



## Application Note AN-T-208

# 电子烟液体中的尼古丁

## 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.

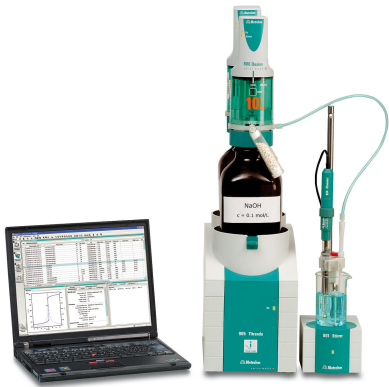
## SAMPLE AND SAMPLE PREPARATION

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 Titrande system 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 Titrande, a rod stirrer, and a Unitrode easyClean. The data are recorded and evaluated by tiamo.

## RESULTS

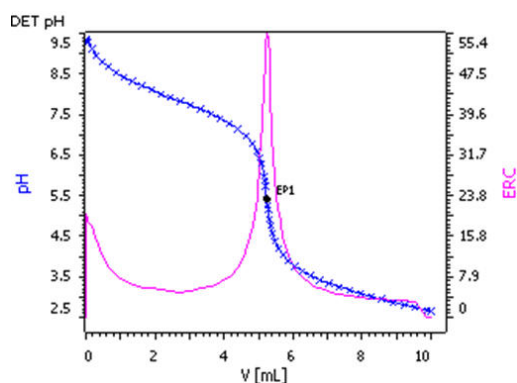
Steep and smooth titration curves are obtained for all analyses. An example titration curve is displayed in **Figure 2**. The automated analysis

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

## RESULTS



**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.

Internal reference: AW TI US1-0073-092018

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## CONFIGURATION



### 905 Titrando

用于使用 Dosino 加液系统一个量接口滴定分析的位滴定。

- 多四套 800 Dosino 加液系
- 等当点滴定(DET)、等量等当点滴定(MET)和点定滴定(SET)
- 使用子性量(MEAS CONC)
- 控的加液功能,LQH
- 用于外拌器或加液器系的四个 MSB 接口
- 智能“iTrode”
- USB 接口
- 使用 OMNIS-Software、*tiamo*-件或 Touch Control
- 如果需要,足 GMP/GLP 和 FDA 要求,比如 21 CFR 第 11 部分



### 802 Stirrer 804 Ti Stand

棒式拌器包括拌螺旋 6.1909.010。



### 804

滴定台及802杆式螺旋拌器的控制器,如果与802型杆式螺旋拌器用,可在磁力拌器之外提供一。Ti Stand工作台有底板、支杆与固定器。



### Unitrode easyClean Pt1000 2 m

easyClean 隔膜,集成有 Pt1000 温度传感器的合 pH 和固定 (2.0 m)。它特用于:

- 用于在的、粘性或性品中行自 pH 量和滴定
- 温度升高的候
- 量的候

asyClean 隔膜易于清,即使是重染的品。

参比: $c(\text{KCl}) = 3 \text{ mol / L}$ ,存在存溶中。

替代方法: $T > 80^\circ \text{ C}$  的量用参比解,存在 Idrolyt 中。