



Application Note AN-T-208

电子液体中的尼古丁

Reliable and affordable determination by potentiometric titration

The vaping and electronic cigarette industries have grown impressively in the past decade. Usage among youths has increased from around 1% in 2011 to 10.5–27.5% in 2019 (pre-teens vs. older teenagers) mainly due to the vast array of flavor options available (Truth Initiative, 2020). The mixtures used in these products are usually called «e-liquid», «e-fluid», or «e-juice». To ensure the quality of these e-liquids, testing the most important quality parameters is required. One important quality control parameter is the nicotine content available in these products. Nicotine in tobacco is usually determined by gas

chromatography or liquid chromatography. Aqueous acid base titration is a much more affordable alternative for this determination. As e-liquids do not contain other components which might interfere with the titration, the aqueous acid base titration presented in this Application Note can be applied for nicotine determination.

This method is an affordable and reliable way to determine the nicotine content in e-liquids and their nicotine starting material, ensuring the quality of these products.

SAMPLE AND SAMPLE PREPARATION

Nicotine starting material for e-liquids as well as e-liquids are analyzed. No sample preparation is

required.

EXPERIMENTAL

The analyses are carried out on a 905 Titrandosystem with a rod stirrer and a Unitrode easyClean for indication of the equivalence point. A suitable amount of sample is transferred into a disposable beaker and deionized water is added. The solution is stirred to ensure complete dissolution and mixing. Afterwards, the solution is titrated with standardized hydrochloric acid until after the first equivalence point is reached.



Figure 1. Titration system consisting of a 905 Titrandosystem, a rod stirrer, and a Unitrode easyClean. The data are recorded and evaluated by tiamo.

RESULTS

Steep and smooth titration curves are obtained for all analyses. An example titration curve is displayed in **Figure 2**. The automated analysis

leads to reproducible results with low RSDs as shown in **Table 1**.

Table 1. Results of the nicotine determination by aqueous titration in nicotine starting materials as well as in various e-liquids (n = 3).

	Mean value / g/L	SD(abs) / g/L	SD(rel) / %
Nicotine starting material	31.39	0.01	0.03
E-liquid 1	5.64	0.01	0.24
E-liquid 2	2.82	0.001	0.04
E-liquid 3	15.32	0.08	0.53
E-liquid 4	10.15	0.04	0.35

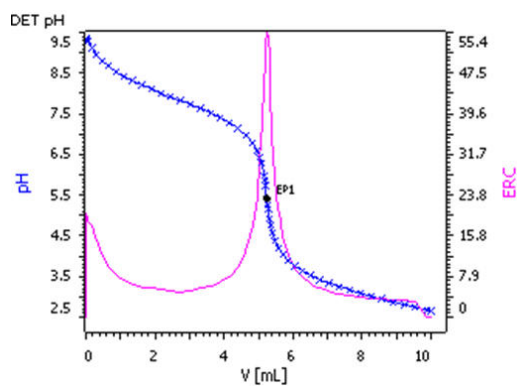


Figure 2. Example titration curve for the nicotine determination in an e-liquid.

CONCLUSION

This method is an affordable and reliable way to determine the nicotine content in e-liquids and their nicotine starting material, ensuring the

quality of these products. Additionally, no harmful chemicals and no sample preparation are required for the determination.

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CONFIGURATION



905 Titrando

用于使用 Dosino 加液系统通过一个测量接口滴定分析的电位滴定仪。

- 多达四套 800 Dosino 加液系统
- 动态等当点滴定(DET)、等量等当点滴定(MET)和终点设定滴定(SET)
- 使用离子选择性电极测量(MEAS CONC)
- 带监控的加液功能,LQH
- 用于额外搅拌器或加液器系统的四个 MSB 接口
- 智能电极“iTrode”
- USB 接口
- 使用 OMNIS-Software、*tiamo*-软件或 Touch Control
- 如果需要,满足 GMP/GLP 和 FDA 要求,比如 21 CFR 第 11 部分



802 Stirrer 804 Ti Stand

棒式搅拌器包括搅拌螺旋桨 6.1909.010。



804

滴定台及802杆式螺旋桨搅拌器的控制器,如果与802型杆式螺旋桨搅拌器联用,则可为您在磁力搅拌器之外提供另一选择。Ti Stand工作台带有底板、支撑杆与电极固定器。



Unitrode easyClean Pt1000 2 m

带 easyClean 隔膜,集成有 Pt1000 温度传感器的组合 pH 电极和固定电缆 (2.0 m)。它特别适用于:

- 用于在较难的、粘性或碱性样品中进行自动 pH 测量和滴定
- 温度升高的时候
- 长时测量的时候

easyClean 隔膜易于清洁,即使是严重污染的样品。

参比电极: $c(\text{KCl}) = 3 \text{ mol / L}$,储存在储存溶剂中。

替代方法: $T > 80^\circ \text{ C}$ 时的测量用参比电解质,储存在 Idrolyt 中。