



Application Note AN-T-097

# Base number in petroleum products

Potentiometric determination according to ISO 3771, ASTM D2896, and IP 276

Basic chemicals are added to petroleum products to prevent corrosion as they neutralize acidic components that form during the use and aging of these products. The base number (BN) gives an indication regarding the amount of these basic additives present, and it can be used as a measure for the degradation of the petroleum product.

The use of a pH electrode suitable for non-aqueous titrations ensures the reliable determination of the equivalence point. A

flexible sleeve diaphragm facilitates its cleaning especially after use in heavily contaminated samples, such as used engine oils. Using the correct electrode greatly increases the precision and reliability of the results.

This Application Note describes the potentiometric determination of the base number according to ISO 3771, ASTM D2896, and IP 276 using the Metrohm Solvotrode easyClean and a fully automated OMNIS system.

## SAMPLE AND SAMPLE PREPARATION

This application is demonstrated on lubricating oil and fresh motor oil.

Care should be taken to use a representative,

well-homogenized sample portion. Otherwise, no sample preparation is necessary.

## EXPERIMENTAL

The analysis is carried out on an automated system consisting of an OMNIS Sample Robot S and an OMNIS Advanced Titrator equipped with a Solvotrode easyClean.

Before the samples are measured, a blank determination is performed using the same amount of solvent as for the sample titration.

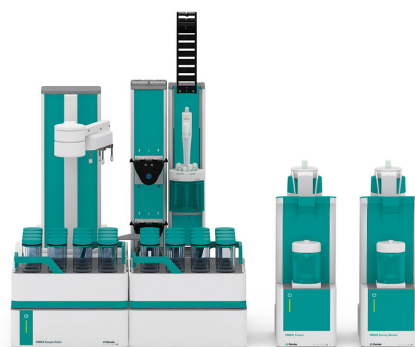
The sample is dissolved in a solvent mixture consisting of toluene, glacial acetic acid, and acetone. For the most efficient release of the basic constituents, these three solvents are added subsequently with a waiting time between the additions. Then the solution is titrated with standardized perchloric acid in glacial acetic acid until after the equivalence point is reached.

After each sample determination, the electrode needs to be rinsed with solvent solution, then isopropyl alcohol (IPA) followed by water. To rehydrate the glass membrane of the electrode, the glass membrane is placed into deionized water.

## RESULTS

For the tested samples, well-defined titration curves are obtained with acceptable results and low standard deviations. Results are summarized

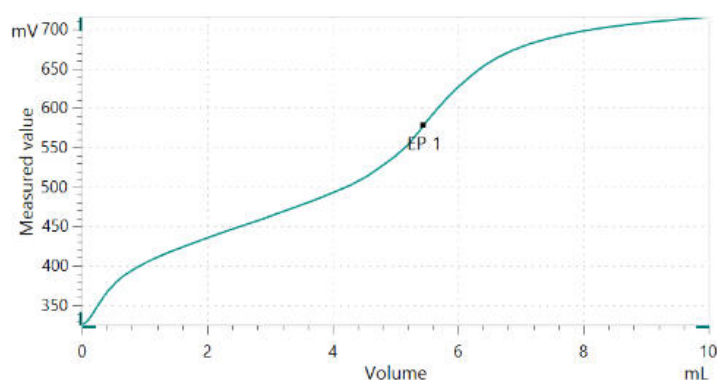
in **Table 1**. An example titration curve is displayed in **Figure 2**.



**Figure 1.** Sample Robot and OMNIS Titrator Advanced equipped with a Solvotrode easyClean for the determination of the base number of lubricating oil and motor oil.

**Table 1.** Results for the acid number determination according to ASTM D2896 on a fully automated OMNIS system.

| BN in mg KOH/g sample | lubricating oil (n = 3) | motor oil (n = 26) |
|-----------------------|-------------------------|--------------------|
| Mean                  | 0.397                   | 7.2325             |
| SD(abs)               | 0.0001                  | 0.0727             |
| SD(rel)               | 0.03                    | 1.01               |



**Figure 2.** Example titration curve of the base number determination in fresh motor oil.

## CONCLUSION

Fully automated determination of the base number of petroleum products according to **ASTM D2896**, **ISO 3771**, and **IP 276** can be achieved using a Metrohm OMNIS system. Using an OMNIS Sample Robot allows the fully automated titration of up to four samples

simultaneously, increasing throughput. The OMNIS platform offers the opportunity to customize your system according to your needs and expand it for other required titration applications.

Internal reference: AW TI CH1-1238-122016

## CONTACT

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## CONFIGURATION



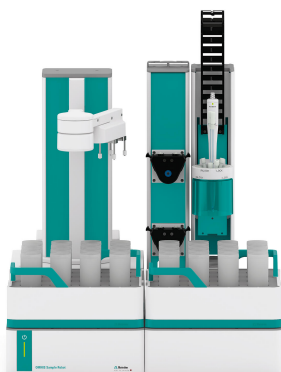
### OMNIS Advanced Titrator

创新型、模块式电位分析 OMNIS Titrator 滴定仪,用于进行终点和等当点滴定(单一/动态)。由于采用 3S 试剂瓶适配器技术,处理化学品很安全。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。在需要时可以通过相应的软件功能许可证为平行滴定升级 OMNIS Advanced Titrator。

- 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四个滴定模块或加液模块
- 可以扩展磁力搅拌器和/或螺旋搅拌器
- 可提供不同大小的计量管:5、10、20 或 50 mL
- 采用 3S 技术的试剂瓶适配器:安全处理化学品,自动传输生产商的原始试剂数据

#### 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),包括平行滴定:“Professional” 功能许可证



### 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 滴定仪或滴定模块的数字测量通道,用于连接数字电极“dTrodes”。



### 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。

dTrodes 可在 OMNIS Titratoren 上使用。