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The Effect of Avgas and Ethanol Fuel Mixture on Fuel Spray Temperature

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Abstract
This research aims to examine the effect of the avgas-ethanol fuel mixture on the fuel spray temperature. The research was carried out using a pressurized tube which was sprayed into the mock up which was assumed to be an aircraft combustion chamber with a pressure of 2 bar and a distance of 7,73 cm which would later be sprayed using pure avgas, a mixture of avgas and ethanol namely A80E20 and A60E40 then added with a temperature sensor at the end nozzle, center of jet, and impact wall. The spray temperature can result in incomplete combustion and result in higher exhaust emissions and also damage to the engine if it does not match the temperature capacity of the combustion chamber walls. The spray temperature results for the A60E40 fuel mixture are the lowest temperature, namely 25°-18.2°C and knowing that the more fuel is mixed, the lower the temperature of the fuel.

Keywords: Language, Strengthening, high school students, word spinner

I. INTRODUCTION

The use of fossil fuels, such as avgas, in internal combustion engines has become a major source of greenhouse gas emissions and air pollution [1], [2], [3]. Therefore, research on developing environmentally friendly alternative fuels is very important [4], [5], [6]. Avgas fuel itself is a fuel commonly used in airplanes [7], [8], [9]. This fuel has a high octane number so it can produce more complete combustion [9], [10], [11]. However, avgas fuel also contains lead which can cause air pollution [12], [13]. So mixing fuel with is one solution to reduce pollution levels, where the alternative fuel that is widely researched is ethanol [14]. Ethanol can be produced from biomass sources such as corn, sugar cane, or straw, so it is considered more sustainable and can be reduce dependence on fossil fuels [15], [16], [17]. Ethanol is an alternative fuel that can be used as a substitute for avgas fuel or as a mixer [17], [18]. Ethanol has a higher octane number than gasoline and avgas but does not contain lead [19].

This research aims to examine the effect of a mixture of avgas and ethanol fuel on fuel spray temperature. Fuel spray temperature is an important factor in the combustion process [20], [21], [22]. Fuel spray temperatures that are too high or too low can cause incomplete combustion and result in higher exhaust emissions and also damage to the engine if it continues [23].

A. Avgas

Avgas / Aviation Gasoline fuel is divided into 3 types, namely AVGAS 100LL, 100, and 115UL [7], [8]. In Indonesia itself, it is often found that AVGAS 100LL is used as fuel in aircraft engines [7]. Avgas has special characteristics that meet the requirements of aviation engines and contains tetraethyl lead (TEL) as an additive. In general, the temperature of AVGAS 100LL fuel when it comes out of the injector ranges from 100°C to 115°C. Too high and too low avgas fuel spray temperatures can cause incomplete combustion and produce higher exhaust emissions, so the impact on the environment and human health is currently of great concern [7], [8].

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B. Effect of Avgas and Ethanol Fuel Mixture on Spray Temperature

Fuel spray temperature is an important factor in the combustion process. A fuel spray temperature that is too high can cause incomplete combustion and result in higher exhaust emissions [24], [25], [26]. Spraying mixed fuel can lower the temperature of the original fuel and also reduce exhaust emissions later [21], [23].

II. METHODS

In This research was carried out using a fuel spray test equipment. The fuel used in this research was pure avgas (A100), a mixture of avgas-ethanol with a ratio of 80:20 (A80E20), and a mixture of avgas-ethanol with a ratio of 60:40 (A60E40).easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it.

The test tube is filled with pure avgas fuel, a mixture of avgas-ethanol with a ratio of 80:20, or a mixture of avgas-ethanol with a ratio of 60:40 and then a pressure of 2 Bar is added to each spray. Then the nozzle is attached to the end of the test chamber and connected to the pressurized fuel tube. The temperature sensor is attached to 3 points, namely the tip of the nozzle, the middle of the spray, and the wall. Then the pressurized fuel tube was sprayed into the test chamber at a distance of 7.73 cm. The temperature of the fuel spray will later be measured using the R3 temperature sensor which is placed at the tip of the nozzle, the middle of the spray and the wall of the spray.

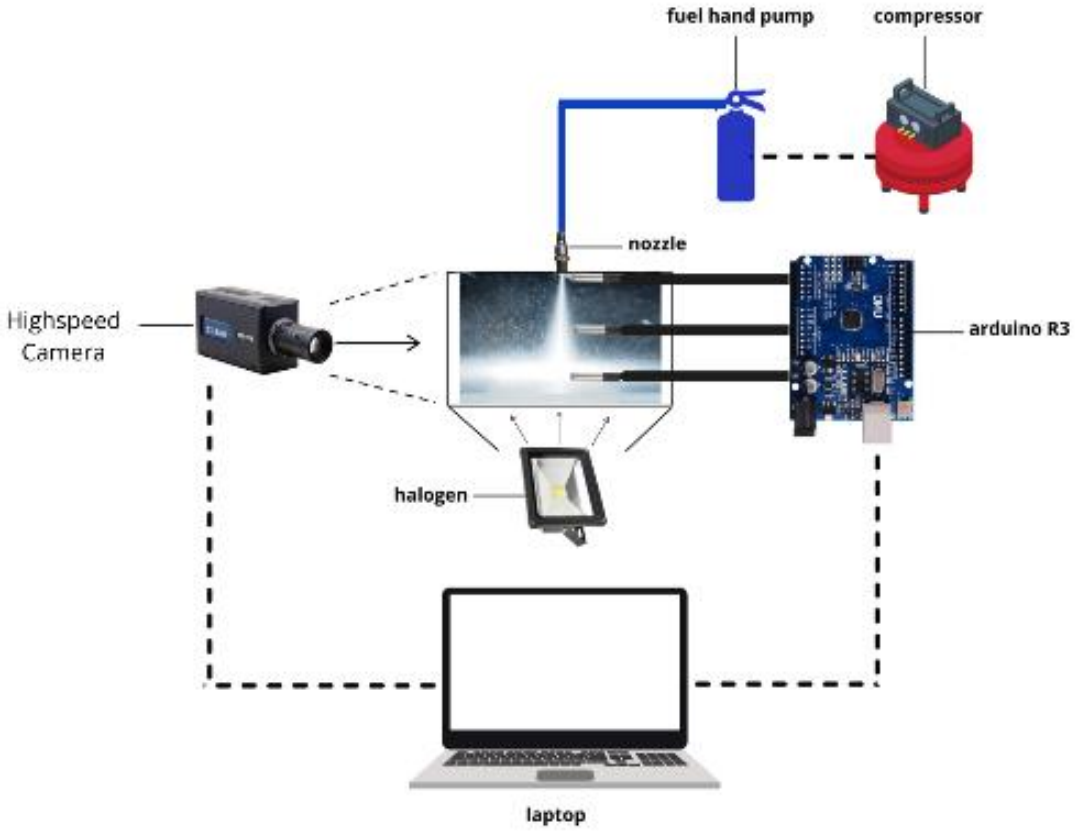

Fig. 1 Image of Fuel Spray Temperature Image

In Figure 1.1, the fuel spray test equipment consists of a pressure test tube, nozzle, and temperature sensor. Test tubes are used to contain pressurized fuel. The nozzle is used to spray fuel into the test chamber. The temperature sensor is used to measure the temperature of the fuel spray.

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III. RESULTS AND DISCUSSION

A. *Result*

The results showed that the spray temperature of pure avgas fuel was higher than the temperature of pure avgas-ethanol fuel spray. The fuel spray temperature in Figure 2 A100 is 25ºC-23ºC, the fuel spray temperature in Figure 3 A80E20 produces a temperature range of 24.5ºC-22.3ºC lower than the A100 fuel spray temperature, while the A60E40 fuel spray temperature in Figure 4 produces a lower temperature, namely 25ºC-18.2ºC, the A60E40 mixture is the lowest mixture compared to the A100 and A80E20 fuel spray temperatures.

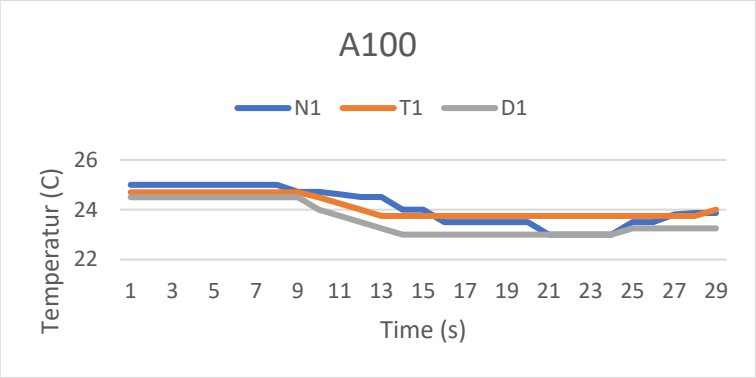

Fig. 2 A100 Fuel Spray Temperature

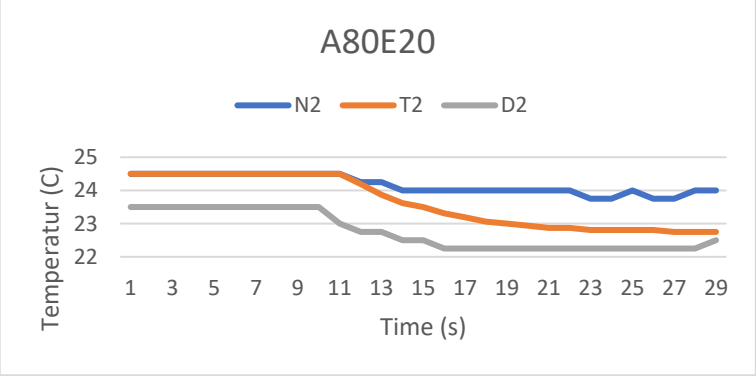

Fig. 3 A80E20 Fuel Spray Temperature

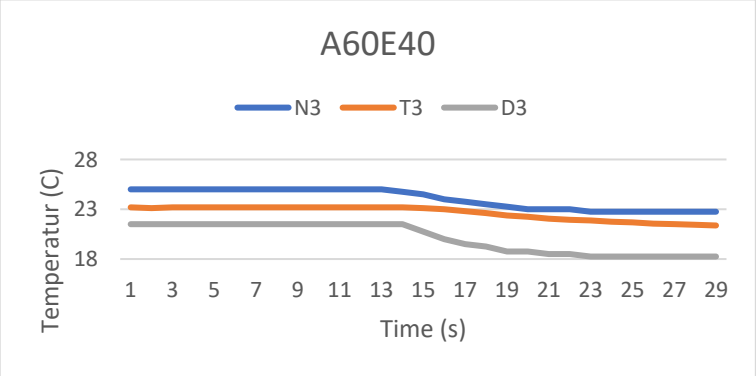

Fig. 4 A60E40 Fuel Spray Temperature

B. *Discussion*

The mixture of avgas and ethanol fuel shows the potential to reduce the spray temperature of avgas fuel and its mixture with ethanol (Ikhsani et al., 2021; Thanikasalam et al., 2018), later if engine vehicle tests are carried out it will have

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an impact on increasing fuel efficiency, reduced exhaust emissions, and increased engine power. However, further research is needed to overcome challenges related to engine compatibility, ethanol availability, and cost before widespread implementation in the aviation industry.

IV. CONCLUSIONS

By knowing that the temperature of A100 fuel is 25ºC-23ºC, A80E20 is 24.5ºC-22.3ºC, and A60E40 is 25ºC-18.2ºC, so mixed fuels can show the potential to reduce temperatures significantly with the right mixture of main fuels, So there is also the potential to reduce exhaust emissions produced by motorized vehicles, one of which is piston engine airplanes, with the right mixture and the right spray point plus the right air fuel ratio when used, the future fuel mixture will be used properly. as best as possible and also does not rule out the possibility of shifting the main fuel.

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