



Application Note AN-R-034

柴油、生物柴油及混合燃料的氧化稳定性

Reliable oxidation stability measurements in diesel, biodiesel, and blends according to EN 14112, EN 15751, and EN 16568

Compared to petroleum diesel fuel, biodiesel produces fewer emissions and is considered sustainable and environmentally friendly. Biodiesel can be blended with petroleum-based diesel in any ratio. Many countries therefore add biodiesel to conventional diesel fuel between 5% to 15% (v/v). Depending on the type of internal combustion diesel engine, the biodiesel fraction can be much higher or even used as 100% pure biodiesel fuel.

However, the quality of both the biodiesel and

its blends needs to be monitored. One of the most important parameters is oxidation stability of fuel. During biodiesel production, the addition and effect of antioxidants (e.g., ascorbyl palmitate) inhibits autoxidation and increases the oxidation stability [1]. The 893 Professional Biodiesel Rancimat is an analytical system for easy and safe determination of the oxidation stability of biodiesel and its blends according to EN 14112, EN 15751, and EN 16568.

SAMPLE AND SAMPLE PREPARATION

This application is demonstrated on various fuel samples which are listed in **Table 1**.

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.

With the biodiesel Rancimat method, the sample is exposed to an airflow at a constant temperature between 80–150 ° C. Highly volatile secondary oxidation products are transferred into the measuring vessel along with the airflow where they are absorbed in the measuring solution.

The conductivity of the measuring solution is continuously registered. The formation of secondary oxidation products leads to an increase in the conductivity. The time until occurrence of this marked conductivity increase is referred to as the «induction time», which is a good indicator for the oxidation stability (Figure 2).

No sample preparation is required.



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

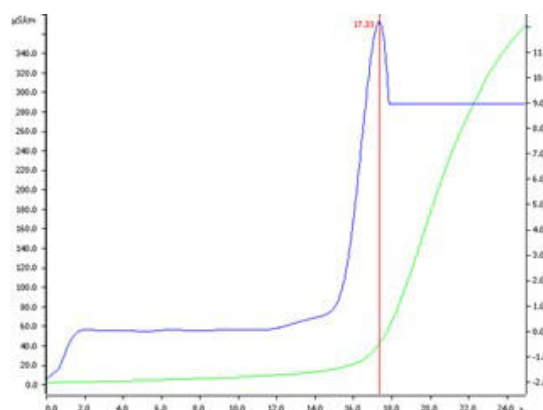


Figure 2. Determination of the oxidation stability of a diesel blend with 20% biodiesel (v/v) at 110 ° C.

Furthermore, a power regression shows that the blends with the corresponding induction time achieved a coefficient of determination of 0.9996 (Figure 3). This demonstrates the accuracy of the 893 Professional Biodiesel Rancimat.

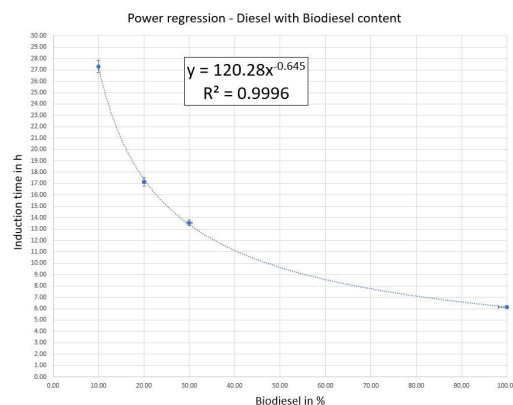


Figure 3. Power regression of diesel with biodiesel blend at 110 ° C.

Table 1. Results for the oxidation stability of diesel, biodiesel, and blends with the 893 Professional Biodiesel Rancimat at 110 ° C.

Sample (n = 4)	Mean value in h	SD(rel) in %
100% Diesel without biodiesel content	N/A*	N/A*
100% Biodiesel (made from organic waste)	6.15	1.2
Diesel blend with 30% biodiesel (v/v)	13.55	0.9
Diesel blend with 20% biodiesel (v/v)	17.15	1.0
Diesel blend with 10% biodiesel (v/v)	27.31	1.6

CONCLUSION

The oxidation stability of biodiesel and its blends with diesel fuels is an important parameter listed in a series of standard methods defining the minimum quality requirements for biodiesel marketed as vehicle fuel or heating oil.

By using the Rancimat, diesel oxidation stability can be easily determined for several samples at a time with eight measuring positions in two heating blocks, increasing laboratory throughput. The built-in display shows the status

of the instrument and each individual measuring position. A button located at each measuring position on the instrument allows 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.

In this application, diesel, biodiesel, and various

blends of both were tested. As diesel fuel itself is very stable against oxidation, no induction period could be found within a reasonable time at 110 ° C. However, the determination worked very well for biodiesel and all blends tested. It was also shown in a power regression that the

blends with the corresponding induction time achieved a coefficient of determination of 0.9996, demonstrating the superior accuracy of the 893 Professional Biodiesel Rancimat for this analysis.

REFERENCES

1. Metrohm AG. Oxidation Stability of Fatty Acid Methyl Esters (FAME, Biodiesel) – Reliable and Accurate Determination of the Oxidation Stability of Biodiesel According to EN 15751; AN-R-009; 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。