Biocides for Fuels & Lubricants – Application and Regulations

UNITI Mineral Oil Technology Congress

Stuttgart, April 4th 2016
Agenda

1. Challenges of Microbial Contamination
2. Biocide Regulations - BPR
3. Trends
Challenges of Microbial Contamination
Introduction

• Most substances are susceptible to biological degradation if in contact with water
  – Caused by bacteria, fungi/yeast and algae
• Microbial growth in mineral diesel fuel has been recognized as an issue since the 1930s.
• The extent of the problem has increased significantly since the introduction of biodiesel blending
• Growth of micro-organisms in diesel fuel storage tanks can result in serious bio-induced problems:
  – Microbial Induced Corrosion (MIC), filter/pipe plugging, loss of performance, bad odour.. and combination
• Therefore water based lubricants like metal working fluids and some hydraulics are even more susceptible to those microbes as water is in by design
• Non water based lubricants might have issues if in contact with humidity
• Fuel, processing and metal working fluid biocide additives can be used to both prevent micro-organism growth and to `shock- treat’ an outbreak.
• Recent European regulatory changes present an increased compliance challenge to customers.
Key Factors for Microbial Growth in Diesel Fuel

- Bacteria and fungi can metabolise the hydrocarbons found in diesel fuel.
  - Middle distillates more easily assimilated than gasoline hydrocarbons.

- Water is essential:
  - most micro-organisms are present at the fuel – water interface in storage tanks.

- Trace elements such as phosphorus and sulphur in the fuel also provide critical nutrients.
- Fatty Acid Methyl Esters (FAME) components provide an additional high quality nutrient for micro-organisms.

- Poor housekeeping and accumulation of water in fuel storage facilities can trigger an outbreak.

Combination of various factors can cause exponential growth of micro-organisms
Bacterial and fungal proliferation in fuel tanks leads to a range of problems

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Consequence</th>
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<tbody>
<tr>
<td>Fungal and Bacteria growth.</td>
<td>Hydrocarbon degradation.</td>
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<td>Formation of biofilms and</td>
<td>Blockage of filters, pipework and valves, fuel injector fouling.</td>
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<td>suspended particles.</td>
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<td>Fatty acid and surfactant</td>
<td>Tank and Fuel Injection Equipment corrosion, water emulsion formation,</td>
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<td>formation.</td>
<td>fuel haziness.</td>
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<td>H2S production.</td>
<td>Bad eggs smell and corrosion.</td>
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Scenario 1: Decontamination Methods

Physico-mechanical:
- Thorough cleaning of tanks, pipework.
- Removal of tank water bottoms and fuel drying and filtering

Chemical:
- Fuel biocides at high shock treatment level.
- Biocide must be effective against broad spectrum of organisms.

... Preventing is better than curing ...
Scenarios for Preventing Microbial Contamination

High levels of fuel storage housekeeping:

- Regular cleaning of fuel tanks.

- Tank water bottoms need to be drained frequently to remove atmospheric water condensation.

- Regular monitoring of stored fuel for signs of contamination.

However a low treat of a fuel biocide additive can improve significantly the prevention of an outbreak.
Properties of an fuel biocide additive

• Good solubility between fuel and water phases for long term effectiveness or quick disinfection.

• Activity against range of bacteria and fungi.

• Testing demonstrates effectiveness.

• Registration in process against European Biocide Product Directive/Regulation.

• Globally available by regional registrations
Microbes in lubricants and metal working fluids

- Non water-based lubricants scenario is very similar to fuels, while system cleaning might be even more difficult
- For water-based system like some hydraulics (HFA) microbial attack is only possible to prevent by use of biocidal active substances
- Water based metal working fluids will always need to have biocidal active substances included or microbes will grow
- As machines are „open“ to environment, contamination with microorganism is a continuous process, therefore higher protection needed, often by regular addition of tank side biocides
Biocide Regulation

BPR
• Substances able to control micro-organism are a focus of authorities as they have also specific impact on humans and environment

• Therefore in Europe those substances need to be registered under the Biocidal Products Regulation (BPR)
  – In US this is FIFRA, in Korea this will be “KBPR”

• In contrast to REACH, there is no volume band: all substances need to be authorized before use
BPR – Biocidal Substances/Products

- Substances – biocide actives to make biocide products
  - Registration always EU-wide
  - All targeted Applications need to be registered

- Biocidal products – ready to use products for customers
  - Registration needed for every EU-country
  - Applications need to be registered:
    - PT2 – disinfection of surfaces/equipment
    - PT6 – in can preservation (fuel preservation)
    - PT11 – preservation of liquid cooling and processing liquids (lubricants)
    - PT13 – metal working (incl. hydraulics)

- Since September 1st 2015 no sales of biocidal substances allowed if not on the ECHA §95 list. (List of authorized suppliers)
• Biocidal product: whenever claimed – but also intended use!
  – Intended use. Added at level which will have biocide effect (but dual use)

• Most countries require national biocide product registration before any sales, but required information/actions/cost vary greatly:
  – No notification needed for metal working (PT13)
  – (Notification +) Listing in national hazardous chemicals inventory
  – Full dossier

• After authorization of a biocidal substance, all biocidal products made therefrom need to be registered within 2 years time in all targeted countries by mutual recognition or by ECHA
  – Authorization to be done by a member state of choice, and mutual recognition by all other targeted countries
  – cost in first country up to 50.000 EUR per product and application, mutual recognition up to 5000 EUR (fees only)
  – “Central” registration of biocide product for each Application (PT) at ECHA for EU-wide authorization possible for all products starting 01.01.2017!
BPR – product / country registration y ECHA

- Cost of central registration by ECHA (approximate):
  - Fee of registration = 80.000 EUR + 10.000 annual fee
  - Fee “product family” = 150.000 EUR + 20.000 annual fee
  - “Changes”: major = 40.000 EUR
    - minor = 15.000 EUR
    - admin = 5.000 / 2.000 EUR
  - “same product” = 5.000 EUR
  - Letter of Access = 5.000 EUR
  - Cost of country registration varies, example is 18.000 EUR in Austria under central registration
  - Discount for SME = 10 – 30%

- Cost of registration by mutual recognition varies depending on targeted countries (beside 700 EUR fee to ECHA for organizing) – expected to result in less cost if seek recognition in ~ < 12 countries
- Beside fees, numerous additional studies and exposure scenarios might be requested by authorities
- For EU wide registration expected cost per product/application might be >> 250.000 EUR
- Some biocidal substances have been authorized already before 2016, therefore already first biocidal products made therefrom are now in authorization phase as biocidal substances
  - Due to high cost of biocidal product authorization and stringent evaluation by authorities numerous biocidal products expected to disappear from market
  - Last biocidal substance/product expected to be authorised in 2024!
• All products treated, or intentionally incorporating, biocides are **Treated Articles (TA)**
  – Can only use EU approved/under evaluation actives
  – As such after 2017 May 1st import of treated articles only allowed if the biocidal substance is on Article 95 list of ECHA.

• All TA have to follow BPR label requirements in addition to those of CLP where:
  – A claim is made that the TA has biocidal properties, or:
  – It is required under the conditions of the approval of the active

• Labelling requirements include:
  – Note regarding that the TA contains biocide and the biocidal property of the TA
  – **Revealing all Active Substances and ist concentration**
  – Handling instructions and precautions based on the Biocidal Product in the Treated Article
  – Labelling with all relevant use instructions including safety measurements, if needed to protect human and environment
  – Labelling easy to read and visible, permanent, and in the official language of the country of sales: on package, technical data sheet and letter of guarantee
Trends
Trends

- Authorized biocides are typically strongly labelled as every potential hazard has been analysed in detail with massive data.

- Handling of biocidal products is therefore strictly controlled, resulting in higher administrative burden.

- This is resulting in trend to use "dual-use products" instead, which have biocidal activity aside its "first use" (pH buffer, corrosion inhibitor…)

- While those formulations are still in line with actual version of BPR, it is at risk to call such formulations "biocide free":
  - Such a claim is indicating that the formulation is less "dangerous" than formulations containing a biocidal product, while the dual use product is acting in a similar way to a biocidal product.