



## Application Note AN-T-214

# 废水中的凯氏氮

## Easy determination by titration according to ASTM D3590

Nitrogen-based compounds are widely distributed in the environment. They are essential growth nutrients for photosynthetic organisms (e.g., plants and algae). Therefore, it is important to monitor and control the amount of nitrogen compounds which are released into the environment.

In this Application Note, a method to determine the nitrogen content in water by Kjeldahl digestion and distillation followed by a photometric or potentiometric titration according to **ASTM D3590** is presented. Nitrogen determination by Kjeldahl digestion and

distillation has been performed since 1883. The universality, precision, and reproducibility of the Kjeldahl method have made it the internationally recognized method for e.g. estimating the protein content in many matrices and it is the standard method to which all other methods are judged against.

After the Kjeldahl distillation, the nitrogen content is determined by acid-base titration. This can either be a photometric or potentiometric titration depending on the sample and the preferences of the user. Both titration methods offer a reliable and inexpensive determination.

# SAMPLE AND SAMPLE PREPARATION

This application is demonstrated on wastewater for the photometric titration, and on spiked water for the potentiometric titration. Each sample is transferred into the Kjeldahl tube for digestion. The digestion is performed automatically using a commercially available

digester. After the digestion, a sodium hydroxide solution is added to the mixture and the resulting ammonia is automatically distilled into a collecting vessel containing boric acid using a steam distillation apparatus.

# EXPERIMENTAL

This analysis is carried out on an OMNIS Advanced Titrator equipped with an Optrode for the photometric titration, and with a dEcotrode plus for the potentiometric titration. The prepared samples are titrated with sulfuric acid until after the equivalence point is reached. To ensure good recovery and reproducibility, it is important that the distillation apparatus used for this sample preparation is leak-proof and that the water, which is used for the blank, is nitrogen-free.



**Figure 1.** OMNIS Advanced Titrator equipped with a dEcotrode plus for the potentiometric determination of Kjeldahl nitrogen in water.

# RESULTS

The recovery and standard deviation of the two different titrations could not be compared, as different samples were used. However, for both

methods relative standard deviations are below 2%, which is acceptable for this application.

**Table 1.** Results of the nitrogen determinations in water by titration after the Kjeldahl digestion and distillation.

|         | Photometric titration (n = 4) | Potentiometric titration (n = 3) |
|---------|-------------------------------|----------------------------------|
| Mean    | 33.63 mg/L                    | 19.78 mg/L                       |
| SD(abs) | 0.45 mg/L                     | 0.26 mg/L                        |
| SD(rel) | 1.33%                         | 1.34%                            |

## CONCLUSION

Titration is an easy method to determine Kjeldahl nitrogen in wastewater according to **ASTM D3590**. The titration can be either performed photometrically or potentiometrically. The potentiometric method provides the advantage that no indicator is needed. On the other hand, the Optrode for photometric measurements is maintenance-free.

Which titration is used depends on the sample and the preferences of the user.

For both methods, an OMNIS Titrator can be used. This allows you to customize the system according to your needs and expand it for other titration applications required for the quality control of water.

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## CONTACT

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## CONFIGURATION



### OMNIS Advanced Titrator

创新型、模块式电位分析 OMNIS Titrator 滴定仪,适于独立运行或作为 OMNIS 滴定系统的核心元件运行,用于使用 OMNIS Sample Robot 进行终点和等当点滴定(单一/动态)。由于采用 3S 试剂瓶适配器技术,处理化学品很安全。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螺旋搅拌器。在需要时可以通过相应的软件功能许可证为平行滴定升级 OMNIS Advanced Titrator。

- 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四个滴定模块或加液模块
- 螺旋搅拌器的连接方式
- 可提供不同大小的计量管:5、10、20 或 50 mL
- 采用 3S 技术的试剂瓶适配器:安全处理化学品,自动传输生产商的原始试剂数据

### 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),包括平行滴定:“Professional” 功能许可证



### Ecotrode plus

适用于含水的酸/碱滴定的组合 pH 电极。固定磨口隔膜对污染不敏感。参比电解质: $c(\text{KCl}) = 3 \text{ mol/L}$ ,储存在储存溶液中。



## 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

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