

Kittisak Kamsinla 2011: Effects of Coolant Temperature and Intake Mixture Preparation on Diesel Dual Fuel Engine Operating Characteristics under Part Load. Master of Engineering (Mechanical Engineering), Major Field: Mechanical Engineering, Department of Mechanical Engineering. Thesis Advisor: Mr. Tanet Aroonsrisopon, Ph.D. 103 pages.

A diesel dual fuel (DDF) using natural gas as a premixed fuel has been regarded as an alternative for conventional diesel engines. The DDF operation is subtle and involves many engine parameters. The current research investigated effects of intake air temperature, coolant temperature, and ratios of natural gas utilization on operating characteristics of a DDF engine.

In this study, the intake air temperature was varied from 30°C to 60°C, coolant temperature was varied from 45°C to 95°C and the natural gas amount was varied from 60% to 80% by energy to the total fuel. All experiments were performed in a 2494-cc Toyota 2KD-FTV under steady-state condition at 1900 and 2400 rpm. Under these engine conditions, all fuel supply was controlled constant, where the corresponding lambda of the charge mixture was 1.6. The diesel injection timing was varied from 30° to 50° BTDC.

By comparing with conventional diesel operations under the same conditions, results showed that DDF operations produced significantly greater engine-out HC and CO emissions. This resulted in a decrease in the combustion efficiency. On the other hand, the DDF operating mode produced very low engine-out smoke and NOx emissions. Raising the intake air temperature from 30°C to 60°C caused the mixture temperature at the intake manifold to increase no greater than 12°C as a result of high EGR (hotter than the intake air) regulation. Lowering the coolant temperature caused the charge to be more difficult to autoignite, the start of combustion to retard and the combustion efficiency to decrease. As the diesel injection timing was advanced from 30° to 50° BTDC, it was more difficult for the charge to ignite. It was expected that the mixture contained more premixed portion which reduced hot zones in the mixture. Furthermore, reducing the fraction of natural gas utilization from 80% to 60% helped promote the autoignition of the charge, reduce the mass-averaged temperature during the start of combustion, and decrease the engine-out HC emissions significantly.

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