



Lynnette Peizer/Alamy

Biodiesel can affect the components found in older boat engines

Biodiesel and the bug

Now biodiesel is a reality for all boat owners, Alex Blackwell explains what's actually in it and how we can tackle diesel bug

In the 2020 Budget, the Chancellor announced that privately owned boats and yachts will have to use white diesel instead of the cheaper red diesel.

When we're back on the water, slowly diluting the variously coloured fuel we still have in our tanks, it's worth taking a look at what it is we'll be purchasing. All white diesel now contains a percentage of biodiesel – usually around 5-7%. Pumps marked B7 have 7% biodiesel and 93% petroleum diesel or petrodiesel.

What is biodiesel?

Biodiesel refers to a vegetable oil – or animal fat-based diesel fuel – consisting of

long-chain alkyl (methyl, ethyl, or propyl) esters. Biodiesel is typically made by chemically reacting lipids such as vegetable oil, soybean oil and animal fat (tallow) with an alcohol (methanol), to produce fatty acid esters.

Biodiesel is compatible with most modern materials in your engine, tanks, valves, pipes, and hoses, but not all the old ones. Here's how it reacts:

Plastics: Polyvinyl chloride (PVC) is slowly degraded by biodiesel. High-density polyethylene (HDPE) is compatible with biodiesel.

Metals: Biodiesel (like methanol) has an effect on copper-based materials (eg brass), and it also affects zinc, tin, lead,

and cast iron. (Copper and zinc also promote oxidation, which can lead to diesel bug – see below) Stainless steel (316 and 304) and aluminium are unaffected by biodiesel.

Rubber: Biodiesel affects types of natural rubbers found in some older engine components. Commonly used synthetic rubbers FKM- GBL-S and FKM- GF-S found in modern engines can handle biodiesel in all conditions.

Contamination by water

Water can get into diesel fuel as a result of condensation, rainwater penetration or adsorption from the air (hygroscopy). Modern biodiesel is especially hygroscopic.

Water reduces the heat of fuel combustion causing smoke, harder starting, and reduced power. It corrodes fuel system components (pumps, fuel lines, etc) and when frozen, ice crystals provide sites for nucleation, accelerating gelling of the fuel, and pitting in pistons.

The presence of water also encourages diesel bug growth. This either occurs at the interface between the oil and water or on the tank, fuel pipe, and fuel filter walls, depending on whether or not the 'bugs' need oxygen.

What is diesel bug?

Diesel bug is the contamination of diesel fuel by microbes including over 100 species of bacteria and fungus. Contrary to the commonly used terminology, these infections do not contain algae. Algae requires light for photosynthesis and there is no light in a diesel tank.

Diesel fuel itself is quite biodegradable.

'Biodiesel is host to well over a thousand species of bacteria and fungus'

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Given a very small amount of water, microbes will thrive and break the diesel down. Biodiesel is much more biodegradable, and is host to well over a thousand species of bacteria and fungus. With the exposure to bacterial and fungal spores from purchased fuel, or even from the atmosphere, troublesome volumes of diesel bug can grow quite quickly. This is particularly true in warm weather and with some gentle agitation as your boat moves at the dock or swings at its mooring.

What does diesel bug do?

By breaking down the diesel molecules the microbes can cause a change in fuel chemistry, which adversely affects how the fuel is burned in your engine. On a rough day out on the water, clumps of these microbes can break loose and block fuel filters or, worse, the fuel injectors. Microbes in water can also cause the paper-element filters in the system to rot and fail, in turn causing failure of the fuel pump or blockage of the injectors due to ingestion of large particles.

What does it look like?

Diesel bug growth is recognizable as a brown, grey, or black gooey substance that coats the inside of the tank, pipes, and fuel filter elements. If the sludge collecting on your fuel filter consists of fine particulates, rust, or tarry material that leaves a black, sticky residue on your fingers, you're not looking at biological contamination. If the material is slimy you have a biological infection.

What can you do about it?

Filtration can help at low levels of infestation. The filters will catch the larger clumps of bacteria. However, even the finest fuel filter will not catch individual bacteria and spores, which measure less than 0.1 micron. The bacteria will pass through the filter unhindered where they can cause further trouble.

Biocides

The only cure for a serious microbial infection is to kill it with biocides.

Fuel companies agree that if left untreated, fuel will remain reliable for just six to 12 months, after which fuel contamination (such as the diesel bug) begins to appear. Most industrial engine manufacturers now recommend a fuel conditioning programme to ensure the reliability of fuel.

RIGHT Diagram showing a typical fuel polishing system

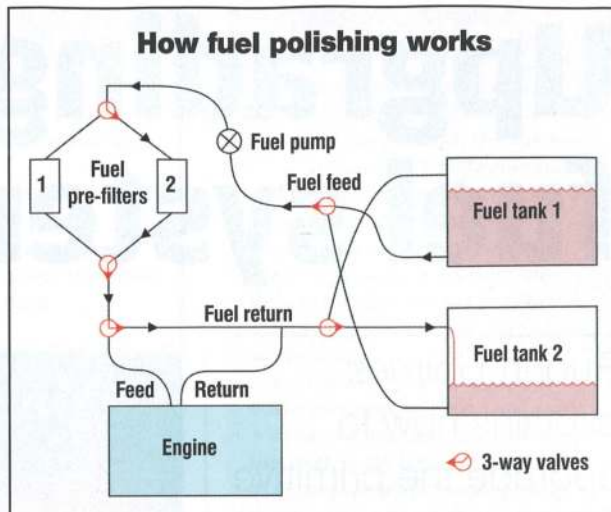
Some, like Yanmar, will suggest that treating a fuel tank with biocides can be dangerous and damaging to an engine. It is not the biocides that are damaging, but rather the dead bacteria and fungi clumps that suddenly release from the surfaces after treatment. This surge of slime can clog filters and can cause fuel starvation and other damage. If your tank was never previously treated, you will need to polish your fuel by pumping it through filters (see note on polishing fuel). You may also need to clean your tank.

For more information on diesel bug treatments, Practical Boat Owner did a test of 12 biocides in 2016, which remains very current. See this link on our website: <https://www.pbo.co.uk/gear/12-diesel-bug-treatments-tested-43353>

How to minimise the risk of fuel contamination

As with most things on a boat, prevention is better than cure. The key to maintaining fuel quality and preventing fuel contamination is good housekeeping. Good fuel housekeeping is a combination of effective processes, a little technology, and some good old-fashioned common sense.

- Keep fuel tanks as full as possible to reduce water condensation from moisture-laden air
- Use tank drains to periodically remove tank bottom water and sediment
- If storing fuel in multiple tanks, employ a rotation system to use the oldest fuel first
- Regularly check fuel for water, particulate and microbial contamination
- If contamination is found, thoroughly clean both fuel and tanks
- Regularly run a fuel polishing system to remove water and other contamination
- Regularly add a fuel additive and biocide to maintain fuel stability and minimise microbial growth



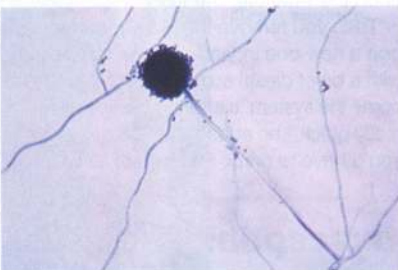
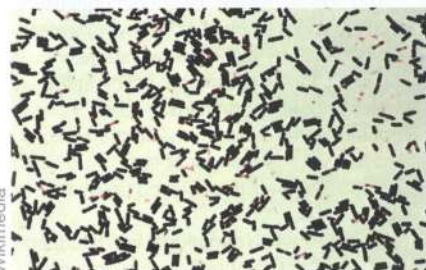
- Use only original equipment manufacturer (OEM) filters as the primaries.
- Go for the finest (2 micron) filter cartridge on the (Racor) pre-filter as opposed to anything coarser

Fuel polishing (cleaning)

There are several commercially available fuel polishing systems. On our boat we built one ourselves. The key components are an electric fuel pump, two parallel Racor fuel pre-filters, and several three-way valves. In addition, we have two fuel tanks, though this is not necessary.

In the configuration shown above, we are pumping the fuel from one tank to the other passing through one of the Racor filters: thus, polishing the fuel.

When running the engine, we would direct the fuel flow to the engine with the return going to the tank from which it originated. The parallel filters allow us to 'hot swap' the pre-filters, should one become blocked. The electric fuel pump has the additional advantage of making bleeding the fuel lines extremely easy after work is done, for example after changing the primary fuel filters.



Two common diesel bugs: The bacteria *Clostridium* and the fungus *Aspergillus*

ABOUT THE AUTHOR

Alex Blackwell is co-author of the best-selling book *Happy Hooking, the Art of Anchoring*.



Now in its third edition, it describes and compares all the different anchors, how to use them, and even discusses anchoring etiquette. He also co-wrote *Cruising the Wild Atlantic Way*, an indispensable companion book to the Irish Cruising Club's *South and West Coasts of Ireland Sailing Directions*. His websites are coastalboating.net and whiteseahorse.ie, where you'll also find his other books.