



Application Note AN-T-179

Fully automated determination of TAN/TBN according to ASTM D664 and ASTM D2896

Fast and reliable analysis of non- and fully synthetic motor oil used in the automotive industry by potentiometric titration

Knowing the exact acid number and base number of an engine oil is important to determine its quality. Monitoring the total acid number (TAN) and total base number (TBN) of engine oils can also prevent damage to engine components. Both TAN and TBN can be accurately determined in fully synthetic and conventional engine oils used in the auto

industry.

This Application Note presents the determination of TAN (ASTM D664) as well as TBN (ASTM D2896) in motor oil samples using potentiometric titration methods. Automated parallel titration is performed using the OMNIS Sample Robot S and the OMNIS Titrator equipped with dSolvotrodes.

SAMPLE AND SAMPLE PREPARATION

This application is demonstrated on fully synthetic motor oil SAE 5W/40 as well as non-synthetic (conventional) motor oil SAE 30,

labelled as mineral oil.
No sample preparation is required.

EXPERIMENTAL

The determinations are carried out using an OMNIS Professional Titrator equipped with a dSolvotrode on an OMNIS Sample Robot S (**Figure 1**). To avoid manually handling chemicals, all solutions can be automatically added using an OMNIS Dosing Module. An appropriate amount of sample is weighed into the titration vessel and solvent is added. Afterwards, the solution is titrated until after the first endpoint with standardized potassium hydroxide for the total acid number, or with standardized perchloric acid in acetic acid for the total base number. One exemplary titration curve of TBN with HClO_4 is shown in **Figure 2**.



Figure 1. OMNIS Sample Robot S equipped with an OMNIS Titrator, OMNIS Dosing Module, and dSolvotrode for the automated determination of TAN and TBN in motor oil samples.

RESULTS

This method offers very accurate results for TAN and TBN oil analysis as displayed in **Tables 1 and**

2.

Table 1. Results for the TAN oil analysis according to ASTM D664.

Motor oil (n = 6)	Mean in mg KOH/g sample	SD(rel) in %
SAE 5W/40	3.80	1.6
SAE 30	1.16	1.2

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Motor oil (n = 6)	Mean in mg KOH/g sample	SD(rel) in %
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SAE 30	1.16	1.2

Table 2. Results for the TBN determination according to ASTM D2896.

Motor oil (n = 6)	Mean in mg KOH/g sample	SD(rel) in %
SAE 5W/40	9.05	0.4
SAE 30	1.01	1.6

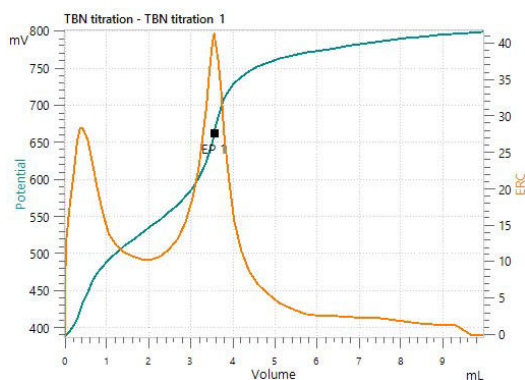


Figure 2. Titration curve of the TBN determination of SAE 5W/40.

CONCLUSION

Titration is a very fast and accurate method that can determine the total acid number and total base number of engine oil (both synthetic and conventional). The OMNIS Titrator equipped with a dSolvotrode delivers reliable determinations. This automated system offers

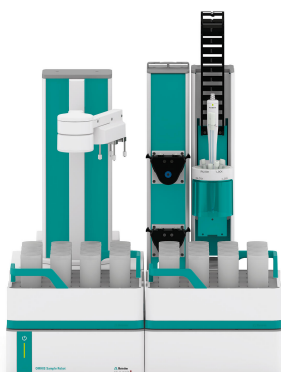
flexible analyses combined with high-end software. Aside from improving the precision and speed of the determinations, OMNIS provides results that are on par with or better than other established titration systems.

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CONFIGURATION



OMNIS Sample Robot S Pick and Place

OMNIS Sample Robot S 具有一个“蠕动”泵模块(2通道)和一个 Pick&Place 模块以及大量附件,可直接进入全自动滴定。此系统具有两个样品盘位置,可用于 32 个 120 mL 的样品盘。此模块化系统供货时已完全安装完毕,因此可在极短时间内投入运行。

该系统也可根据需要扩展配备另外两台蠕动泵以及多加一个 Pick&Place 模块,由此使通量翻倍。如果需要更多工作台,则可将此 Sample Robot 扩展为 L 规格款型的 OMNIS Sample Robot,由此可使七个样品盘的样品在多达四个 Pick&Place 模块上并行处理,将样品通量扩大四倍。



OMNIS Professional Titrator

创新型、模块式电位分析 OMNIS Titrator,用于进行终点和等当点滴定(单一/动态)。由于采用 3S OMNIS Liquid Adapter 技术,处理化学品从未像现在一样安全。可以使用测量模块和计量管单元自由配置滴定仪,并在需要时扩展一台搅拌器。包括用于使用其他滴定或加液模块平行滴定的“Professional”功能许可证。

- 通过计算机或本地网络控制
- 可以为其他应用或辅助溶液另外连接最多四个滴定模块或加液模块
- 可以扩展磁力搅拌器和/或棒式搅拌器
- 可提供不同大小的计量管:5、10、20 或 50 mL
- 采用 3S 技术的 OMNIS Liquid Adapter:安全处理化学品,自动传输生产厂家的原始试剂数据

测量模式和软件选项:

- 终点设定滴定:“Basic” 功能许可证
- 终点和等当点滴定(单一/动态):“Advanced” 功能许可证
- 终点和等当点滴定(单一/动态),包括 5 路平行滴定:“Professional” 功能许可证



OMNIS Dosing Module

用于与 OMNIS Titrator 滴定仪相连的加液模块,以扩展额外用于滴定/加液的滴定管。可以扩展磁力搅拌器和/或螺旋搅拌器,以作为单独的滴定台使用。可自由选择 5、10、20 或 50 mL 计量管单元。



dSolvotrode

用于所有非水性酸/碱滴定的 OMNIS 数字组合式 pH 电极。玻璃膜针对导电性差的溶液进行了优化,并且由于灵活的磨口隔膜,该电极也适用于非常脏的样品。

此电极可与非水参比电解质(氯化锂或四乙基溴化铵)一起使用。

储存在相应的参比电解质中。

dTodes 可在 OMNIS Titratoren 上使用。