



Application Note AN-T-225

# Analysis of caffeine, pH, and acidity in coffee

Fully automated determination including filtering, reagent addition, and sample pipetting using OMNIS

With the ever-increasing consumption of coffee due to the availability of small home espresso machines, shelf life and consistency of flavor are becoming more important for brand quality in a competitive market.

Many of the key factors that influence coffee taste correlate with chemical properties that can be measured. These include pH, titratable acidity, refractive index, and caffeine.

Historically, many of these analyses have included long, manual sample preparation processes using the time-consuming, liquid chromatography (LC) technique.

This Application Note looks at a faster, simpler, alternative method for analysis of key quality parameters in coffee using a single titration platform: OMNIS.

## PH AND TITRATABLE ACIDITY

Coffee is primarily acidic, with most roast extracts displaying a pH of approximately five. When coffee is too acidic, it can taste sour and be harsh on the palette. When shifting to the alkaline end of the pH scale, the flavor then becomes bland and lifeless.

Different coffee beans require different amounts of roasting, depending on the bean origin and the level of acidity, to achieve the consistent flavor expected from the brand line. By

analyzing the pH and acidity of coffee brewed under consistent conditions, it is possible to judge the final flavor of a roast. This is most beneficial to roasters of large volumes of coffee beans, or to those who supply products with expected flavor profiles (e.g. instant coffee pods).

The analysis of pH and acidity in brewed coffee is quite simple and very similar to the procedure used for juices and soft drinks.

**Table 1.** Results of quality parameters in various coffee brews measured with OMNIS.

| Analyte              | Sample 1 | Sample 2 |
|----------------------|----------|----------|
| pH                   | 5.37     | 6.41     |
| Acidity (mg/15 g) *  | 9.9      | 7.1      |
| Caffeine (mg/15 g) * | 120      | 87       |

## CAFFEINE

Unlike the simple sample preparation required for titratable acidity analysis, the analysis of caffeine in brewed coffee is a more intensive process that relies upon several manual preparation steps. Requiring reagent addition (iodine and sulfuric acid), filtration, and accurate sample volume transfer in specifically timed

steps to provide consistent results, the conventional analysis is very time consuming when performed manually.

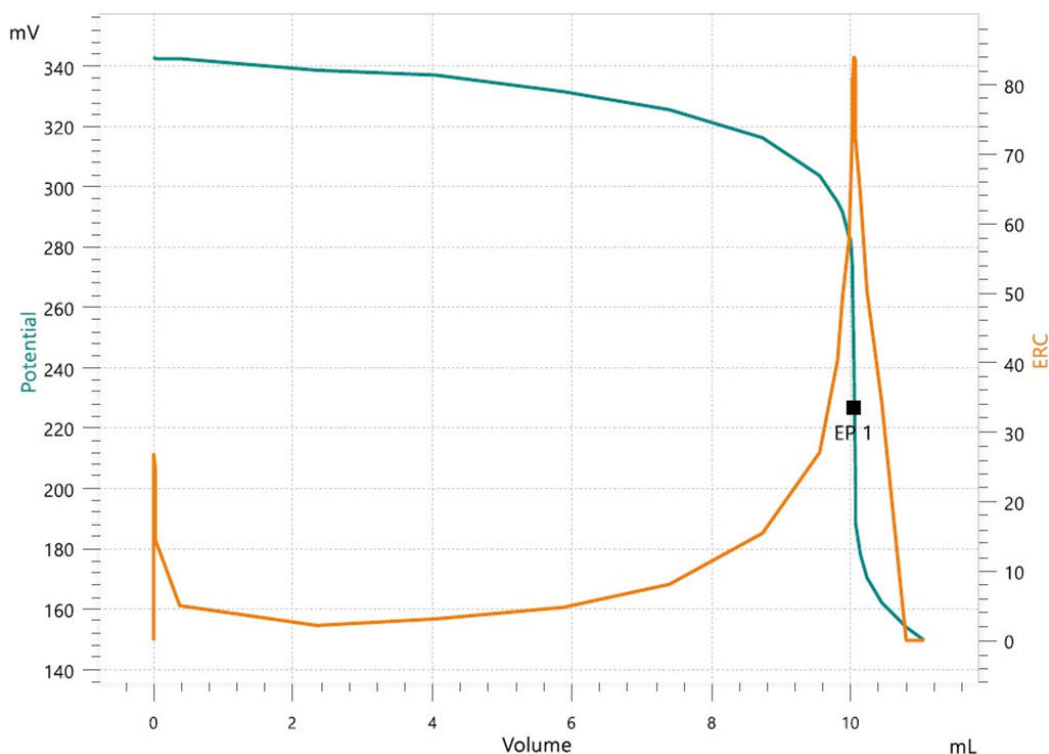
The flexibility of OMNIS allows for the automation of these steps, eliminating the variability introduced by manual liquid handling and manual timing.



**Figure 1.** OMNIS Robot S with Discover and parallel analysis.

OMNIS automates the entire analysis process with:

- Discover Capping system which keeps samples covered until the time of analysis
- Highly accurate dosing of iodine and acid
- Consistent stirring time for reaction
- Automatic inline filtration
- Highly accurate dosing of sample to titration vessel
- Automatic start of titration
- Automatic cleaning of titration vessel and sample path



**Figure 2.** Figure 2. Example titration curve for caffeine analysis with OMNIS.

## CONCLUSION

Metrohm's OMNIS titration platform provides the perfect blend of automation and intelligence for the analysis of coffee. Instead of time-consuming manual sample preparation and long analysis times with several different instruments,

key coffee quality parameters can be measured accurately and reliably on a single system. With OMNIS, you can enjoy your coffee without worrying about your analysis.

Internal reference: AW TI AU-001-072020

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## CONFIGURATION



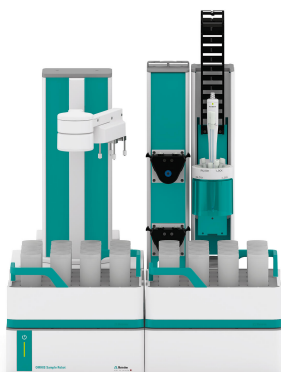
### OMNIS Professional Titrator

创新型、模块式电位分析 OMNIS Titrator,用于进行终点和等当点滴定(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
- 可以扩展磁力搅拌器和/或棒式搅拌器
- 可提供不同大小的计量管:5、10、20 或 50 mL
- 采用 3S 技术的 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 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。



### dUnitrode Pt1000

数字式、组合 pH 电极,用于集成有 Pt1000 温度传感器的 OMNIS。其特别适用于:

- 在较重、粘稠或碱性样品中进行 pH-测量和滴定
- 温度提升时
- 长时间测量

固定套管式隔膜对污染不敏感。

参比电解质:  $c(\text{KCl}) = 3 \text{ mol/L}$ , 储存在保存液中。

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

dTrodes 可在 OMNIS Titratoren 上使用。



### dPt Titrode

带 pH 玻璃膜的 OMNIS 用数字组合式铂环形电极,用作参比电极。

该免维护电极适用于 pH 值恒定的氧化还原滴定,例如:

- 碘量法
- 重铬酸钾法
- 铈量法
- 高锰酸盐滴定法

该电极存放在蒸馏水中。

dTrodes 可在 OMNIS Titratoren 上使用。