

Recommendation on Additional Requirements for FAME as Blend Component

Preamble

Biodiesel (FAME) is a fuel component important for the achievement of the legally set targets concerning the reduction of GHG emissions generated by road traffic. Worldwide, biodiesel is used as blend component to conventional Diesel fuel.

Today, the standard for Diesel fuel, EN 590, sets uniform European requirements. It allows the blending with FAME up to 7% (V/V). Every EU member state implements the standard in national requirements. In Germany this standard is put into force by DIN EN 590:2017-10.

All stipulations mentioned for biodiesel were based on the application of EN 14214 for the definition of requirements concerning FAME as blend component. In the meantime, however, there has been a demand regarding diverse additional quality requirements for this component beyond those stipulated in EN 14214, in order to ensure the final product quality of the Diesel fuel. Among others there is also the requirement to verify quality assuring measures during the production as well as the purchase of biodiesel which essentially base on obligatory in-house documentation. Additionally, customers must be given confirmation and verification that the internal documentation requirements are met and checked externally (e.g. by audits).

For that, the following aspects must be observed and/or verified:

- Compilation and observation of an explicit quality management manual,
- Internal and external checks of the product's quality parameters at regular intervals,
- Application of measures which reduce and alleviate unfavourable influences due to storage and transport

- Application of measures which ensure that inferior products are not marketed
- Proof of competence and qualification for a sound product control, i.e. by participation in Round Robin tests.

Objectives

This recommendation is meant to close gaps in the existing requirements for FAME used as blend component beyond DIN EN 14214:2014. The recommendation presented is based on the assessment of technical facts and the analysis of the risk that a produced blend fuel may not be 'fit for purpose'.

It is a compendium of the results of comprehensive scientific/technical research reports and monitoring of product properties of FAME as well as field studies in Germany and findings of experts.

Additionally, with the implementation of this recommendation it is intended to simplify the pooling of data of any parameters to be viewed in the future, in order to improve the data situation for any advancement of EN 14214. The additional requirements suggested here are checked periodically in line with any further development of EN 14214 and adjusted if necessary. This recommendation applies for blending with up to 7.0% (V/V) FAME.

Note:

Not all limitations of test parameters, which would objectively be desirable in principle (e.g. reduced limits for metal contents), can be achieved due to the current status of the test methods. Furthermore, requirements with a fixed limit should not be included if standardised or sufficiently validated test methods are not available. Ultimately, such requirements would rather produce new uncertainties instead of improving the marketing situation of FAME.



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Requirements

FAME used as blend component should comply with the following additional conditions beyond the fulfilment of the requirements of DIN EN 14214:

Parameter	Test method/Criterion	Value/Condition	B
General			
Clear & bright	Appearance: „At 15° C at least clear and bright of undissolved water and visible contamination“	Condition must be observed	(1)
Water content	DIN EN ISO 12937	max. 300 mg/kg for traders max. 220 mg/kg for producers	(2)
Cold property and filterability			
Pourpoint (PP)	DIN EN ISO 3016	16.11. to 28./29.02. max. -6 °C and min. -18 °C	(3)
Total contamination	DIN EN 12662:1998	max. 20 mg/kg	(4)
Optionally			
Content of Sterylglycosides (SG)	DIN EN 16934:2017	Measuring value must be given (no limit)	(5)
Saturated Monoglycerides (SMG)	DIN EN 17057:2018	Measuring value must be given (recommended limit max. 1,200 mg/kg)	(6)
Oxidation stability and Stabilisers			
Oxidation stability	DIN EN 14112	min. 9 h	(7)
Proof of observance of the no-harm criteria and proper dosage of the oxidation stabilisers (min./max.)	Recommendation of the no-harm criteria and determination of the relative efficiency according to the description of the methodology of the no-harm test (available on request at AGQM). (See also no-harm list of AGQM under www.agqm-biodiesel.com)	Requirements must be complied with; supplier must give confirmation thereof. On request supplier reveals data supporting his confirmation.	(8)

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Explanation of the requirements

(1) The parameter “clear & bright“ is easy to determine and with its use mineral oil products have been successfully characterised for a long time. It averts the acceptance of obviously faulty products which may contaminate storage facilities for example.

(2) FAME is hygroscopic and can solve up to 1,500 mg water/kg. From a multitude of investigations it is known that the exhaustion of the maximum water content of FAME stipulated as 500 mg/kg by DIN EN 14214 can have various detrimental consequences for blend fuels. These include e.g. precipitation of water when mixing with very non-polar arctic Diesel fuels which may lead to corrosion and microbial growth. The suggested limits of 220 mg/kg for producers and of 300 mg/kg for traders may avert these risks.

(3) The Pourpoint (PP) secures that FAME can be handled safely until it is blended. This is only relevant during the winter period. The lower limits are set in order to restrict the use of additives with a potential for incompatibility.

(4) The reduction of the limit of the total contamination compared with that of DIN EN 14214 provides a ‘safety buffer’ which improves the application security of the product. At European level, CEN TC19 WG31 is currently working on a new method for the determination of total contamination in FAME. At present, method EN 12662:2008 is recommended. However, it was shown that EN 12662:1998 gives excellent results with low effort and sample volume. In the national foreword of DIN EN 12662:2008 the use of the method from 1998 is recommended.

(5) In multiple examinations it was shown that sterylglycosides are one of the main sources for poor filterability of FAME and blend fuels made thereof. But next to the

connection between filterability and the sterylglycoside content further impacts have to be taken into account. Moreover, the blend fuel made from FAME with a poor filterability does not automatically have a poor filterability itself. A complete refining of the crude oil usually leads to a FAME with no significant amounts of sterylglycosides. In 2017, a test method for the determination of sterylglycosides (DIN EN 16934) was validated.

(6) Saturated monoglycerides (SMG) are hardly soluble in mineral Diesel due to their physicochemical properties, they accumulate in the cold and may lead to precipitations. Higher concentrations of those components cause a deterioration of the filterability of blend fuels up to a point of risking filter blocking in vehicles. In 2018, DIN EN 17057 was released, a method to measure the SMG content directly. Alternatively, the SMG content was calculated via the monoglyceride content and the Cloud Point (CP). Until now no limit value for SMG content could be defined because neither a correlation nor the actual contents were determined yet. On a basis of FAME monitoring and determined concentrations thereof, AGQM recommends a maximum SMG content of 1,200 mg/kg.

(7) The increase of the limit of the oxidation stability compared with that of DIN EN 14214 provides a ‘safety buffer’ which improves the application security of the product.

(8) DIN EN 590 contains a strong recommendation for the use of stabilisers for FAME. The assumption is that proper dosage applies because both excess and reduced dosages cause detrimental effects. Against this background, a no-harm test for oxidation stabilisers for FAME was developed which at the same time provides the option to assess the relative efficiency of stabilisers, thus enabling a proper dosage by the user. The



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no-harm list with all successfully tested additives can be found on AGQM's homepage under www.agqm-biodiesel.com.

Not recommended as additional requirement

It is not recommended to limit the colour of FAME since it is no true quality feature. Potentially critical products are safely excluded by means of the other characteristics of DIN EN 14214 with the combination of 'clear and bright'.

There is no intention to create requirements for an additional limitation of the Na, K, Ca, Mg and P contents below the limits stipulated in DIN EN 14214; also, there will be no additional limitation of other metal contents. Such specifications cannot be supervised and monitored with the precision data of the existing test methods with legal reliability. However, it should be noted that the values measured in the field lie far below the limits of DIN EN 14214.

It is not recommended to limit the filter blocking tendency (FBT), because the precision of the method (IP 387)¹ is not sufficient. Until now, neither correlations between FBT and occurrences in the field (e.g. dead vehicles) nor between FBT and other parameters like steryl glycosides or saturated monoglycerides could be found. Additionally, a multitude of factors (e.g. storage, transport) have an influence on the FBT.

All presented standards have been published by Beuth-Verlag and can be obtained there (www.beuth.de).

Note

The leaflet is a summary of the experience of the AGQM and its members and has been compiled with the utmost care. Nevertheless, no guarantee can be given for the accuracy, completeness and timeliness of the content provided. For this reason, we exclude any liability in connection with the use of the leaflet.

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¹ <https://publishing.energyinst.org/topics/fuel-quality-and-control/ip-test-methods/ip-387-determination-of-filter-blocking-tendency>

