Analysis of the Effect of Fuel Heating Using a Shell and Tube-Type Heat Exchanger on the Mixture of Pertalite and Polypropylene Toward Exhaust Gas Emissions

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ABSTRACT

The increasing number of motor vehicles in Indonesia contributes significantly to air pollution due to higher exhaust gas emissions. One effort to reduce these emissions is through fuel heating using a heat exchanger and utilizing alternative fuel sources. This study aims to analyze the effect of using a shell and tube-type heat exchanger and a mixture of pertalite and polypropylene fuel on exhaust gas emissions. The method used is an experimental approach with independent variables being fuel temperature (without heating, 30°C, 40°C, and 50°C), dependent variables being emission levels of HC, CO, CO_2, and O_2, and controlled variables including engine speed at 1000 rpm and a fuel mixture of 70% pertalite and 30% polypropylene. The results show that using a heat exchanger can reduce HC emissions and increase combustion efficiency. In the fuel mixture, the lowest CO emission was found at 30°C with 2.29%, while the lowest O_2 level was recorded at 50°C with 13.1%. For pure pertalite, HC levels consistently decreased as the temperature increased, reaching the lowest value of 1160 ppm at 50°C. However, CO_2 levels in all tests remained below the ideal standard of 12–15%, indicating incomplete combustion. In conclusion, fuel heating can improve combustion efficiency, but optimizing the air-fuel ratio is still necessary. Future studies are recommended to test temperatures above 50°C and explore various polypropylene concentrations and environmentally friendly additives.

Keywords: *Heat exchanger, pertalite, polypropylene, exhaust gas emissions, combustion efficiency*.