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# BIODIESEL: A COMPLEX MINEFIELD

By Dave Scott

## INTRODUCTION

The subject of biofuel is vast and often controversial, and very topical right now as the world seeks more sustainable fuel sources. A practical and strategic approach to biodiesel is the thinking in what follows. Need, greed, legislation, climate change, deforestation, fake news, opportunism, ignorance, oil price, and a lack of long-term thinking all go into the melting pot of biofuel debates.

Biofuels are energy sources made from recently-grown biomass (plant or animal matter). Biofuels have been around for a long time, but petroleum and coal have been used primarily as energy sources due to their high abundance, high energy value, and cheap prices. Fossil fuels such as coal and petroleum also come from biomass, but the difference is that they took millions of years to produce.

*SANS 833 Biodiesel Production - Quality Management – Producer Requirements is an important step towards helping create a local biodiesel industry, as it helps producers and suppliers - particularly those producing small batches of biodiesel - to manage their quality requirements in a more cost-effective way. If followed correctly, SANS 833 will help the local industry to regulate the quality of the biodiesel, from manufacture to sale, while also reducing the associated complexity and costs.*

## JUST FOLLOW THE MONEY

It appears that successful biofuel projects the world over are propped up by government subsidies. Not so in South Africa. This means it is too expensive to produce – especially on a small scale – and the result is a number of back-yard stills producing uncertified 'biofuels' that cause havoc in an internal combustion engine. 'No Biodiesel' is printed on some truck fuel tanks. And no-one admits to the fact that an engine has been running on biodiesel when engine lube samples are submitted for analysis – What, me? Never!

The authoritative SAPIA book, ***Petrol & Diesel in South Africa*** states: 'The cost of biodiesel analysis is very high and technically complex. Analytical facilities in South Africa are limited. It is not feasible for small-scale producers to carry out the analysis due to the high costs involved and a means of overcoming this must be addressed.' During the development of SANS 1935:2004, it became apparent that South Africa does not have the technical and analytical capability to test biofuels. As a countermeasure to this problem the SABS invested over R2,9 million in test equipment some years ago - probably the cost today is at least twice R2,9 million.

***Petrol and Diesel in SA*** goes on to say that 'Care needs to be taken to ensure acceptable quality of the manufactured biodiesel (SANS 1935), so that when blended with conventional diesel at up to 5% by volume, the resultant product complies with the national automotive diesel specification (SANS 342) and is therefore fit for use as an on-road transport fuel.' How many of these small biodiesel processing plants are not making use of the SABS test equipment or alternatively could afford the Rand millions and trained staff it needs to operate test machinery?

## NOXIOUS PLANTS CAN IMPACT BIODIVERSITY

It was a lovely thought far away from reality – vast waving fields of poisonous, hardy Jatropha trees in arid conditions with thousands of happy unskilled labourers singing as they collect little football-shaped fruit pods. The latter yields seeds that, when crushed, provide oil good for making soap, burning in lamps — or converting into diesel fuel. Originating in Central America, Jatropha is not an African plant, so it would become a toxic, dominating, alien species. All of this fell apart with the 2009 financial crisis plus the discovery that Jatropha needs as much irrigation as food crops to produce the seeds. Jatropha fell into the food vs fuel battle. Added to that, it is classified as a noxious weed and large-scale cultivation has also raised environmental concerns.

Published standards for ease of reference:

SANS 1935:2011 (ED. 2.00) Automotive biodiesel — Fatty Acid Methyl Esters (FAME) for diesel engines — Requirements and test methods

SANS 833:2012 (ED. 1.01) Biodiesel production — Quality management system — Producer requirements

SANS 342:2016 (ED. 5.01) Automotive fuels — Requirements and test methods for diesel

SANS 465:2018 (ED. 2.00) Automotive fuels — Requirements and specifications for fuel ethanol as a blending component with petrol

SANS 1598:2019 Automotive fuels – requirements and test methods for petrol

SANS 1462:2018 Automotive fuel ethanol – quality management system – producer requirements

The Govt Gazette 37232, 15 January 2014, 'A draft position on the South African Biofuels Regulatory Framework' lists Jatropha as being excluded 'due to biodiversity concerns and to protect local bird and animal species from poisoning'. There is a lesson to be drawn from this by not introducing any alien plant species.

Biofuels are making a resurgence due to increasing oil prices, dwindling fossil fuel reserves, the desire to have a renewable, reliable source of energy and to mitigate the effects of climate change. Biofuels are a renewable resource because they are continually replenished. Fossil fuels on the other hand are not renewable since they require millions of years to form.

But climate change – global warming – is driving massive movements in the global biofuel industry. Example: Finland's Neste, claiming to be the world's leading producer of renewable diesel and sustainable aviation fuel produced from waste and residue raw materials, will modify its existing renewables production capacity in Rotterdam, the Netherlands, to enable production of sustainable aviation fuel (SAF). Sustainability is defined as meeting the needs of the current generations without jeopardising the needs of future generations.

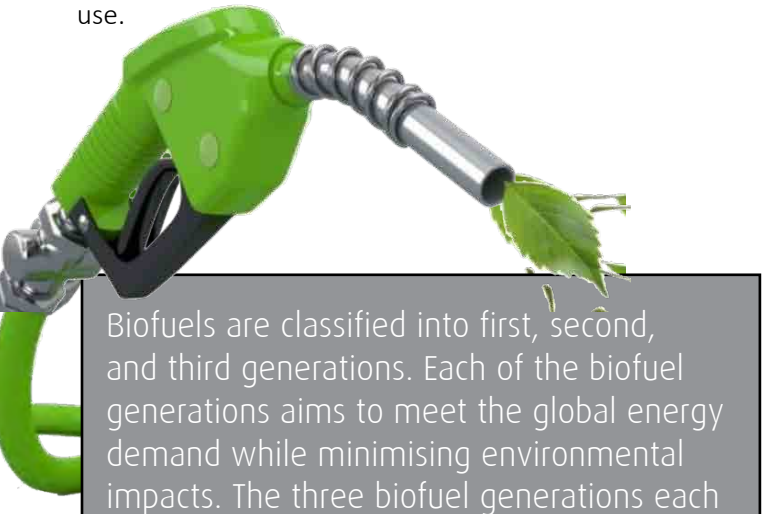
Global resources company BHP, German shipping company Oldendorff Carriers, and advanced biofuels pioneer GoodFuels, with the support of the Maritime and Port Authority of Singapore (MPA), have conducted the first marine biofuel trial involving an ocean-going vessel bunkered in Singapore. As part of the trial, the 2020-built 81,290 deadweight tonne dry bulk carrier Kira Oldendorff was refuelled with "drop-in" advanced biofuel blended with conventional fossil fuels.

And SA Government Gazette No. 44363 of 30 March 2021 published for 60-day comment indicates a forced pace of change – a 'mandatory blending of biofuels with petrol and diesel'. All of this must be read together with Government Gazette No. 44362 of 30 March 2021, also published for 60-day comment. Sulphur in diesel fuel is forecast at 10ppm in five years.

Biofuel combustion chemistry is more complex than petroleum-based fuels. In general, the term biofuel is associated with only a few select chemical compounds, especially ethanol (used exclusively as a gasoline replacement in spark-ignition engines) and very large methyl esters in biodiesel (used as a diesel fuel replacement in diesel engines). The biofuels are oxygenated fuels, which distinguishes them from hydrocarbons in conventional petroleum-based fuels.

## THREE BIOFUEL GENERATIONS

The main drawback of 1st generation biofuels is that they come from biomass that is also a food source. This presents a problem when there is not enough food to feed everyone. 2nd generation biofuels come from non-food biomass, but still compete with food production for land use.



Biofuels are classified into first, second, and third generations. Each of the biofuel generations aims to meet the global energy demand while minimising environmental impacts. The three biofuel generations each show different benefits and drawbacks.

## CRITICAL FACTOR – FEEDSTOCK MATERIAL

Another biodiesel problem is that variations in feedstock material for processing can have a significant effect on the processing chemistry – it is not just a case of pouring any vegetable oil into a tube with a standard outcome while it only becomes viable to test and certify large batches. According to estimates there are more than 10 million litres of used cooking oil in circulation every year. The problem for biodiesel is adherence to standards and the consequences for modern diesel engines. Where does all that used cooking oil go if it is not sold as a cheap mixture of carcinogens for the poor to reuse and consume?

There is an interaction between biodiesel and engine oil; the question is to what extent does this impact lubricant performance level and service intervals? Biodiesel can affect the engine oil durability in several ways, specifically:

- Fuel dilution: Due to the differences in volatility, the biodiesel tends to accumulate in the sump, diluting the engine oil.
- Viscosity decrease: The viscosity of the engine oil is reduced with the high levels of unburnt fuel, shortening the useful service life of the lubricant.
- Increased piston deposits: The nature of the biodiesel caused increased piston deposits. However, it is very dependent on the engine oil formulation. Testing should be conducted to ensure that the formulation is robust with biodiesel and biodiesel blends.
- Increased lubricant oxidation: The presence of biodiesel in the engine oil increases the lubricant oxidation rate, which increases the engine oil viscosity. This, in turn, can potentially lead to sludging of the engine oil.

It is essential that the lubricant formulators ensure that engine oil durability is maintained. This will necessitate the use of high-quality engine oils. Vehicles will need to remain on the correct Original Equipment Manufacturers (OEM)-approved or recommended engine oil throughout their lives to ensure that no problems are encountered. Failure to do so may result in premature engine or component failure.

Engine oil formulating is complex, and biodiesel is introducing additional challenges. Engine oils can be formulated to reduce the impact of biodiesel; however, high levels of fuel dilution may need to be addressed via reductions in oil drain intervals. This will potentially have

a significant impact on service maintenance plans and customer operation, and hence should be avoided if at all possible, through engine design and lubricant.

## A BIODIESEL BATCH CERTIFICATE IS ESSENTIAL!

*Petrol & Diesel in SA* points out – 'In certain quarters, there is a growing resistance to the use of biodiesel because it tends to have blending and performance characteristics that are not consistent, especially with new ultra-high pressure common-rail injection systems and associated emission control devices.'

The point of all this is that if you are operating a modern, common-rail diesel powered truck you dare not tank up with diesel of unknown quality. The tendency to offer power-train warranties that include unlimited distances over two years and more does not extend to diesel fuel that cannot match consistent laid down standards. Insist on a batch certificate or fill up at reputable sites. And even then, audit your suppliers on a regular basis.

**References & acknowledgement for extracts**

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- REPORT ON SABS PETROLEUM LABORATORY CAPABILITY TO TEST BIODIESEL Compiled by Aleesha Sewpersad MARCH 2008
- Paper presented at SAI International Conference 2011 - Webster M, Fitton, J; Lubrizol; Effect of Biodiesel on Engine Lubricant Durability- A copy of this paper can be obtained from the SA Institute of Tribology
- FleetWatch May 2011

*About the writer...*

Dave Scott is an award-winning journalist and author, with a career spanning over 50 years in the transport industry. He is a member of the SA Institute of Tribology (SAIT) and editor of their newsletter, taking a keen interest in the application of lubricants to road transport maintenance and the cost of ownership. He also serves as the technical correspondent for *Fleetwatch* magazine and the truck correspondent for *AutoForum* magazine, and has done for many years.

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