

OILONSPEC



Fuelguard

MICROBIAL CONTAMINATION OF FUELS AND ITS CONTROL

GROWTH OF MICROORGANISMS IN PETROLEUM PRODUCTS HAS BEEN RECORDED SINCE 1895, CAUSING FOULING, MALFUNCTION AND CORROSION IN STORAGE TANKS, PIPELINES, AND ENGINES. EARLY IDENTIFICATION OF CONTAMINATION CAN HELP REDUCE SIGNIFICANT DAMAGE TO MACHINERY AND TANKS.

Microbiological contamination consisting of bacteria, yeasts and moulds, are easily tolerated at low contamination levels. It is only when their numbers are not controlled that rapid infestation occurs.

YOU'LL NEVER HAVE TO GUESS ABOUT MICROBIOLOGICAL CONTAMINATION IN FUEL AGAIN.

There are six main areas of concern for microbiological infestation.

These are:

1. Distillate fuel;
2. Lubricating oil;
3. Cooling water;
4. Bilge water;
5. Ballast water;
6. Distillate cargoes.



Contaminated fuel oil after being allowed to settle

CAUSES

WATER

The main requirement for microbial activity is water. The presence of free water can lead to rapid microbial growth after 1 week at 30°C. Airborne bacteria and fungi can readily enter fuel tanks through air vents, and multiply very fast in this bottom water phase. This is particularly likely to happen in diesel and gas oil tanks where it is impossible to exclude water altogether. Water enters these tanks by various methods, such as through condensation, rain water or water leakage or even with the fuel delivery.

NUTRIENTS

Hydrocarbons, chemical additives and bio-components in the fuel and lubricant act as their food source. In addition to this are nutritive matter found in contaminated water either fresh or seawater. Cargo residues, particularly from ships carrying cargo like fertilizers, are also sources. The presence of rust and other particulates can promote growth.

TEMPERATURE

Warm engine room (15 -35°C) provides ideal breeding ground for microbial growth

ENVIRONMENT

Any condensation or water leakage completes the required environmental conditions for micro-organisms proliferation, since they live in a water phase but feed of nutrients within an oil phase. Given the ideal environment, a small number of microbial cells can multiply to produce a few kilograms of biomass in a very short period.



TYPE OF MICROBES



There are three basic types of microbes that cause problems in the petroleum industry; these are bacteria, yeasts and moulds.

Counting "colonies" of microbes in fuel

BACTERIA

They exist in two distinct groups: *aerobic*, which use oxygen to oxidize their nutrients, and *anaerobic*, which cannot tolerate oxygen. On the latter type, one strain, called *sulphatereducing* bacteria is particularly virulent. They can only use simple carbon compounds therefore they require the presence of other microbes. They will produce hydrogen Sulphide in the presence of sulphur containing compounds such as sulphates found in seawater.



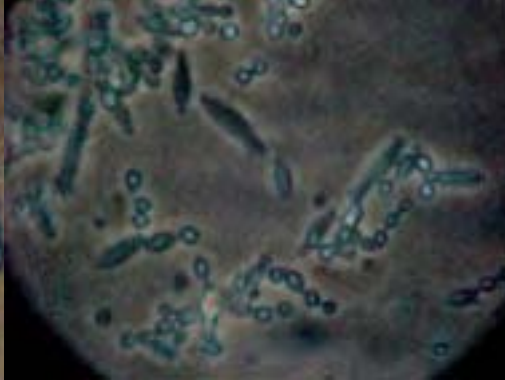
The above is typical sulphate reducing bacteria corrosion pitting of a diesel oil storage tank 10 mm bottom plate, which occurred within nine months.



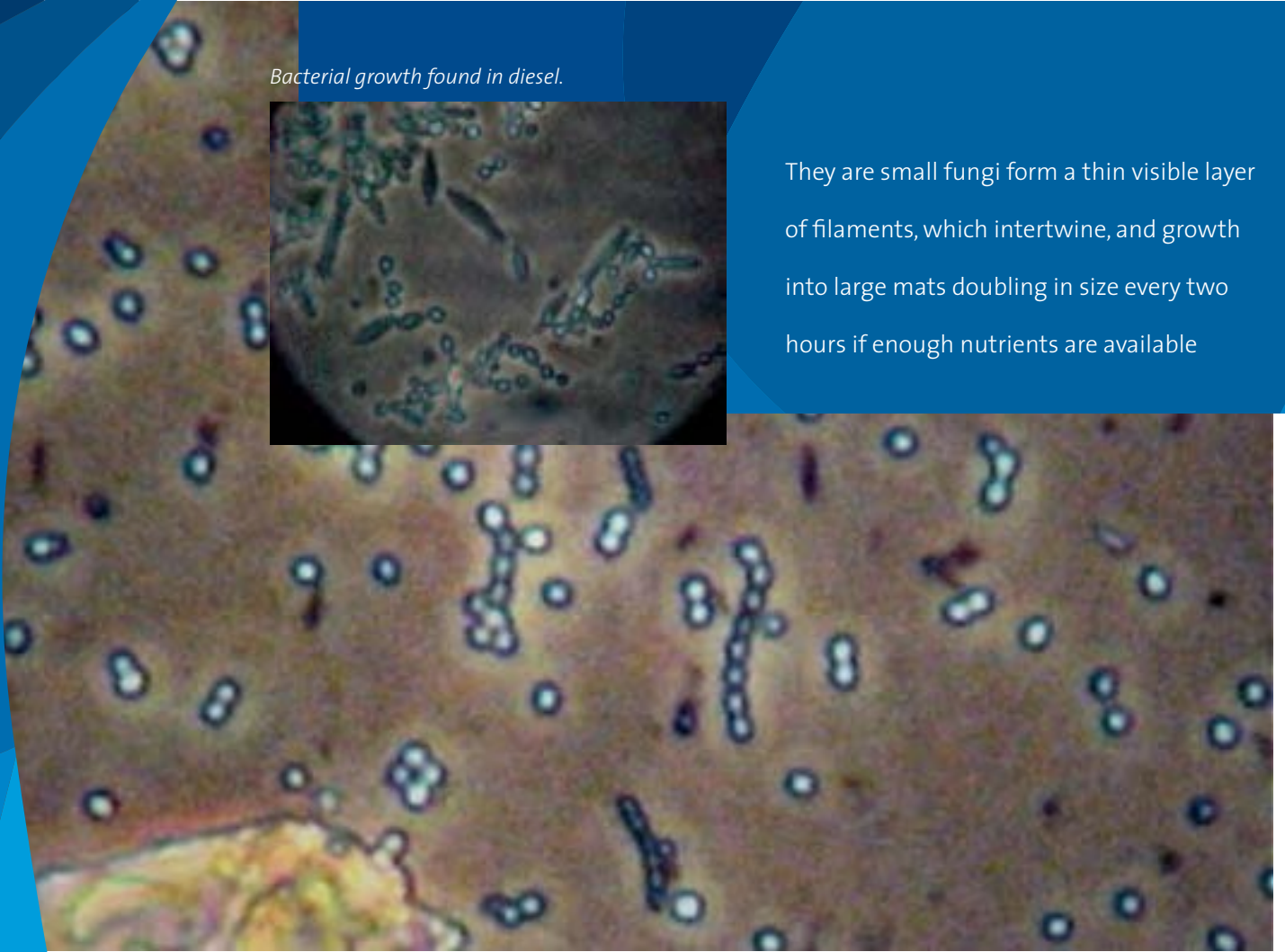
Sulphate reducing bacteria corrosion of fuel injectors

MOULDS

Bacterial growth found in diesel.



They are small fungi form a thin visible layer of filaments, which intertwine, and growth into large mats doubling in size every two hours if enough nutrients are available



FUNGAL HYPHAE AND OTHER DEBRIS FROM THE SURFACE OF A DIESEL FUEL FILTER WHICH BLOCKED IN SERVICE.



YEAST

They utilize the hydrocarbons in fuels and oils to produce organic acids, which then corrode surfaces and can produce large amounts of biomass.



Filter housing



Oil reservoir

SYMPTOMS OF MICROBIAL CONTAMINATION OF FUEL, LUBRICANTS AND BILGE/BALLAST WATER

MEDIUM	FUEL	LUBRICANT	BILGE & BALLAST WATER
Visual	<p>Aggregation of microbes into a biomass, observed as discolouration, turbidity and fouling.</p> <p>Purifiers and coalescers, which rely on a clean fuel/water interface, may malfunction.</p> <p>Tank pitting.</p>	<p>Slimy appearance of the oil; the slime tends to cling to the crankcase doors.</p> <p>Rust films Honey-coloured films on the journals later associated with corrosion pitting.</p> <p>Black stains on white metal bearings, pins and journals.</p> <p>Brown or gray/black deposits on metallic parts.</p> <p>Corrosion of the purifier bowl and newly machined surface.</p> <p>Sludge accumulation in crankcase and excessive sludge at the purifier discharge.</p> <p>Paint stripping in the crankcase</p>	<p>The formation of slimes and sludge, which are, black.</p> <p>Pitting of steel work, pipes and tank bottoms.</p> <p>Rapid corrosion of plating.</p>
Operational	<p>Bacterial polymers may completely plug filters and orifices within a few hours.</p> <p>Filters, pumps and injectors will foul and fail.</p> <p>Non-uniform fuel flow and variations in combustion may accelerate piston rings and cylinder liner wear rates and affect camshaft torque.</p>	<p>Additive depletion.</p> <p>Rancid or sulphitic smells.</p> <p>Increase in oil acidity or sudden loss of alkalinity.</p> <p>Stable water content in the oil, which is not resolved by the purifier.</p> <p>Persistent demulsification problems.</p> <p>Reduction of heat transfer in coolers.</p>	<p>Unusual foul or sulphitic smells.</p> <p>Structural damage.</p> <p>Loss of suction in pipelines.</p>

TREATING MICROBIAL CONTAMINATION

Microbiological analyses can be undertaken to determine whether harmful micro-organisms are present. If they are, the extent of contamination can be assessed and the appropriate remedial treatment can be taken at the following dosage rates:

Slight contamination 150-200ppm

Moderate contamination 200-250 ppm

Heavy contamination 250-300 ppm

MAINTENANCE TREATMENT

Biodiesel contains water in suspension and is hygroscopic. This organic environment stimulates microbial growth, which occurs even at low temperatures.

As a maintenance dosage you can use OOS Fuelguard at a low concentration of 50-100 ppm, we advise to use 100 ppm; this dosage gives the best results in practice.

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