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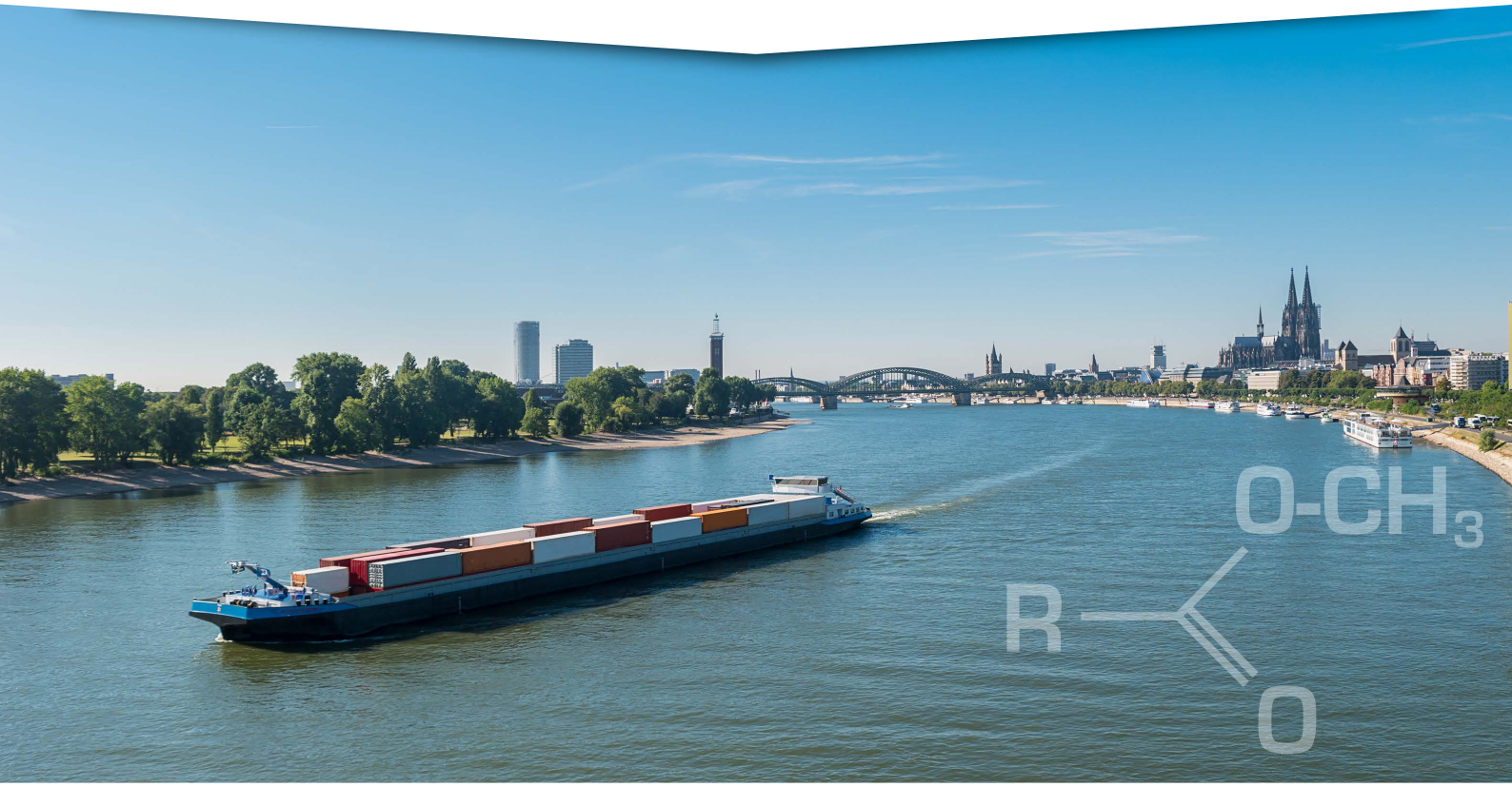


Reliable operation with biodiesel and FAME blends

This white paper provides insight into the challenges of biodiesel and FAME blends in inland shipping and explains why active fuel management is becoming increasingly important.

You will learn which risks these fuels entail and how targeted filtration and conditioning solutions contribute to reliable and stable fuel quality.

From problem statement to active fuel management

From 1 January 2026, the share of renewable components in European gas oil will increase further. In practice, this means the use of biodiesel blends containing 12–20% FAME (Fatty Acid Methyl Esters). This development is driven by climate objectives and the European energy transition, but it has far-reaching consequences for fuel systems in inland shipping and the maritime sector.

Where engines and fuel installations were historically designed for fossil diesel or a maximum of B7, higher FAME concentrations lead to fundamentally different fuel behaviour. Properties such as water binding, lower oxidation stability, microbiological sensitivity and the cleaning effect on existing contamination increase the risk of malfunctions, accelerated filter clogging and unplanned downtime.

The core message of this white paper is clear: with higher FAME blends, active fuel management is essential. Inline filtration alone is no longer sufficient.

Biodiesel and the energy transition

Since the signing of the Green Deal for Maritime Shipping, Inland Shipping and Ports in 2019, biodiesel has become a structural part of the fuel landscape. What was initially regarded as a simple blend component has, in practice, proven to be a fuel with fundamentally different properties. The use of higher FAME percentages places demands not only on the engine, but especially on the entire fuel system.

Biodiesel consists of conventional petroleum diesel to which a bio-component is added. This bio-component may be derived from vegetable oils, animal fats, used oils or other renewable feedstocks. The origin of this component has a major influence on the behaviour of the fuel during storage, filtration and combustion.

What is FAME and why does it behave differently?

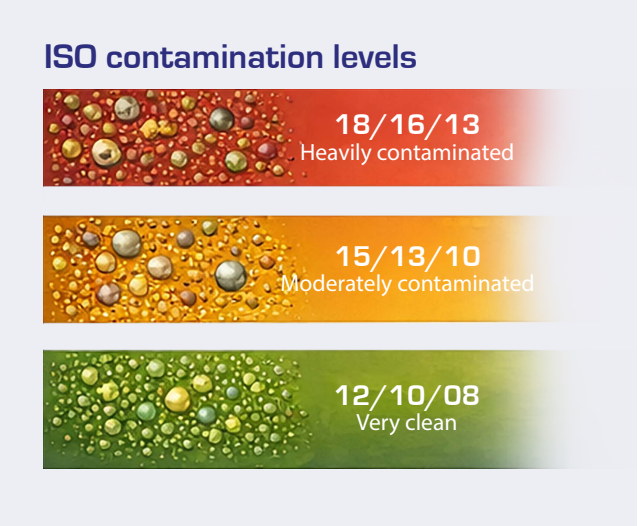
FAME (Fatty Acid Methyl Esters) is produced through a chemical process in which fats and oils are converted into a fuel suitable for diesel engines. Unlike fossil diesel, which is produced by distillation, biodiesel remains chemically more active after this process.

FAME is hygroscopic and readily absorbs water, which is also kept in suspension. In addition, oxidation stability is lower, the fuel ages faster, and FAME acts as a solvent on existing deposits in tanks and pipelines. These characteristics are not anomalies but are inherent to biodiesel.

Chemical background of instability and quality standards

During biodiesel production, residual components such as traces of methanol, salts, acids, glycerine residues and soap-like compounds always remain. Despite cleaning and neutralisation, these substances are never completely removed. Because FAME is polar, it binds water strongly and releases it only with difficulty.

To safeguard the quality of biodiesel and FAME blends, international standards have been established. For biodiesel (FAME), EN 14214 applies, defining requirements for ester quality, oxidation stability, water content and contamination. For diesel fuels blended with FAME, EN 590 is the governing standard. This standard specifies, among other things, the maximum permitted FAME percentage, fuel properties and limit values for water and particles.



Although fuel that complies with EN 590 and EN 14214 is formally suitable for use, this does not automatically mean it will function without problems in existing fuel systems. The standards indicate minimum quality limits at the time of delivery but say little about behaviour during storage, downtime and onboard use.

As a result, biodiesel remains more sensitive to oxidation, ages faster and forms sludge sooner. In combination with water, it also creates an ideal breeding ground for microbiological growth, further undermining fuel stability.

Water: the greatest risk with FAME blends

Water plays a central role in virtually all problems associated with biodiesel. Whereas fossil diesel allows water to settle, water remains dispersed throughout FAME blends. This means it cannot easily be drained and instead spreads throughout the entire system.

In practice, this leads to accelerated microbiological growth, biofilm formation, corrosion of tanks and pipelines, and a significantly increased filter load. Without active water removal, fuel quality deteriorates rapidly, resulting in malfunctions and engine problems.

Filter system with water separator

Differences between biodiesel types

Not all biodiesel behaves the same. Soy-based biodiesel generally has lower oxidation stability, while biodiesel derived from animal fats has a higher saturation level and is therefore more prone to gelling and crystallisation. Biodiesel from vegetable oils often performs slightly better at low temperatures but remains sensitive to water and contamination.

This means that not only the FAME percentage is decisive, but also the origin and quality of the biodiesel used.

Cold flow, flocculation and temperature influence

Due to the higher cloud point and pour point of FAME blends, wax formation and crystallisation can occur at lower temperatures. In practice, this can already happen at temperatures below 7–8°C, depending on the composition of the biodiesel.

Heating can limit these effects, but it rarely provides a structural solution. High flow rates require substantial power, while residence time in heaters is often limited. In addition, heating increases system complexity. For this reason, Micfil applies heating exclusively as part of an integrated total solution.

Micfil total solution including heater

The cleaning effect of FAME

When switching from fossil diesel to biodiesel, existing contamination in bunker tanks and pipelines is loosened. This temporarily leads to a significantly increased filter load and may cause unexpected malfunctions. However, this phenomenon is predictable and temporary.

Once the accumulated contamination has been removed, the system stabilises and biodiesel can be used reliably, provided the correct measures have been taken.

Bunker tanks: designed for a different fuel

Most existing bunker tanks were designed for fossil diesel. The assumption was that water would settle, the fuel would be chemically stable, and microbiological activity would play no role. FAME blends completely invalidate these assumptions.

Water remains dispersed throughout the fuel and adheres to tank walls, while biofilms and sludge form in corners and dead zones. In addition, heavier and lighter fractions can separate, meaning the engine no longer receives consistent fuel quality. FAME also reacts more actively with tank walls and coatings and dissolves old deposits.

Complete tank replacement is rarely feasible in practice. Retrofit solutions such as external polishing loops, additional circulation and active conditioning are therefore essential.

Downtime as a critical factor

During downtime, fuel quality deteriorates most rapidly. Water becomes unevenly distributed, microbiological activity increases, and sludge forms in tanks and pipelines. The longer the fuel remains unused, the greater the risk of problems upon restart.

From filtration to active fuel management

Traditional fuel systems filter only the fuel flowing toward the engine. With FAME blends, however, the biggest problems arise already in the bunker and during storage. A different approach is therefore required.

Active fuel management focuses on conditioning the entire fuel inventory. By continuously controlling water, contamination and instability, fuel quality remains stable—even during downtime.

Micfil AL Series filter systems

Polishing as a structural solution

A proven method of safeguarding fuel quality is polishing. In this process, fuel is circulated and filtered in a closed loop using an independent pump, separate from the engine system. This process can remain active during downtime and prevents stratification, water accumulation and microbiological growth.

Micfil AL300 double filter system in combination with a Micfil WS800 water separator

The Micfil approach: from filtration to conditioning

The solutions of Micfil are based on the principle that modern fuels must be actively managed. Micfil therefore does not supply standard filters, but complete conditioning systems tailored to the specific properties of biodiesel and FAME blends.

The core of this approach consists of a combination of different filtration and conditioning steps:

- **Pre-filtration with bag filters,** intended to effectively capture coarse contamination and loosened deposits during transition phases
- **Water separation,** removing free water and a large portion of bound water at an early stage
- **Microfiltration down to 0.5 micron,** essential for protecting injectors, fuel pumps and modern engine technology
- **Optional fuel heating,** applied when cold-flow properties require it, always as part of a total concept
- **Polishing and circulation solutions,** ensuring active fuel quality control even during downtime

Bag filter

Water separator

Fuel filter

Heater

Unique filter system with refills for every system

The Micfil filter elements are water-resistant and contain no paper. This is crucial for biodiesel applications, where increased water content would otherwise lead to rapid filter saturation and malfunctions.


Filter elements

Effect on combustion and wear

Very fine filtration results in cleaner fuel and more complete combustion. This leads to less soot formation, reduced contamination of lubricating oil and particulate filters, and lower wear of injectors and fuel pumps. As a result, maintenance costs and susceptibility to malfunctions decrease.

Dimensioning as a prerequisite

For inline applications, Micfil uses generous dimensioning, with systems capable of handling at least four times the maximum engine consumption. This prevents pressure drop, cavitation and fuel shortages and contributes to stable operation under all conditions.

Application, support and emergency service

Micfil Filters Benelux supplies its solutions in various forms, depending on the situation and user requirements. Systems are available for purchase, rental or lease and can be deployed either permanently or temporarily.

In addition to system supply, Micfil offers extensive support. Installations are tailored to fuel consumption, storage capacity and sailing behaviour and are implemented by Micfil's own experienced specialists.

In the event of emergencies or acute fuel problems, Micfil can also provide rapid on-site assistance. Using mobile installations, tanks and fuel systems can be flushed, circulated and filtered at high flow rates. This approach makes it possible to restore heavily contaminated or unstable fuel without prolonged vessel downtime.

This combination of technology and service ensures that Micfil is not merely a supplier, but an active partner in fuel management.

Micfil is happy to assist you

The introduction of biodiesel with 12–20% FAME represents a fundamental change in fuel behaviour. Without active measures, malfunctions, maintenance costs and downtime will increase. By intelligently combining microfiltration, water separation, bag filters, polishing and correct dimensioning, this transition can be made manageable and reliable.

Micfil supports the sector with many years of experience, proven technology and practical advice—from analysis to long-term operational support.

By now, more than 3,500 companies in inland shipping have chosen Micfil Filters' solutions.
We are extremely proud of this, and we are happy to put that experience to work for you as well.

Our systems comply with the following certifications

BUREAU VERITAS 1828 BUREAU VERITAS

UMTEC Institut für Umwelt- und Verfahrenstechnik

FME POWERED BY DUTCH TECHNOLOGY

RINA

RINA 1861

IACS International Association of Classification Societies

TÜV

Feel free to contact us for non-binding advice

Would you like to know more about what we can do for you, or discuss your situation with one of our advisors? We would be pleased to visit you without obligation to explore the possibilities together.

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