

Evaluation of ignition and combustion characteristics of bio-blended fuel using a diesel engine equipped with a DPF

Minoru Tsuda¹⁾ Masateru Ishida¹⁾ Dai Yamanishi¹⁾ Joriyuki Kanbe²⁾ Hidetsugu Sasaki³⁾

1) National Fisheries University

2-7-1 Nagata-honmachi, Shimonoseki, Yamaguchi, 759-6595, Japan (E-mail: tuda@fish-u.ac.jp)

2) Was-inc Co.,LTD.

1-1-17 Uehara, Shibuya, Tokyo, 151-0064, Japan

3) Tokyo University of Marine Science and Technology

2-1-6 Etchujima, Koto, Tokyo, 135-8533, Japan

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In this study, a 161kW/2,187 min⁻¹ diesel engine was first operated using B5 (5% biofuel blend), B10, B20, and B30 fuels to determine their ignition and combustion characteristics, as well as the GHG (CO₂) reduction rates associated with each fuel. Next, using a fuel consisting of B5 blended with a cerium-based fuel additive¹⁾, we verified the effect of oxidizing and removing soot accumulated in the DPF; by comparing these results with those of a similar experiment conducted using diesel fuel, we demonstrated that the synergistic effect of the GHG reduction provided by B5 and the soot oxidation/removal provided by the cerium-based additive makes it possible to reduce GHG emissions by 10% or more.

Figures 1 and 2 show that operating a diesel engine using B5, B10, B20, or B30 fuel can reduce GHG (CO₂) emissions by approximately 4.4%, 8.8%, 18.2%, and 27.5%, respectively, while maintaining ignition and combustion characteristics.

Figures 3 and 4 indicate that by blending a cerium-based fuel additive into B5, once the exhaust gas temperature reaches or exceeds the catalyst activation temperature, the soot that had accumulated on the DPF—while the temperature was below that threshold— is oxidized and removed from the surface; this enables the continuous oxidation and removal of soot generated thereafter.

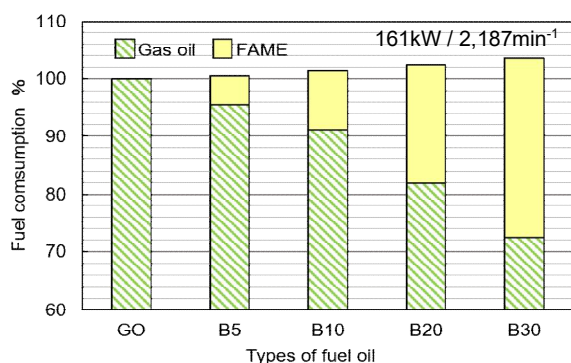


Fig.1 Change in fuel consumption and GHG reduction rates

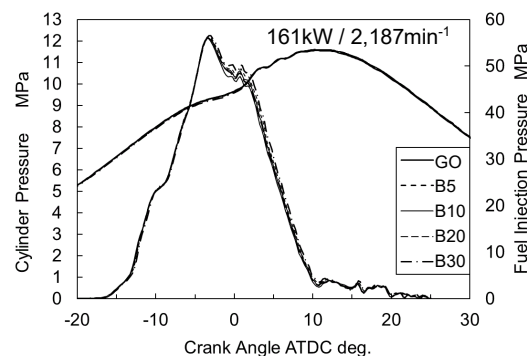


Fig.2 Changes in indicator diagram and fuel injection pressure

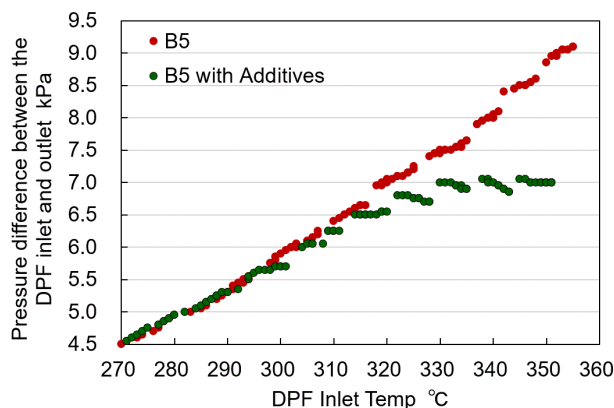


Fig.3 Changes in the pressure difference between the DPF inlet and outlet due to temperature when a cerium-based additive is mixed with B5 fuel

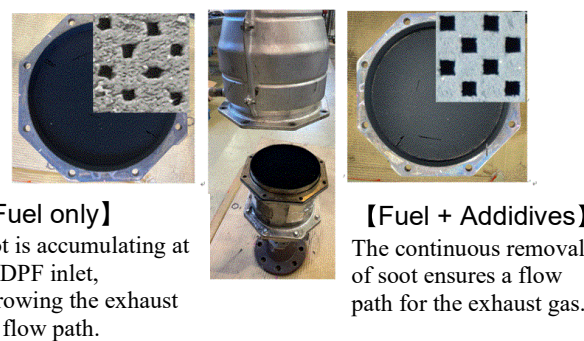


Fig.4 Soot oxidation and removal effect of a cerium-based catalyst mixed into the fuel