

# Fluid analysis: helping to prevent the effects of microbial contamination

Microbial contamination of fuels, oils and bilge waters can cause severe fouling and damage to machinery and corrosion of storage tanks, pipework and shell plating. Contamination in fuels and oils is generally caused by poor housekeeping in the storage and supply chain. Ingress of harbour waters into static areas of the bilge may cause the microbial organisms to multiply.

Early identification of contamination can help reduce significant damage to machinery and tanks.

The Lloyd's Register Group can identify and assess the extent of the microbial damage and recommend remedial action including the use of biocides.



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

## Bacteria, moulds and yeasts/fungi

There are three defined kinds of microbes: bacteria, moulds and fungi, and yeasts. To survive and grow, bacteria need water and a food source, both of which can usually be found in the interface between water and oil in tanks at temperatures between 15°C and 40°C.

**Bacteria** exist in two distinct groups: aerobic, which use oxygen to oxidise their nutrients, and anaerobic, which cannot tolerate oxygen. Of the latter type, one strain, called sulphate reducing bacteria (SRB) is particularly virulent, producing highly corrosive sulphides as a result of chemical reaction.

**Moulds** (small fungi) form a thin visible layer of filaments which intertwine and grow into large mats doubling in size every two hours if enough nutrients are available.

**Yeasts/Fungi** utilise the hydrocarbons in fuels and oils to produce organic acids which then corrode surfaces and can produce large amounts of biomass.

## Fuels

Microbial contamination of fuels is usually limited to the lighter products that can be handled without heating, such as gas oils and kerosines,

as microbes do not survive in the high temperatures needed to handle heavy fuels.

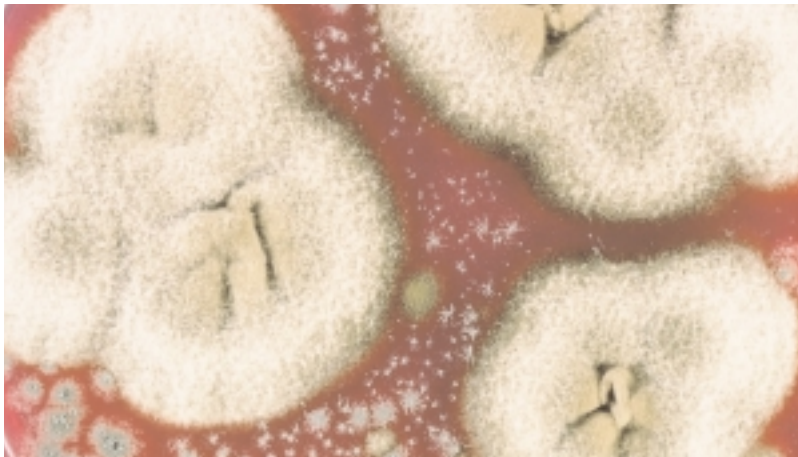
## Bilge waters

Microbially influenced corrosion in bilges arises when inland or coastal waters, which may contain oils and fertiliser residues and/or sewage, establish colonies in stagnant areas of the bilges. These localised concentrations of microbes can rapidly cause pitting and perforation.

## Lubricating oils

Microbial contamination of the temperate areas in lubricant systems can lead to potentially catastrophic failures. Bacterial and fungal infestations have often been overlooked as a contributor to machinery failure. In the marine and offshore sectors, the storage and transportation of lubricants leads to greater potential for water contamination.

Aerobic and non-aerobic microorganisms thrive upon the nutrients provided by the components of these fluids. As the colonies multiply, the by-product of nutrient ingestion, i.e. acidic products and slimes, can have a significant effect upon machinery components and storage tanks.



Hormoconis (cladosporium) resiniae fungus.

Microbes like a stable environment and dislike movement, so laid-up ships or vessels on intermittent service are at greatest risk of sustaining growth of microbes especially in humid conditions where water is not regularly drained off.

#### Treating microbial contamination

It is vital that micro-organisms are precisely identified if an effective treatment is to be found. The Lloyd's Register Group undertakes microbiological analysis to determine whether harmful micro-organisms are present. If they are, we assess the extent of contamination and assist you in taking the appropriate remedial treatment.

Heavy infestations of fuels and lubricants will require the use of biocides, which are themselves toxic and need to be handled and disposed appropriately. Using the best expertise available, we can help you minimise the difficulties experienced by operators of vessels and platforms when dealing with microbial contamination.

#### What to look for

Signs of microbial infection include the following:

- demulsification of the oil
- an increase in acidity
- slime formation on surfaces
- filter plugging and fouling
- unpleasant odours with the characteristic smell of bad eggs
- reduction of heat transfer efficiency in heat exchangers
- black deposits on copper or copper-containing alloys in pipework, valves, bearings etc.
- rapid corrosion often identified as individual pits
- purifier component erosion/corrosion damage.

#### Savings potential

Reducing the potential for corrosion damage and maintaining your hull's integrity are important benefits of the services we provide. Early detection of microbial contamination could save you in excess of US\$ 2.0 million in replacement steel costs alone.

#### Lloyd's Register EMEA

71 Fenchurch Street  
London EC3M 4BS, UK

Tel: + 44 (0)20 7709 9166

Fax: + 44 (0)20 7423 2057

Email: [emea@lr.org](mailto:emea@lr.org)

#### Lloyd's Register Asia

Suite 3501 China Merchants Tower  
Shun Tak Centre  
168-200 Connaught Road Central  
Hong Kong, SAR of PRC

Tel: + 852 2287 9333

Fax: + 852 2526 2921

Email: [asia@lr.org](mailto:asia@lr.org)

#### Lloyd's Register Americas, Inc.

1401 Enclave Parkway, Suite 200  
Houston, Texas, 77077, USA

Tel: +1 (1)281 675 3100

Fax: +1 (1)281 675 3139

Email: [americas@lr.org](mailto:americas@lr.org)

[www.lr.org](http://www.lr.org)

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#### Summary of business benefits

- Identification of microbial contamination helps maintain vessel structures.
- Helps you reduce corrosion damage and fouling to the entire fuel system.
- Helps safeguard you from loss of hull integrity and downtime for costly repairs.
- Provides you with a detailed corrective action plan if necessary.