Microbes in the system

A workshop co-sponsored by CONCAWE, the UK's Energy Institute and Germany's DGMK looks at the problem of microbial growth in fuel supply and distribution systems.

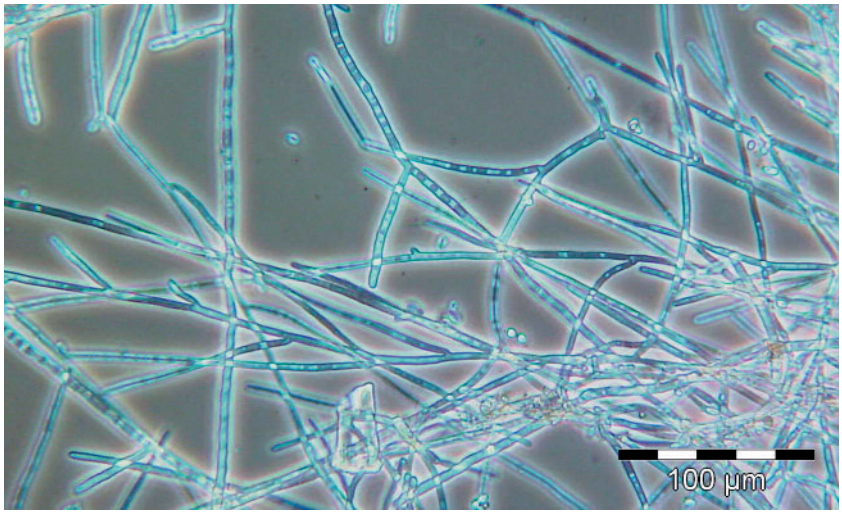
'Microbe' is an overly general term for a wide range of bacteria, fungi and yeasts that are frequently found in air and water, and are capable of building themselves a comfortable home in fuel supply storage tanks and distribution systems. These micron-sized cells (much smaller than the diameter of a human hair) readily multiply to form organised microbial communities in the presence of water, trace elements required for cell growth, and a suitable food source such as biodiesel or aviation fuel. Once growth has started, these communities can rapidly form microbial mats or 'biofilms' that can coat tank walls, plug fuel supply filters, and even lead to the corrosion of tanks and other metal parts. Fortunately, in-line filters at service station pumps are effective at removing microbes from the fuel during the dispensing process. However, frequently blocked fuel filters often provide an early warning that microbial growth may be flourishing in storage tanks.

Dealing with microbial growth problems can have a significant and disruptive impact on day-to-day fuel supply operations. It is an urgent concern for those responsible for distributing high quality transport fuels to the marketplace. For this reason, about 160 experts recently came together in Brussels for a one-day workshop on microbial growth in fuel supply and distribution systems, in order to share experiences and possible solutions. The workshop, held on 16 March, was co-organised by CONCAWE and two partner organisations—the Microbiology Committee of the Energy Institute (EI) and DGMK (the German society for petroleum and coal science and technology, located in Hamburg). Workshop participants included: those responsible for fuel logistics operations in pipelines, terminals and service stations; microbiologists familiar with the fundamentals of microbial growth; manufacturers of measurement equipment and mitigation solutions; and others with an interest in the impact of biofilms on fuel products, equipment operations and vehicles.

The workshop had four objectives, which were to: understand how microbial growth problems occur in the first place; share best practices on how to measure their presence and mitigate their effects; identify areas for future research; and network with others who are interested in the same issues. To address the last objective, the workshop included a commercial exhibition that allowed attendees to meet and exchange business cards with suppliers of measurement test kits, and with experts in tank cleaning and biocide treatments.

The workshop covered five important questions: What is the industry experience? What environmental conditions can contribute to microbial growth problems? How are these problems routinely measured and monitored? How can microbial growth problems be mitigated? What additional research is needed in order to understand and deal with these problems?

Figure 1 Microscopic photo of one type of micro-organism found in a fuel storage tank



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Although microbe problems have been known for many decades, increasing fatty acid methyl esters (FAME—derived from vegetable and animal oils) in diesel fuels while decreasing the concentration of residual sulphur- and nitrogen-containing molecules have generally favoured more microbial growth. More FAME in the fuel increases the food and nutrient supply, while lower sulphur and nitrogen molecules may deplete potential microbial poisons. While some microbes are genetically engineered to grow well in oxygenated environments, others are quite content in oxygen-free or anaerobic environments, so understanding the specific needs of common microbes is important to routinely mitigating their growth in fuel supply and distribution systems.

Taking action

Water is the key, however—without water, growing and sustaining a microbial community is very difficult. For this reason, routine monitoring of storage tanks, using test kits that are sensitive to microbes, helps spot problems early enough so that remedial treatments can be avoided or can be put into action quickly if needed. Although aggressive biocide treatments are sometimes needed to mitigate microbial blooms, good housekeeping, especially draining storage tanks of residual water layers, is an essential control strategy. This means that a routine maintenance and remediation action plan must be in place before problems occur, and is an increasingly important quality control tool for terminal and service station operators.

Unfortunately, microbe problems are sometimes not spotted early enough and a broad-spectrum biocide from a speciality chemical company may be needed as well as an expert in biocide application and tank remediation. Although these approaches can be effective, over-using biocide treatments runs the risk that microbes can eventually adapt to today's chemical treatments, leading to the need for new and ever more aggressive options. More research was identified at the workshop to keep ahead of these problems, including obtaining more complete and detailed information on different microbial types that are found in fuel systems, faster and more specific monitoring kits and more targeted biocide treatments.

The workshop presentations are available on the 'Events' page of the CONCAWE website. The three organisations that hosted the workshop are planning to issue a full report on the proceedings later this year. The EI's Microbiology Committee is also currently working on new guidelines for managing microbial growth problems in fuel supply and distribution systems, which will be published soon—for more information see www.energyinst.org/microbiology-bulletin.

Figure 2 A typical biofilm that can be found in an affected fuel supply system

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