Cite abstract as Author(s) (2009), Title, European Aerosol Conference 2009, Karlsruhe, Abstract T083A05

Particle and gas emission for a EURO 4 light duty engine using 1st and 2nd generation biodiesel

A.G. Hemmersam[1], C. Raahede[2], J. Klenø Nøjgaard[3], A. Massling[3], P. Wåhlin[3] H.O. Hansen[2] and S. Nygaard[1]

[1]Department of Chemistry and Water technology, Danish Technological Institute, Kongsvang Alle 29,8000, Aarhus C, Denmark
[2]Department of sustainable energy and Transportation, Danish Technological Institute, Kongsvang Alle 29, 8000, Aarhus C, Denmark
[3]Department of Atmospheric Environment, National Environmental Research Institute, University of Århus, Frederiksborgvej 399, 4000 Roskilde, Denmark

Keywords: Diesel emissions, Combustion particles, biofuels, number size distribution, SMPS.

A significant source of particle emission in the urban areas originates from diesel driven vehicles and the impact of different types of diesel on the particle and gas emission is a subject of increasing importance, due to the increase in the use of biodiesel (Swanson et al., 2007). The increase in usage of biodiesel is motivated by the whish to limit the dependency and environmental impact that is associated with the use of fossil diesel. 2nd generation biodiesel is based from on a feedstock that originates from non food or waste products and is therefore from a sustainability as well as economical point of view an interesting source of biodiesel (Taylor, 2008). However not much data comparing particle and gas emission from vehicles using 1st and 2nd generation biodiesel exists, it is therefore of scientific, as well as from an applied interest to compare emission from diesel vehicles using 1st and 2nd generation biodiesel.

This study presents the particle and gas emission from a Euro 4 light duty engine using standard petrochemical diesel, biodiesel blend with 20% (B20) or 100% (B100) biodiesel. The 2nd generation biodiesel was made from a feedstock consisting mainly of animal fat (AFME) and the 1st generation biodiesel was based on rapeseed oil (RME). The engine was operated in 5 different operating modes taken from ISO/EN 8178, which simulate driving conditions of various loads and effect. Specifically were 0 %, 25 %, 50 % and 100 % loads and 100% effect of the engine tested in the current study.

Table 1. Comparison of the weighted gas emission and fuel consumption of a EURO 4 engine.

	NOx (g/kWh)	CO (g/kWh)	Fuel consumption (g/kWh)
Diesel	7.18	0.18	209
B20 RME	6.80	0.13	211
B20 AFME	7.48	0.11	211
B100 AFME	7.86	0.29	235

Both particle number concentration and particle size distribution was characterized using rotating disc diluter followed by a scanning mobility particle sizer (SMPS). The gas emissions were measured using mandatory measuring principles and weighted according to ISO/EN8178.

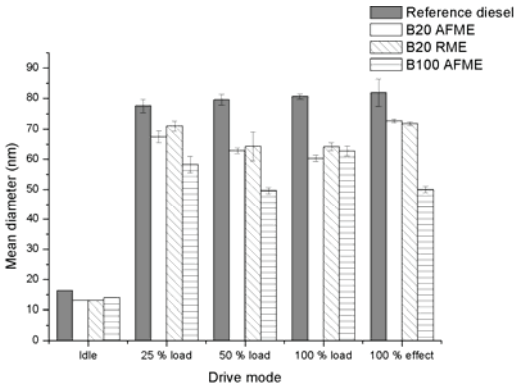

Figure 1.The mean diameter of the particle emissions as a function of biodiesel blend and engine load .

The particle emission results, se figure 1, show that the mean diameter of the particles emitted using biodiesel was found to be smaller than for particles emitted using standard diesel. This trend was seen for both AFME and RME based biodiesel blends. The mean diameter of particles emitted using 1st (RME) and 2nd (AFME) generation biodiesel was not significantly different. The particle concentration emitted was found to be significant lower when using 1st and 2nd generation biodiesel compared to standard diesel, this trend was seen for all 5 driving modes. The lowest particle concentration emission and the smallest particle mean diameter was found when operating at 0% load. The gas emission data, as seen in table 1, show that the NOx emission increase when using blends of AFME biodiesel but seems to decrease when using RME blends. The CO emission decreases when using B20 but raises when using B100.

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