



Introduction

Since 100% hydrocarbon diesel fuel was first developed in 1893, it has enjoyed an enviable track record in terms of reliability, efficiency and effectiveness. As a result of growing concerns regarding depleted oil reserves, advanced developments in diesel fuel technology and 'State-of-the-art' Diesel engine design enhanced the reputation of diesel fuel even further.

Unfortunately, everything that was remarkable about the quality and performance of diesel fuel came to an abrupt end in 2007. At this point, the Government under the title of the RTFI (Renewable Transport Fuel Initiative) set a mandate to ensure that all diesel fuel had a minimum of 2.5% Bio Content (B2.5).



Why did the Government introduce this legislation?

This legislation was introduced because Bio Diesel is classified as Carbon Neutral. 100 per cent biodiesel (or B100) reduces new emissions of carbon dioxide by

some 60 - 80 per cent, so even a five per cent blend in conventional diesel, (B5), will save up to four per cent on new CO₂ emissions.

From January 2010 this was set to rise to 5% (B5). However, the Government then decided that Bio Diesel content this year was acceptable from between 5 to 7.5% (B7.5). So what prompted this change in Government policy? Biodiesel has a high 'Cetane Number' so there is less combustion knock and quieter engines, while its fatty properties provide good lubrication giving lower fuel pump and injector wear.

The natural products already contain some oxygen to provide lean burn with reduced hydrocarbon, carbon monoxide, and particulate emissions. Add in the benefits to rural economies of growing the rape seed feedstock plus reduced imports of crude oil and there are many purported benefits from adding bio-fuel components to conventional hydrocarbon fuels.

BAFSA's concerns about Biodiesel fuel

Unfortunately, natural fats are too viscous to be used in high-performance, low-emission diesel engines, so, a process is used to change the natural fat using methyl alcohol and a catalyst into the Fatty Acid Methyl Ester (FAME).



Palm Linseed Rapeseed Sunflower Glycerine

Highly saturated beef fat, or palm oil have serious implications for diesel engine driven plant. This is because they crystallise at a higher temperature than the more unsaturated rapeseed oil or fish oils and as a result are more likely to cause winter waxing in diesel fuel.

In biodiesel fuel, the methyl esters of the same unsaturated fat are also more reactive because they are unstable to heat and oxygen, which is decidedly bad news for diesel driven plant.

Being more thermally unstable, FAME containing blends tend to age more rapidly and create higher levels of oxidation. This fact is presumed not to present a problem for a busy main-road petrol station, but it is known to create a significant problem for stand-by diesel driven plant that may not get through a whole tank of fuel in a year.



The impact of Biodiesel fuel on Diesel Driven Fire Pumps

Biodiesel is a perfect 'growth media' for micro-organisms. Microbes need minimal water to establish a colony. Bio Fuels form different feed stocks and all have different reactions to emulsified water.

Conventional Diesel fuel typically holds 60ppm of suspended water while Biodiesel fuel holds 1500ppm. Diesel fuel properties have greatly changed over the past five years. There are numerous types of bio-fuel

additive available. Colony Forming Units of bacteria (CFU's) react differently to these additives as they live on the phase between water and the fuel.

Lloyds Register Fuel Guidelines		
Category A	<500cfu per litre	Acceptable
Category B	500-1000cfu per litre	Warning microbial proliferation occurring
Category C	1000-1000cfu	Microbial proliferation Operational problems Investigate thoroughly Use anti microbial treatment

If Bio-diesel fuel holds far more water than hydrocarbon diesel, is there a way to reduce the water content to minimise the problem?

Unfortunately, the answer is no. That is because it easily enters the tank through breathers. Also as a fuel tank is emptied, air will enter through the vent pipes to displace the fuel that was in the tank. The extra air drawn into the tank may lead to more oxidation, particulate contamination and increased water levels.

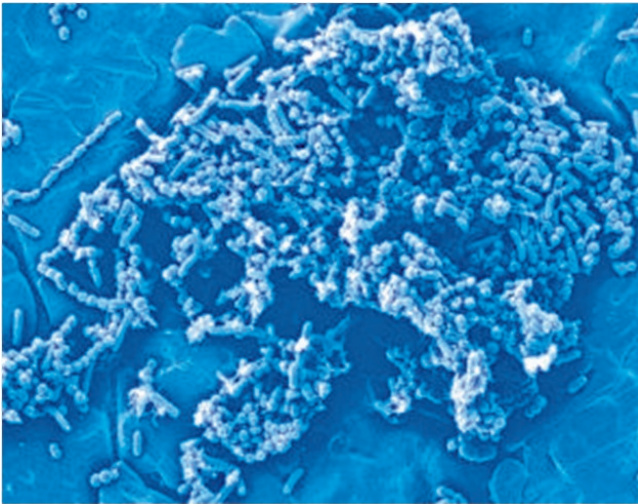
Condensation is also created due to temperature changes within the sprinkler pump house making any potential remedy extremely expensive and highly unlikely to be successful.

Unfortunately, the chemistry of FAME increases its affinity for water, its conductivity, its reactivity and its bio-availability. All diesel fuel has entrained suspended water content and as the bacteria grow on this water fuel inter-phase, they become heavier and drop out of the fuel to the bottom of the tank where bio films and sludge quickly form.



Like humans, microbes need food and water. They live in the water and eat the fuel to grow. As they multiply, they break down the carbon chains reducing the combustible properties, which results in poor or non-starting, excessive smoke and reduced power output.

There are 27 species of micro-organism generically referred to as the “Diesel Bug” – all able to reproduce and grow at bio diesel/water interfaces and most (not all) as bio films that sit in suspension.



Unfortunately, microbial growth in biodiesel occurs at up to four times the rate than that of conventional Hydrocarbon diesel and is very expensive to get rid of.

BAFSA members are frequently reporting outbreaks of microbiological infestations in biodiesel fire pump tanks in the North West, North East and the South East. For good measure, methyl esters are known degreasing solvents. They lift accumulated resins, gums, polymeric material, fuel additives and debris from storage tank walls and distribution pipe work and carry them forward to block filters protecting your engine, or more worryingly, to pass through them.

The reaction (Fatty) Acid + (Methyl) Alcohol = (Methyl) Ester + Water is reversible so that water plus the diesel esters can produce methyl alcohol plus fatty acids. The acids released cause corrosion. This process accelerates corrosion and attacks rubber seals, ‘O’ rings and hoses.

A by-product of this bacterial break down is the creation of organic sulphuric acid that scours any surfaces it comes into contact with. This creates corrosion debris and tank corrosion. Anaerobic organisms, known as SRB’s or sulfate reducing bacteria are referred to as “metal-eating bacteria”.

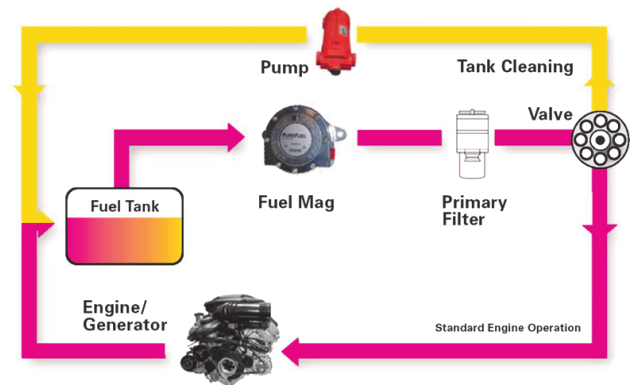


A fuel line corroded by Fungus

Consequently, with biodiesel there are increased risk factors and associated costs and the higher the methyl ester concentration, the higher is the risk. So B10 is more risky than B5 which is more risky than B2. Diesel fuel containing FAME in whatever concentration does not behave like the petroleum-derived diesel, yet our government is not telling us much about this.

What can BAFSA members do to solve this problem?

Cleaning and treatment of contaminated fuel to bring it within specification can usually be achieved with the fuel still in the tank ensuring any Diesel Driven Plant remains on line in readiness for an emergency. Passing biologically contaminated fuel through a focused high gauss (G) magnetic field causes the Bio mass to plasmolyse or collapse into individual cells.



This process does not kill the cell but puts it into a dormant state. In perfect conditions the Cells will start to reproduce in approximately twenty eight days. The weekly running duty cycle of 30 minutes dynamic and seven days static for a diesel driven fire pump will ensure the fuel passes over the magnet before biological contamination can proliferate, guaranteeing a rapid un-aided start with no de-rating effects to the kilowatt output.

Are there any other alternatives to using a high gauss (G) magnet?

Unfortunately, at this moment in time, there is nothing available that is as safe or efficient in controlling Biodiesel fuel contamination. Until recently, many experts and organisations were advocating the use of micro biocides as performance additives to destroy microbial contamination in fuel systems. Today, those same experts and organisations are recognising that the potential problems with this strategy far outweigh the potential benefits.

This is because to be effective, micro biocides must be used at specified dosages and it can be quite difficult to determine the appropriate starting concentration for a micro biocide used as a fuel additive. Secondly, storage tanks holding fuels that contain micro biocide additives will still need periodic treatment to prevent fuel deterioration.

In addition, the regular use of biocides may even increase the resistance of micro-organisms to treatment. Also, the regular use of biocides must be properly managed because they are toxic chemicals.



For Health & Safety reasons, biocide treatments should therefore be executed by specialists with expert knowledge in dealing with biocides.

What do the Diesel Manufactures recommend?

John Deere states that Biodiesel blends up to B20 must be used within 90 days of the date of biodiesel manufacture. Biodiesel blends from B21 to B100 must be used within 45 days of the date of biodiesel manufacture.

They suggest that fuel buyers request a certificate of analysis from their fuel distributor to ensure that the fuel is compliant with the above specifications. Clarke UK Ltd and the NFPA even advise that Bio-fuel for diesel engines is not recommended. However, they do not suggest what should be used in its place and where an alternative can be found.

Under the RTFO (Renewable Transport Fuel Obligation), fuel suppliers have to ensure that a certain percentage of their aggregate sales are made up of bio-fuels. The current legislation has been in place since April 2008 and has meant that the requirement has been for 5% of ALL UK fuels sold on UK forecourts to come from a renewable source by 2010.

The 5% by volume target represents the maximum bio-fuel content allowed by European Specifications to be sold on the forecourts as standard petrol or diesel.

Since July 2009, the British and European diesel standard (BS EN590) actually already allowed up to 7.0% biodiesel to be blended in diesel, but there was an issue with some old legislation in the UK that

meant that above 5.0% biodiesel required special labelling at the pump.

This legislation was being updated from the beginning of April 2010 after which no special labelling will be required. Therefore, we can now expect all diesel fuel to currently contain up to 7% biodiesel.

It is worth noting that the 7% figure is a maximum figure. It does not mean all supplies will be at this level, all of the time. The actual amount of biodiesel blended could be anything between 0-7percent and will vary from refinery to refinery and even within a given refinery depending on a number of factors.



For example, what are the economic driving factors at the time and what is the availability of biodiesel supply. The Fuel Refinery Operators state quite clearly that all their fuels are subject to the same supply chain and therefore may or may not contain the bio component.

Conclusion

Having acknowledged the problems that biodiesel fuel has created, fuel technology experts are working tirelessly to develop a solution to Biofuel contamination. In the meantime, it is vital that users of 'Off Road' Diesel Driven Plant follow the detailed service & maintenance recommendations of the Diesel Engine Manufacturers and guidelines from organisations such as the US NFPA and the UK FPA/ RISC Authority.

Presented by:

