



## Application Note AN-T-208

# Nicotine in e-liquids

## 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

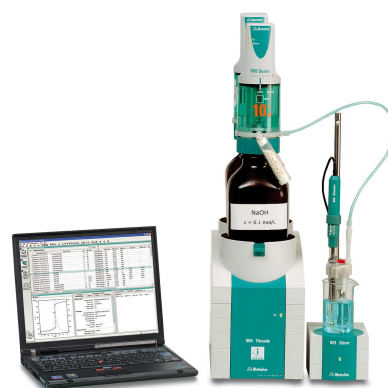
Nicotine starting material for e-liquids as well as e-liquids are analyzed. No sample preparation is

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.

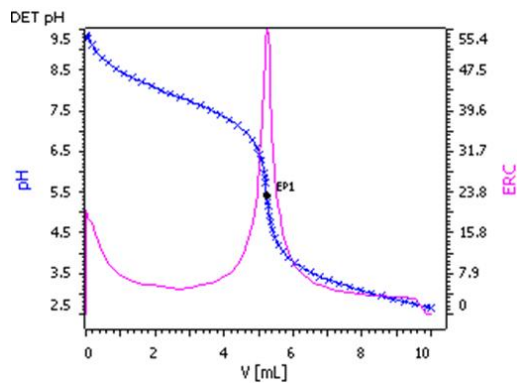
## RESULTS

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



**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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## CONTACT

メトロームジャパン株式会社  
 143-0006 東京都大田区平  
 和島6-1-1  
 null 東京流通センター アネ  
 ックス9階

[metrohm.jp@metrohm.jp](mailto:metrohm.jp@metrohm.jp)

## CONFIGURATION



### 905 Titrando

Dosino-トーションシステムを用いた用途のための測定インターフェースを備えた電位差滴定のためのハイエンド滴定装置。

- タイフ800 Dosinoのトーションシステムが4つまで
- 変動滴下量当量点滴定 (DET)、等量滴下当量点滴定 (MET)、終点滴定 (SET)
- イオン選択性電極を用いた測定 (MEAS CONC)
- モニタリング、LQHを備えたトーション機能
- 追加スターラーまたはトーションシステムのための4つのMSBコネクタ
- インテリシエント電極「iTrode」
- USB コネクタ
- OMNISソフトウェア、*tiamo*ソフトウェアもしくはTouch Controlを適用
- GMP/GLP基準およびFDA 基準21 CFR Part 11の要件を満たしています(必要な場合)



### 804 Ti Stand 802 Stirrer

フロヘラスターラ 6.1909.010 を備えるロットスターラ。



### 804 Ti Stand with stand

Titration stand and controller for 802 Rod Stirrer. The 804 Ti Stand together with the optional 802 Rod Stirrer provides an alternative to the magnetic stirrer. Ti Stand with base plate, support rod and electrode holder.



### Unitrode easyCleanPt1000 (2 m)

easyCleanタイアフラム、および内蔵Pt1000温度センサー付きの複合pH 電極および固定式ケーブル (2.0 m)。これは、特に以下の用途に適しています:

- 困難なサンプル、粘性のあるサンプル、またはアルカリ性のサンプルにおける自動化された pH測定および滴定
- 高温時
- 長期測定

easyCleanタイアフラムは、強度な汚れのサンプルの場合でも簡単に洗浄することかできます。

参照内部液:  $c(\text{KCl}) = 3 \text{ mol / L}$ 、保存液で保管。

代替:  $T > 80^\circ \text{ C}$ での測定用参照内部液: イトロライト、イトロライトで保管。