

IMPACT ON DIESEL ENGINES

The impact of biodiesel on diesel engines has been measured extensively. Trials have been carried out by Volkswagen in Brazil, Europe, the USA and Canada to measure oil dilution and engine wear.

In diesel engines, some fuel seeps through the piston rings into the oil container. Typically oil dilutes in direct injection engines. Diesel fuel is much lighter and has less lubricant capacity than oil. As a result of polymerisation, oil thickens with reduced lubrication capacity and increased engine wear.

Durability tests were conducted by Volkswagen in VW's IDI diesel engines in the early 80's to find out that pure biodiesel does not adversely affect engine performance. Oil dilution was found to be unacceptably high in the durability tests results from DI engines.

Even though oil thickens faster with biodiesel than with petrodiesel (due to the unsaturated fatty acid chain in vegetable oils), no evidence has been found to date of oil dilution resulting from blends with high biodiesel content.

In the early 80's, VW recommended <30% biodiesel blends to prevent oil dilution. Since then, oil dilution and engine performance tolerances have been dramatically reduced and varying blends are recommended by car vendors, based on their own experience. Virtually all US vehicle manufacturers have found that biodiesel has no adverse impact on oil dilution in both new and operational vehicles.

Oil assay results in biodiesel engines are promising. In addition to the high lubricant capacity of biodiesel, less carbon and metal particulate matter has been found in oil in biodiesel engines, with the resulting extension in the engine life.

Significant reductions to metal particulate matter in biodiesel engines have been found by Canadian researchers (who identified a 40% reduction in scaling levels, using B10) as well as by the Cummins engineers researching at the University of Missouri.

The latter concluded that the outstanding performance of a direct injection 5.9 Cummins biodiesel engine along 160000 km was actually the result of the reduced carbon particulate matter as described above.

In summary, B20 trials both in direct and indirect injection engines proved to be highly successful. Whereas the results for >B20 blends in IDI engines are supposed to be better, oil thickening is likely to occur in old DI engines using >B20 blends.

BIODIESEL ENGINE PERFORMANCE

The performance of biodiesel engines has been specifically tested by VW in Brazil. No impact on vehicles subject to a 30 million km trial for the last four years has been identified by US assayers.

VW performed 1400-hour[1] durability tests using B100 in VW 1.6 IDI engines (including VW Passat and light vans), with the following features:

[1] Including 1000 hours at full capacity and 300 hours at maximum torque

Nbr. of cylinders	4 cylinders in line
combustion process	Chamber of whirlwind
Cylinder capacity	1.588 cm ³
Diameter/stroke	76.5 mm/86.4 mm
Compression ratio	23
Injection pump	Rotating

19 oil samples have been taken and the engine was disassembled after the trial in order to measure wear and tear.

Oil sample results showed acceptable solid and alkalinity levels. The roller bearing, piston ring, cylinder sleeve and valve support wear levels remained within VW specs for ordinary wear.

Similar results were obtained in VW field durability tests on DI engines, except that the oil dilution level was slightly higher with pure biodiesel. At that time, VW recommended <30% biodiesel blends to prevent oil dilution.

Since then, engine performance tolerances have been dramatically reduced to mitigate pollution and reduce oil dilution levels. This has been clearly demonstrated by VW full warranty for its TDI biodiesel engines.

OTHER DURABILITY TESTS

Trials have been recently completed by Cummins engineers researching at the University of Missouri on a direct injection 5.9 Cummins biodiesel engine along 160000 km, with highly successful results. They found out that engine wear is probably lower with biodiesel than with conventional petrodiesel.

The results of the above trials on biodiesel engines demonstrate a longer engine life resulting from biodiesel's high lubrication levels and a cleaner combustion process.