

Effects of different water percentages in non-surfactant emulsion fuel on performance and exhaust emissions of a light-duty truck

*Nurul Aiyshah Mazlan a, Wira Jazair Yahya a, *, Ahmad Muhsin Ithnin a, A.K. Hasannuddin a, Nur Atiqah Ramlan a, Dhani Avianto Sugeng a, A.R. Muhammad Adib a, Tsuyoshi Koga b, Rizalman Mamat c, Nor Azwadi Che Sidik a*
aAdvanced Vehicle System, Malaysia-Japan International Institute of Technology (MJIIT), Universiti Teknologi Malaysia, Jalan Sultan Yahya Petra, 54100 Kuala Lumpur, Malaysia
bDepartment of Mechanical Engineering, Faculty of Engineering, Yamaguchi University, 2-16-1 Tokiwadai, Ube shi, Yamaguchi Prefecture 755-8611, Japan
cFaculty of Mechanical Engineering, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia

ABSTRACT

The interest in emulsion fuel grows worldwide because it is potentially more environment friendly than its base fuel. Nonetheless, it has yet to be widely used as it is pricier than conventional diesel fuel due to its dependency on surfactant. This paper highlights the application of non-surfactant emulsion fuel in a light-duty truck (1 ton). The fuel is produced on demand with the so-called Real-Time Non-Surfactant Emulsion Fuel Supply System (RTES) just before being transferred into the engine. The emission characteristics and performance of the truck were then evaluated. To identify the optimum water percentage, the RTES is controlled to produce an emulsion with various water percentages during the testing. The experiment was performed on a chassis dynamometer using the West Virginia University (WVU) 5-Peak Cycle. The variants of fuel used throughout this experiment are Euro 5 diesel (D) and emulsion fuel based from it with varying water percentage of 5% (E5), 6.5% (E6.5), 10.8% (E10.8), and 30% (E30). The smoke number and nitrogen oxides, NO_x emission of the truck are reduced with the use of emulsion fuel. E6.5 shows the highest average reduction of NO_x at 45%. E30 emits higher carbon monoxide, CO than D while its carbon dioxide, CO₂ is reduced by about 0.13%. E6.5's fuel consumption is the lowest; it is around 8.56% lower than D, followed by E10.8, E5 and E30. Overall, the concept of non-surfactant emulsion fuel appears to have the potential for application in diesel-powered vehicles to reduce harmful emissions.

Keywords: Non-surfactant emulsion fuel; Diesel emulsion fuel; Diesel emissions; Diesel engine performance