



#### 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.

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## CONFIGURATION



### 867 pH Module *tiamo*™ light

ハイエントpH/イオン計測器は、*tiamo*™ light、854 iコネクト、インテリシエントなpHガラス電極《iユニットロート》を含む867 pH モジュールをヘースとしています。pH モジュールは、pH、温度、mV、Ipol、Upol、濃度の他に 標準添加 (manual、dos、autos) およびリキッドハンドリング (add、prep、empty) を実施することかてきます。このモジュールにより、測定のための従来のセンサーおよびインテリシエントセンサーの使用が可能です。ソフトウェアにはGLP準拠の自動のpH電極テストも組み込まれています。pH モジュールには、プリンター、ハーコートリーターまたはサンプルチェンジャーを接続するUSBインターフェースが2つ、スターラーもしくはトシーノを接続するMSBインターフェースが4つ装備されています (予備溶液の添加もしくは標準添加のため)。

*tiamo*™ (2.0以降) に組み入れることにより、GLPおよびFDA 21 CFR part 11の要求仕様を満たします。