



Application Note AN-I-033

# Determination of ammonia in cacao

## Reliable cost- and timesaving determination of ammonia by standard addition

Ammonia is one of the most widely manufactured chemicals. It is also produced naturally in our bodies, by fermentation processes, and can be found in different products. Additionally, ammonia is formed by the bacterial decomposition of animal and plant matter in soil.

In the case of cacao, ammonia is naturally formed by fermentation of the cacao beans. The addition of ammonia during the alkalization

process is a common practice to give an intense black color to the cacao nibs and to modify their flavor.

Ammonia is usually determined by ion chromatography by converting it into the ammonium form. This Application Note offers an easy way to determine the ammonia content in cacao nibs by using ion measurement, applying the standard addition technique in a reliable cost- and timesaving manner.

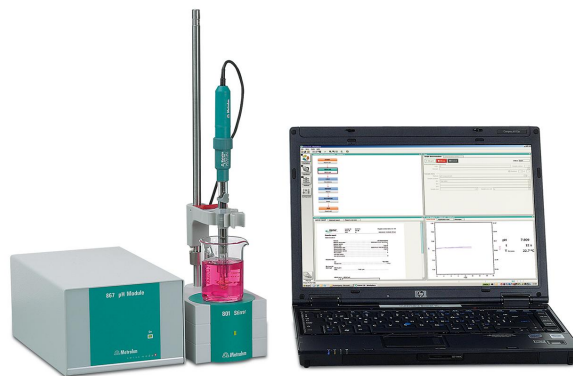
## SAMPLE AND SAMPLE PREPARATION

The sample is homogenized in 400 mL diluted hydrochloric acid (HCl) for 30 seconds. Afterwards, it is filtered using gravity through a

folded filter paper into a volumetric flask. The resulting filtered solution is filled up to the mark on the flask with deionized water.

## EXPERIMENTAL

The filtered sample solution is pipetted into a beaker and filled up to 50 mL with deionized water. Highly concentrated sodium hydroxide (NaOH) solution is added, and the standard addition is performed.



**Figure 1.** 867 pH Module controlled by tiamo software for performing standard addition.

## RESULTS

The standard addition is performed automatically within 10 minutes using the setup in **Figure 1**. The additions of the reagent increments as well as the calculation of the ammonia content in cacao are performed automatically by **tiamo™**.

**Table 1.** Ammonia content of Sample B and Sample X (cacao). Both samples were obtained in their natural and their alkalized form. Sample B was alkalized by using ammonia, while sample X was alkalized without using ammonia.

	Mean / mg/kg	SD /mg/kg	RSD/%
Sample B	151.6	2.6	1.71
Sample B, alkalized	499.0	6.9	1.39
Sample X	136.5	1.8	1.35
Sample X, alkalized	189.7	0.8	0.43

## CONCLUSION

This Application Note shows how ammonia in cacao samples can be determined in a straightforward manner by using the standard addition method. The standard addition method is easy to apply and does not require much system maintenance. Additionally, this method is

matrix-independent and does not need an external calibration.

The obtained results exhibit good reproducibility with a relative standard deviation <2 % which is very satisfactory for ion measurement.

Internal reference: AW ISE CH-0180-122021

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## CONFIGURATION



### 867 pH Moduletiamo™ light

高端 pH/子基于 867 pH 模,包括 *tiamo*™ light、854 iConnect 和智能合的 pH 玻璃 «iUnitrode»。除量 pH、温度、mV、Ipol、Upol 和度外, pH 模可行准加入法(手、dos、autos)并且能行快量化程序。它允使用常和智能型感器行量。在件中集成了符合 GLP 要求的自 pH。

pH 模有 2 个 USB 接口,用于接打印机、条形取器或自器,以及 4 个 MSB 接口用于接拌器或 Dosino(用来添加助溶液或行准加入法)。

集成于 *tiamo*™ full(2.0 以上)中足 GLP 和 FDA 21 CFR 第 11 部分的要求。