

DIESEL 

FOR SUCCESSFUL YACHTING

Microbial contamination of fuel, commonly known as the diesel bug, is an increasing problem within the marine sector. **Frances and Michael Howorth** investigate the phenomena and ask how you can test for it and what can be done to prevent it.

There are a small number of microbes, which can degrade fuel. They tend to work together as a consortium. The most dominant micro-organism is *Hormoconis resiniae* (H.res.), which is commonly referred to as the Diesel Bug. Conditions in which microbial contamination may be present in fuel vary, but include temperature, humidity and the quality and composition of fuel and its water content. It is a well established fact of life that on board any yacht large or small water has an annoying habit of migrating into fuel from any number of different sources including condensation, humidity and poor handling. Diesel fuels with bio-fuel content are particularly susceptible due to the hygroscopic nature of their make up.

Don't bug me

H.res does not merely float around in the fuel and water phases or at the water/fuel interface like other contaminants, it adheres to the internal surfaces of the tank and fuel system. The damaging effects of bug contamination, include corrosion of fuel tanks and fuel lines, as well as filter blockage. Monitoring the on board fuel systems, for microbial contamination, is therefore very important and should be carried out on a regular basis.

If infestations go undetected and untreated, the consequences in super yachts can be dramatic, in both financial and safety terms to say nothing about upsetting the owner when he learns about it! These harmful micro-organisms if undetected can cause blocked fuel filters, wear injectors and stop engines. If they are left for long periods, without treatment the 'bugs', can literally eat through stainless steel.

Fuel systems are a perfect habitat for micro-organisms to live and grow in, which is why it is so crucial, for sensible husbandry and regular draining of the bottom of the tank, if possible, to ensure that there is no build up of sediments. Draining the water from the tanks is key to any control system and some engineers do regularly dose their fuels with biocides that are meant to keep the bugs at bay. There are, however, problems associated with these routine prophylactic applications of biocides. Firstly because there are significant costs in manpower terms and of the biocide itself and secondly there can be problems with warranties from the engine manufacturers if they have any doubt about the ppm (parts per million) levels of biocide added to the fuel. Added to that there are other reasons why routine use of biocides has risks. There are for example health and safety considerations when it comes to the use and handling of biocides. Their use should, therefore, be restricted to the minimum required to maintain clean fuel.

Environmental care

Then there is the environmental impact of indiscriminate applications of biocide on exhaust gas emissions, which should be considered. Worse is that unless the correct ppm level is maintained throughout the soak period, there is a danger that a resistant strain or strains of microbes will be produced which in turn becomes even more costly to eradicate and brings you back to square one! Regular fuel testing is the only way engineers can identify a microbial problem. Testing fuel for contaminants can be a frustrating business. They traditionally employed the Colony Forming Unit (CFU) count methodologies. These tests typically take 2 to 3 days to

give a full picture of bacterial and fungal contamination. As some fungal spores take a number of days to show significant growth, traditional growth based testing techniques may take several days to produce a comprehensive result. During that time, samples may have to be incubated and many have to be monitored daily. ATP (Adenosine tri-phosphate) based tests while rapid, show total life and may not, therefore, discriminate actively growing organisms.

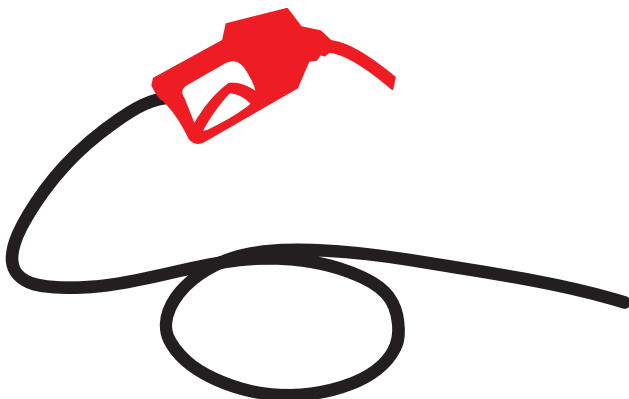
On board testing

There is a newer faster and some say more reliable way of testing fuel with results available just 10 minutes after testing. Using an immunoassay device (rather like a pregnancy test) it measures the amount of different types of contamination growing in a sample harvested from either the fuel or water phases and reports the results as the weight of active material in that sample. This is a newer, faster and more accurate measurement system than the older CFU count methodology.

The testing kit is from Conidia and is available through Global Services who act as a distributor for the manufacturer. Conidia is an internationally recognised organisation within the Bioscience sector rapid testing technologies for the detection of microbial contamination in light distillate hydrocarbon fluids (specifically diesels and kerosene) in the fuel supply chain. Called FUELSTAT resinae plus, it will deliver accurate results in 10 minutes, is simple to use, requires no special user skills, and there is no investment needed for a reader to translate the results.

The objective of the test is to provide rapid screening of samples, ignoring any micro-organisms that have entered from elsewhere (through tank breather vents for example), which may have been growing on trees or other food sources. Other tests will grow whatever they find in the sample, whether it came from the fuel or not. Other tests also require sterile sampling conditions, where Conidia's test just requires that the sample equipment is clean (i.e. has no residue from a previous test sample).

The results from many competitor products are deduced either by comparing colours or spot numbers with a chart or (if high accuracy levels are required) counting under a microscope. The test from Conidia just requires a visual inspection of the six lateral flow devices on the test paddle. The readings



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will indicate the level of contamination in the sample: negligible, moderate or heavy. These levels correspond to the recommended limits set out in the IATA guidelines for negligible, moderate and heavy contamination.

The process of the test is unaffected by the presence or absence of biocide. However, if results indicate the need for biocide application, there should be a delay (as indicated by the manufacturer's instructions) between application and retesting. This is to ensure that the biocide has been completely effective. Retesting one week after the biocide has been introduced into a contaminated tank is recommended.

Frequency of testing

One test per tank is required in any monitoring regime. On board testing should be supervised by the Chief Engineer who should establish the frequency of testing by means of a risk assessment. The recommendations are for a minimum frequency of once a year. Yacht engineers may vary this according to their risk assessment. The risk may be considered higher, and so more frequent testing may be

required, between the tropics for instance.

Yachts moving from Europe to the Caribbean have been found to be susceptible to this but some engineers have suggested it is more to do with the way fuel is handled in the Caribbean than on board infestation due to condensation.

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If operating in a high-risk area, frequency of testing could be increased to 3 monthly or even to a monthly basis. It is considered unnecessary to test more frequently than monthly. Conidia Bioscience for example recommends that this frequency and risk assessment process is also carried out by diesel users. The company offers a consultancy service to assist with conducting these risk assessments where required.

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Use and disposal

The test is intended to be stand-alone device. A clean container to collect the sample and usual safety equipment such as gloves are all that is required. Unlike many other kits, which require special handling for testing and / or safe disposal, Conidia kits (apart from the fuel itself, of course) can be disposed of in any shore side waste disposal unit or recycled, if there is a plastics recycling policy in place.

Contacts

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