



Application Note AN-RS-023

饮料中阿斯巴甜的痕量检测

Protecting consumer safety with Misa

Aspartame is an artificial sweetener touted as a diet-conscious alternative to sugar in beverage and food products. Some studies suggest that consumption of aspartame is correlated with increased risk for brain and hematopoietic cancers, however, the majority of studies find aspartame to be a safe food additive. Consequently, the US and EU approve aspartame as a multi-purpose sweetener with an acceptable daily intake of 40 mg/kg body

weight/day. However, the clear health hazard to individuals suffering from phenylketonuria and ongoing criticism by health food advocates continues to fuel the challenge against aspartame's widespread use in the food industry.

Using Misa (Metrohm Instant SERS Analyzer), beverage products are screened for aspartame levels with no sample preparation beyond simple dilution of a consumer product.

INTRODUCTION

Misa is a versatile analytical tool for detecting additives in food products. This application note describes a facile method for the rapid and

sensitive detection of aspartame in carbonated water and diet cola.

REFERENCE SPECTRUM AND LIBRARY CREATION

To establish a reference spectrum for aspartame, a pure standard dissolved in water at a concentration of 1 mg/g is analyzed using gold

nanoparticles (Au NPs). The unique baseline-corrected spectrum shown in **Figure 1** can be used to create a library entry for aspartame.

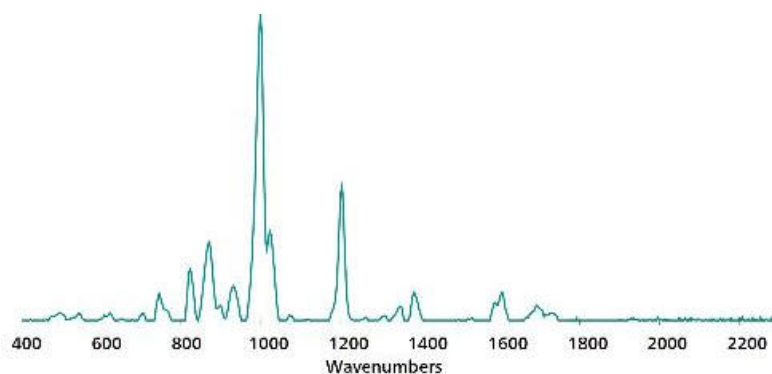


Figure 1. Standard SERS Au NP reference spectrum for aspartame in water.

EXPERIMENT

A stock solution of aspartame in water was used to spike carbonated water from a local grocer to create a concentration range of samples: 100, 50, 10, 5, and 1 $\mu\text{g/mL}$, and 100 ng/mL . For testing purposes, 100 μL of each sample was pipetted into a glass vial containing 800 μL of Au NPs and 100 μL of 0.5 mol/L NaCl. The contents were shaken to mix, and the vial was placed into the Misa vial attachment for spectral acquisition. Diet cola from the same vendor was subjected to a 10x dilution (1:9 cola:water) and analyzed using the same procedure. Dilution reduces spectral contribution from other ingredients in the cola matrix.



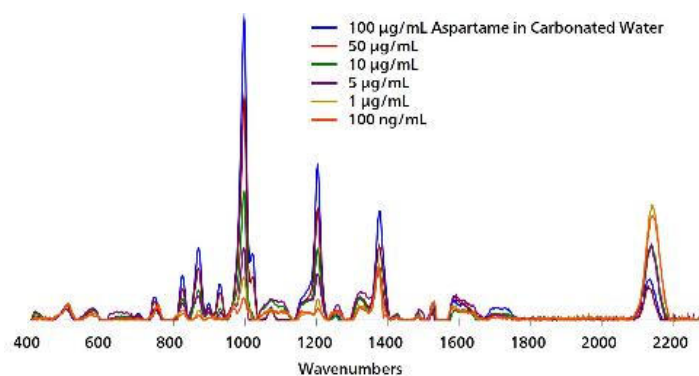
Table 1. Experimental parameters

Instrument		Acquisition	
Firmware	0.9.33	Laser Power	5
Software	Misa Cal V1.0.15	Int. Time	1 s
Misa Vial Attachment	6.07505.040	Averages	10
ID Kit - Au NP	6.07506.440	Raster	ON

RESULTS

Overlaid baseline-corrected SERS spectra acquired for carbonated water spiked with

varying concentrations of aspartame shows detection down to 100 ng/mL (**Figure 2**).

**Figure 2.** SERS Au NP concentration range for aspartame in carbonated water.

SERS analysis of 10x diluted diet cola with minimal processing provides high resolution detection estimated between 10–50 µg/mL,

which is consistent with typical concentrations of aspartame used to sweeten diet cola (e.g., 350 µg/mL).

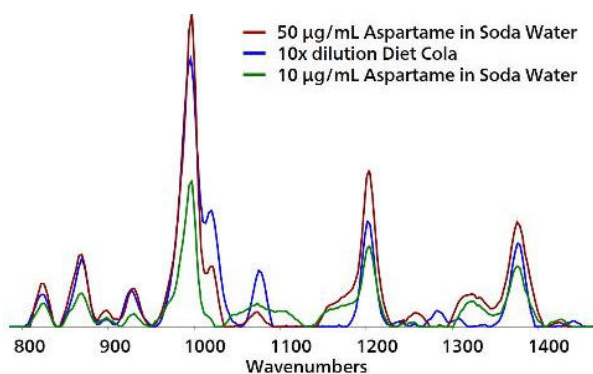


Figure 3. Detection of aspartame in 10x diluted diet cola.

FIELD TEST PROTOCOL

Detection of aspartame in the field

Using a pipette, add 1 drop of diet soda to a clean vial. Add 9 drops DI water to soda in vial, cap, and shake to mix. Fill a *clean vial* halfway full with Au NPs. Using pipettes, add 2 drops

each of sample solution and NaCl solution to Au NPs, then cap and shake the vial gently to mix. Insert into vial attachment on Misa for measurement.

Table 2. Requirements for field test protocol

ID Kit - Au NP	6.07506.440
includes:	Gold nanoparticles (Au NP)
	Scoop
	Disposable pipettes
	2 mL glass vials
Reagents	
DI water	
NaCl solution	3 g NaCl in 100 mL water
Test settings	Use ID Kit OP on MISA

CONCLUSION

The rapid and sensitive detection of aspartame in beverages is demonstrated using Misa and Au NPs. This assay demonstrates a quick and easy,

cost-effective and portable solution for detection of food additives in low-resource testing environments.

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CONFIGURATION



MISA Advanced

Metrohm Instant SERS Analyzer (MISA) 是一款高性能、便携式分析系统,可快速检测/鉴定非法物质、食品添加剂和微量食品污染物。MISA 的特点是配备了 Metrohm 的轨道光栅扫描 (ORS) 技术设备的光谱仪。其空间需求小和并且电池寿命有所延长,适用于现场测试或移动实验室应用。MISA 提供各种 1 级激光附件,可灵活选择取样。该分析仪可通过 Bluetooth 或 USB 连接运行。

MISA Advanced 套件是一个完整套件,其作用是让用户能用 Metrohms 纳米颗粒溶液和 P-SERS 试剂条进行 SERS 分析。

MISA Advanced 套件包含了一个 MISA 小管附件、一个 P-SERS-附件、一个 ASTM 校正标准件、一个 USB 迷你电缆、一个 USB 供电单元和用于运行 MISA 仪器的 MISA Cal 软件。还随供了一个用来安全保管仪器和附件的坚固保护箱。



ID – Au NP

ID 套件 - Au NP 包含了 Mira/Misa 用户使用胶体金溶液进行 SERS 分析所需的组件。该套件包含了一个一次性抹刀、一个移液管、样品小瓶和一个含金胶体的瓶子。