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Deliverable 5.5

Single cylinder characterization and fuel blend assessment on a single cylinder engine

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Publishable Summary

Engine tests of the diesel fuel matrix was performed at Volvo Trucks during the autumn 2017.
The diesel fuel matrix has been setup in order to meet the European standard for CI engine fuels, EN590, as close as possible with regards to the properties of the drop-in components that are selected.
The fuel assessment was carried out on a Volvo D13 based single-cylinder engine. The fuels were compared at 6 speed/load test stages. Figure S1 shows weighted results from these 6 test stages, which can be seen as the summing results from the tests at Volvo, regarding fuel effects on soot emission and engine efficiency.
Test Fuel 1, consisting of 70% fossil diesel and 30% HVO, compared to the reference Fuel 3 (100% fossil diesel):

- Engine brake efficiency was measured to improve by 0.2%
- Soot was lowered by 10 – 20 %

Test Fuel 2, consisting of 70% fossil diesel, 20% HVO and 10% n-butanol, compared to the reference Fuel 3:

- Engine brake efficiency was measured to improve by 0.5 – 0.7%
- Soot was lowered by 30 – 40 %

The slightly lower energy content of Fuel 1 and Fuel 2, especially for Fuel 2 which contains 10% butanol, leads to certain torque loss (down rating) along the max torque curve. Fuel 1 shows almost no down rating of the engine, while with Fuel 2 the torque at max power conditions was reduced by a few percentage, see Figure S2.
In general the engine tests show that it is possible to use fuel blends with high levels of components potentially produced from algae feedstock, HVO and/or butanol, in a diesel engine with high efficiency and significant reduction of soot emissions.

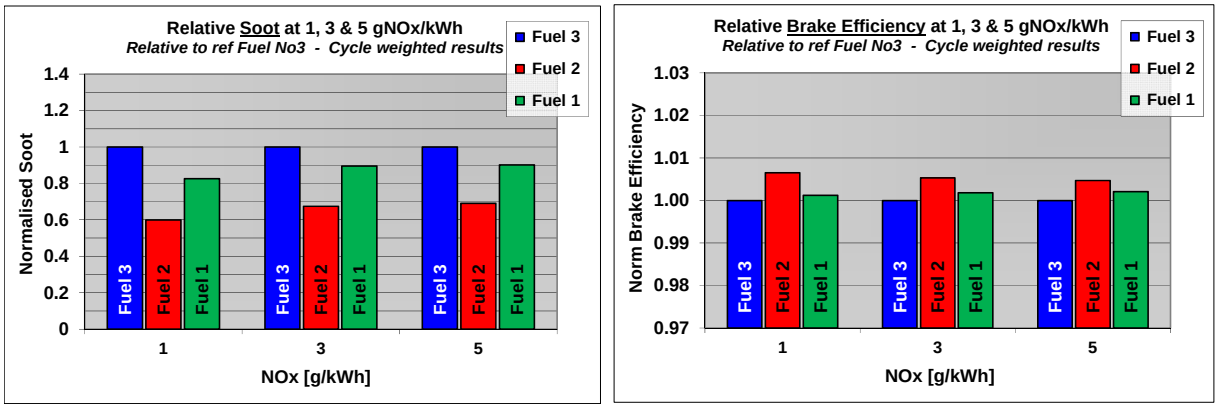

Figure S1. Normalised soot emissions and brake efficiencies at three different engine out NOx levels. Weighted results from the 6 speed/load test stages, and hence, the summing results.

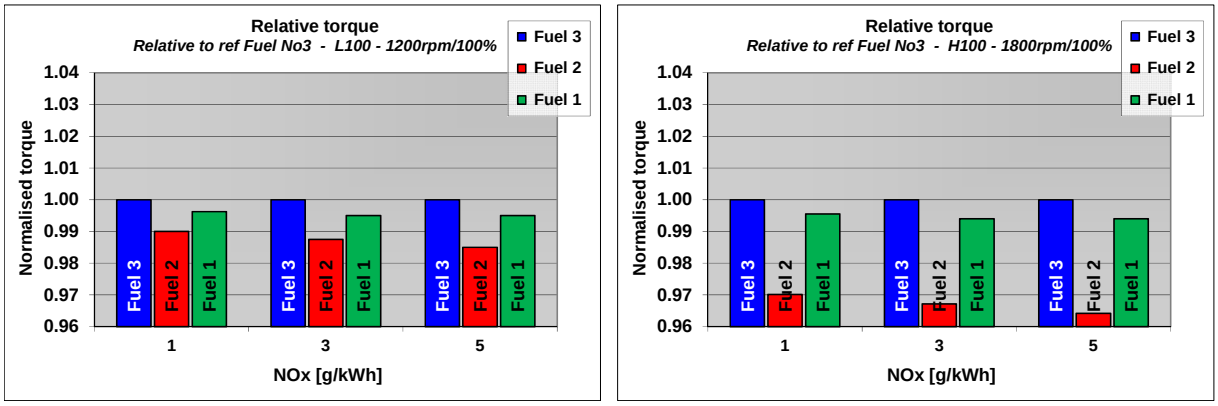

Figure S2. Observed relative max engine torque levels for the different fuels using the same injection settings (calibration) as for the baseline fuel 3. Left graph is at 1200 rpm (max torque conditions) and right is 1800 rpm (max power conditions).

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