Trace Detection of Aspartame in Beverages

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 phenlyketonuria 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.

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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.
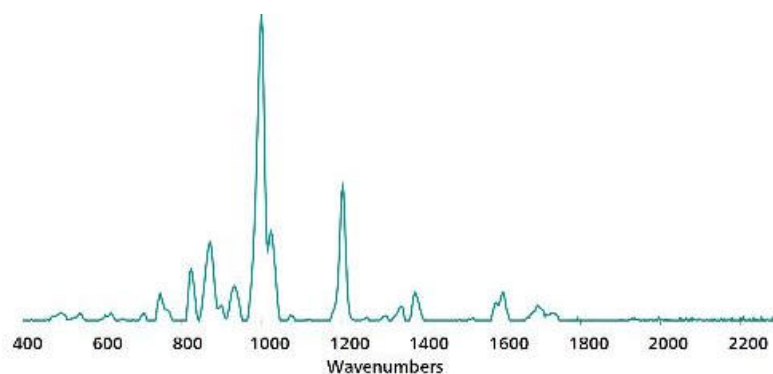

Figure 1. Standard SERS Au NP reference spectrum for aspartame in water.

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 µg/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.

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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).
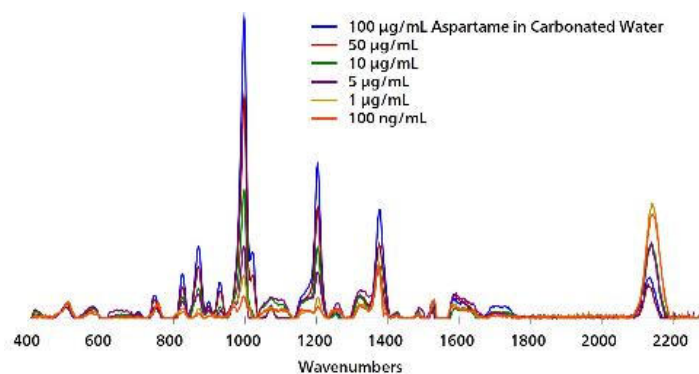

Figure 2. SERS Au NP concentration range for aspartame in carbonated water.

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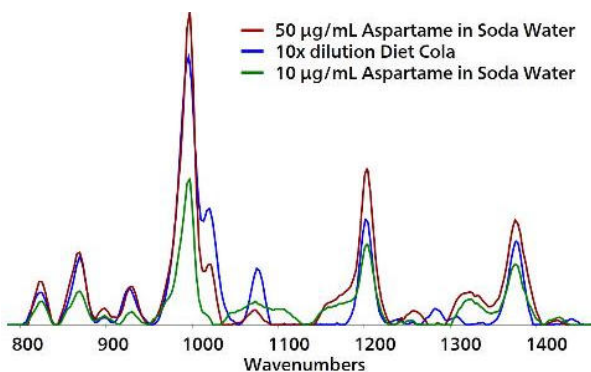
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Figure 3. Detection of aspartame in 10x diluted diet cola.

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

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CONCLUSION

The rapid and sensitive detection of aspartame in beverages is demonstrated using Misa and Au NPs. This assay demonstrates a quick and easy, costeffective and portable solution for detection of food additives in low-resource testing environments.

CONTACT

Metrohm Brasil
Rua Minerva, 161
05007-030 São Paulo

metrohm@metrohm.com.br

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