



Application Note AN-R-009

脂肪酸甲酯(FAME,生物柴油)的氧化稳定性

Reliable and accurate determination of the oxidation stability of biodiesel according to EN 15751

Biodiesel, also known as fatty acid methyl esters (FAME), is used just like petroleum-based diesel. Fatty acid methyl ester biodiesel can also be blended with petroleum diesel fuel in any ratio for use in diesel engines [1]. Biodiesel fuel produces fewer emissions, is sustainable, biodegradable, and environmentally friendly, and has good lubricating properties. Transesterification of glycerides in vegetable oils, animal fats, or organic waste with monohydric alcohols (e.g., methanol or ethanol) can make

FAME.

Antioxidants, whether natural or added (e.g., ascorbyl palmitate), inhibit FAME autoxidation and help to prolong shelf life. Both the quality and antioxidant capacity of biodiesel need to be monitored. One of the most important parameters to measure is oxidation stability. The 893 Professional Biodiesel Rancimat determines the oxidation stability of biodiesel according to EN 14112, EN 15751, and EN 16568 standards.

SAMPLE AND SAMPLE PREPARATION

This application is demonstrated on biodiesel with and without added antioxidants (Table 1). For measurements of biodiesel with

antioxidants, 10 mg of ascorbyl palmitate was added to 100 mL of biodiesel.

EXPERIMENTAL

The determinations are carried out using an 893 Professional Biodiesel Rancimat (Figure 1).

An appropriate amount of sample is weighed into the reaction vessel, and then the analysis is started.

The biodiesel sample is exposed to an airflow at a constant temperature of 80–150 °C using the biodiesel Rancimat method. In this way, highly volatile secondary oxidation products are transferred along with the airflow into the measuring vessel where they are absorbed in the measuring solution.

The conductivity of the measuring solution is registered continuously. The formation of secondary oxidation products leads to increased conductivity of the solution. A good indicator for the oxidation stability, the «induction time», is the amount of time until this marked conductivity increase occurs (Figure 2).



Figure 1. 893 Professional Biodiesel Rancimat equipped with measuring and reaction vessels for the determination of oxidation stability of biodiesel.

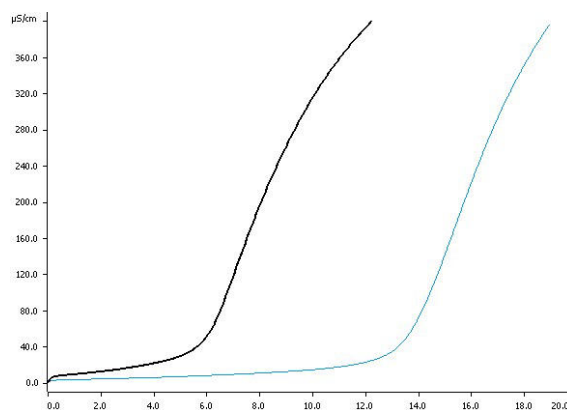


Figure 2. Determination of the oxidation stability of biodiesel both with (blue curve) and without (black curve) added antioxidants (100 mg/L ascorbyl palmitate) at 110 °C.

Table 1. Results for the oxidation stability of biodiesel with and without added antioxidants (100 mg/L ascorbyl palmitate) using the 893 Professional Biodiesel Rancimat at 110 ° C.

Sample (n = 4)	Mean value in h	SD(rel) in %
Biodiesel without added antioxidant	6.15	1.1
Biodiesel with added antioxidant	13.55	0.9

CONCLUSION

The oxidation stability of biodiesel as well as blends of biodiesel is an important quality control parameter in a series of standards defining the minimum quality requirements for FAME (fatty acid methyl ester) analysis in biodiesel marketed as vehicle fuel or heating oil. In addition, a comparison of biodiesel with and without the presence of added antioxidants can be made by determining oxidation stability according to EN 15751. This allows conclusions to be drawn about the shelf life, the effect of antioxidants, durability, and comparative value between samples which are still stable and those which are already rancid. With the Rancimat, this quality parameter can easily and simultaneously be determined for eight different samples at a time, increasing

quality control laboratory throughput. The status of the Rancimat is shown with a built-in display. Buttons for each measuring position on the instrument allow individual measurements to be started. The use of practical disposable reaction vessels and dishwasher-safe accessories reduces cleaning to a minimum. This saves time and money and significantly improves accuracy and repeatability. Biodiesel samples with and without antioxidant addition (100 mg/L ascorbyl palmitate) have been tested in this Application Note. The determination worked superbly and has shown that biodiesel with antioxidant additives has a significantly higher induction time and therefore longer shelf life.

REFERENCES

1. Metrohm AG. Oxidation Stability of Diesel, Biodiesel, and Blends – Reliable Oxidation Stability Measurements in Diesel, Biodiesel, and Blends According to EN 14112, EN 15751, and EN 16568; [AN-R-034](#); Metrohm AG: Herisau, Switzerland, 2024.

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CONFIGURATION



893 Professional Biodiesel Rancimat

893 Professional Biodiesel Rancimat 是一套用于根据 EN 14112、EN 15751 和 EN 16568 的规定测定生物柴油(脂肪酸甲酯、FAME)和混合型生物柴油的氧化稳定性的分析系统,既简便又安全。2 个加热块中共有 8 个测量位置。内置显示屏可显示设备状态和每个测量位置。每个测量位置都有启动按钮,可在仪器上启动测量。采用实用的一次性反应管和可使用洗碗机清洗的附件可将清洗工作降至低。这即可节省时间和费用,并且也可显著提高。

执行测定所需的所有附件均已包括在标准配置内。需要使用 StabNet 软件来进行仪器控制、数据记录 and 评估以及数据保存。



Rancimat

用于精确温度调整的套件



Rancimat

用于生物柴油 Rancimat 的重要耗材的组合。