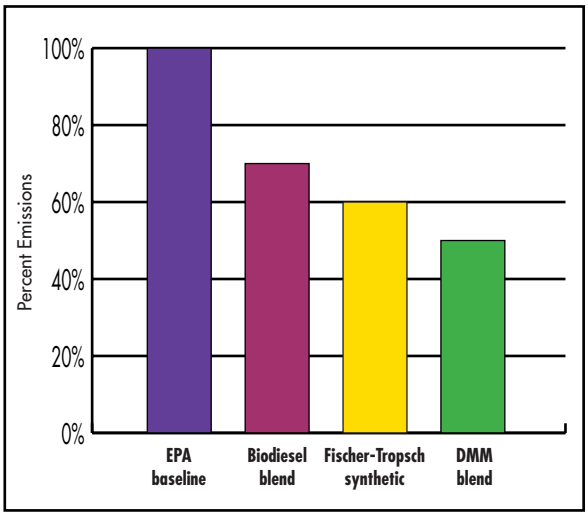
Reduce particulate matter without compromising fuel efficiency

OAAT ACCOMPLISHMENTS

Advanced Diesel Fuel Formulations

Challenge

Compression-ignition, direct-injection (CIDI) engines currently produce nitrogen oxides (NO_x) and particulate matter (PM) above future U.S. Environmental Protection Agency (EPA) standards for these pollutants. A goal of the Partnership for a New Generation of Vehicles program is to develop an advanced diesel fuel that enables the high energy efficiency of these engines while reducing emissions to the level required by EPA standards.



Percent of PM emissions compared to EPA certification baseline diesel fuel.

Technology Description

Six test fuels having the potential for low emissions and viable commercial production were examined against a baseline EPA Certification diesel fuel. Three were used as straight, or "neat" fuels: a "pseudo" California reformulated diesel; a low-sulfur, low-aromatics diesel; and a synthetic diesel made by the Fischer-Tropsch process. The remaining three were blends in low-sulfur diesel; 20% biodiesel, 20% Fischer-Tropsch; and 15% dimethoxymethane (DMM).

Testing was conducting using a DaimlerChrysler OM611 2.2L CIDI engine. No adjustments were made to the engine to compensate for any performance differences resulting from fuel property variations. Engine-out NO_x and PM emissions and performance were determined over 13 steady state test modes and compared to those of the baseline diesel fuel. Engine thermal efficiency also was measured at various operating modes.

Accomplishments

All 6 test fuels reduced PM when compared with the EPA baseline diesel fuel.

The fuel blend containing DMM lowered PM emissions by 50%, the neat Fischer-Tropsch synthetic fuel by 40%, and the biodiesel blend by 30% (see figure).

None of the 6 fuels tested degraded the engine's high efficiency during any operating modes.

Benefits

Advanced diesel fuel formulations can achieve PM emission reductions without compromising fuel efficiency; PM emission reductions can be achieved without raising NO_x emissions.

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Future Activities

Future activities will focus on the development of vehicle, engine, emission control, and fuel systems. As the current program focused on steady state conditions, future activities will explore transient in vehicle drive cycles.

Partner in Success

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CIDI test engine.