximately 26% carbon dioxide, and decrease approximately 33.2 % oxygen emission.

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