Application Note AN-T-242

Acidity in aviation turbine fuel according to ASTM D3242

Automatic photometric titration with the Optrode

Aviation turbine fuels may contain acids, either from naturally occurring organic compounds or introduced through acid treatment during refining processes. These acids are detrimental even in trace amounts as they can corrode metal components within fuel systems and negatively impact the fuel's ability to effectively separate from water.

The standard method ASTM D3242 determines acidity in aviation turbine fuel with titration, using *p*-naphtholbenzein as a color indicator. The sample is purged with nitrogen gas for three minutes before analysis and the flow is maintained during the titration. Precision may be challenging for inexperienced users due to the small volume of titrant needed and gradual color change close to the endpoint of titration.

This study presents how to fully automate ASTM D3242 using an automatic titrator and the Optrode. The titrator controls a degas box to facilitate the gas to flow and then close the valve at the end of each titration. The results obtained statistically meet the precision criteria defined in the ASTM standard.

SAMPLE AND SAMPLE PREPARATION

To the nearest 0.5 g, weigh 100 g ± 5 g of jet fuel into a 400 mL tall form beaker. Add 100 mL of the titration solvent according to ASTM D3242 and 0.1 mL of the *p*-naphtholbenzein indicator solution. Begin purging the sample with dry-type, carbon dioxide-free nitrogen gas (N_2) at a rate of 400 to 450 mL/min. Purge the solution while continuously mixing for 3 min ± 30 s to remove any carbon dioxide.

EXPERIMENTAL

Start the titration and continue purging the sample with N_2 until the end of the analysis. The monotonic endpoint titration mode – MET U is used.

The titrator adds alcoholic KOH titrant (prepared as per ASTM D3242) to the sample in fixed volume increments—each time waiting for the sensor reading to stabilize before adding the next volume. The equivalence point is indicated by the first derivative of the titration curve (Figure 1).

At the end of the titration, the result is displayed, and the gas flow is stopped.

Table 1. Results of the determination of acidity in jet fuel samples according to ASTM D3242.

No. (n = 5)	Mean value in mg KOH/g	s(abs) in mg KOH/g	s(rel) in %
1	0.0219	0.0001	0.6
2	0.0478	0.0003	0.6
3	0.0839	0.0005	0.6

RESULTS

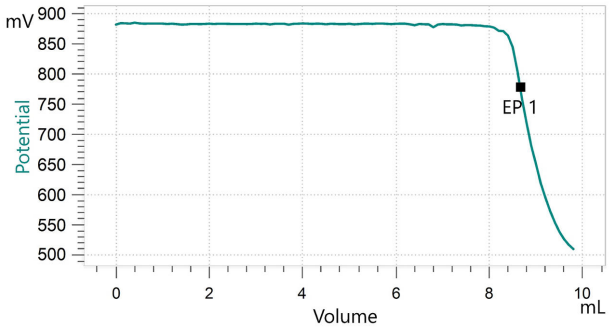

Figure 1. Exemplary titration curve of acidity in jet fuel according to ASTM D3242 using the Optrode at 610 nm for unambiguous endpoint detection.

CONCLUSION

It was possible to fully automate the determination of acidity in aviation fuel by automatic titration, including a sample degassing system that purges the sample with nitrogen before and during the analysis. The results meet the accuracy specifications of ASTM D3242.

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CONFIGURATION

OMNIS Professional Titrator

创新型、模块式电位分析 OMNIS Titrator,适于独立运行或作为 OMNIS 滴定系统的核心元件运行,用于终点和等当点滴定(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棒式搅拌器。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
- 棒式搅拌器的连接方式
- 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

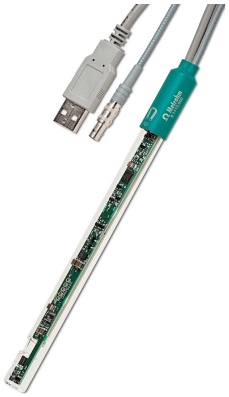
用于与 OMNIS Titrator 滴定仪相连的加液模块,以扩展额外用于滴定/加液的滴定管。可以扩展磁力搅拌器和/或螺旋搅拌器,以作为单独的滴定台使用。可自由选择 5、10、20 或 50 mL 计量管单元。

OMNIS 20 mL

智能 20 mL 计量管单元,用于一台 OMNIS Titrator、滴定模块或加液模块。该计量管单元特别推荐用于以下溶液:

- 水性碱溶液
- 滴定剂 5
- 硝酸银溶液
- 非水性碱溶液
- 高锰酸盐溶液
- EDTA 溶液

包含加液软管和防扩散滴管头。



Optrode

有 8 种可用波长的光度滴定用光学传感器。可以通过软件控制(tiamo 2.5 及以上版本)或通过磁铁来进行波长切换。该玻璃鞘对溶剂耐受,并且易于清洁。这种节省空间的传感器适用于,例如:

- 按照 USP 或 EP 的非水溶性滴定
- 羧基端基的测定
- TAN/TBN 根据 ASTM D974
- 硫酸测定
- 混凝土中的 Fe、Al、Ca
- 水硬度
- 根据 USP 的硫酸软骨素

传感器不适合通过测量颜色强度(比色法)来测定浓度。

OMNIS

A WHOLE NEW LEVEL OF PERFORMANCE

OMNIS

允许单机版 OMNIS 软件在一台 WindowsTM 计算机上运行。

特性:

- 该许可证已含有一份 OMNIS 设备许可证。
- 须通过万通许可授权平台进行激活。