



Application Note AN-RS-015

Trace Detection of Melamine in Dairy Products

Protecting consumer safety with Misa

The illicit addition of melamine to milk due to its apparent enhancement of protein content in foods attracted worldwide attention in 2008. It was discovered at this time that melamine was being deliberately added to raw milk at collecting stations in rural China. Thousands of young children and infants that consumed formula produced from melamine-tainted milk experienced kidney damage and death. As a result, both daily intake limits and increased monitoring of melamine in dairy products were

established globally.

Misa (Metrohm Instant SERS Analyzer) provides quick, easy, and robust detection of melamine in a complex food matrix. As a direct test with no additional reagents, Misa's assay format requires minimal user training, in contrast to standard analytical tests for detecting melamine, including capillary electrophoresis, GC-MS, LC-MS, and immune-based assays.

INTRODUCTION

Melamine is used in the production of industrial materials such as kitchenware, building materials, paints, and paper products.

Melamine's high nitrogen content can enhance the apparent protein content of animal feed and foods for human consumption, notably in dairy products. Unfortunately, this provides motivation for food adulteration for enhanced profits at the expense of human health.

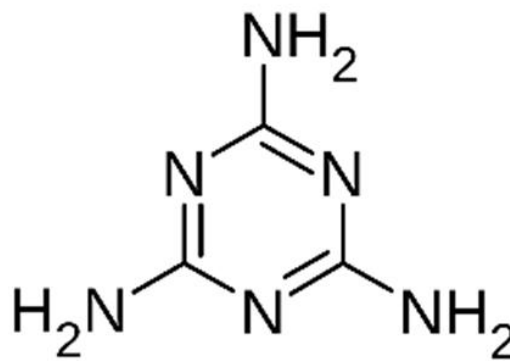


Figure 1. Melamine's nitrogen-rich structure.

REFERENCE MATERIAL AND LIBRARY CREATION

To establish a standard SERS reference spectrum for melamine, a pure standard is analyzed on silver (Ag) P-SERS strips. The unique spectrum for melamine as shown in **Figure 2** can be used to create a library entry for the analyte.

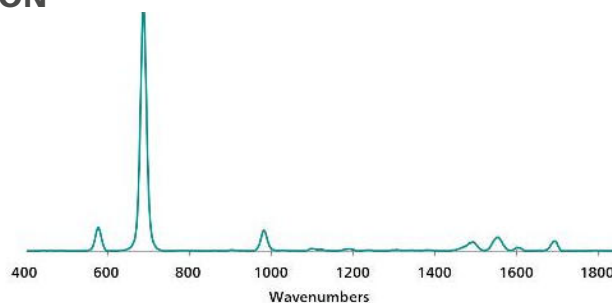


Figure 2. Standard Ag P-SERS reference spectrum of melamine.

EXPERIMENT

Light cream bought from a local grocery was spiked with melamine and tested directly to simulate an authentic scenario of a tainted dairy product. A stock solution of melamine dissolved in methanol was added to light cream to yield samples ranging from

1–500 $\mu\text{g/mL}$ melamine concentration.

10 μL of each sample was pipetted directly onto Ag P-SERS strips, dried briefly, and inserted into the P-SERS attachment on Misa for analysis.

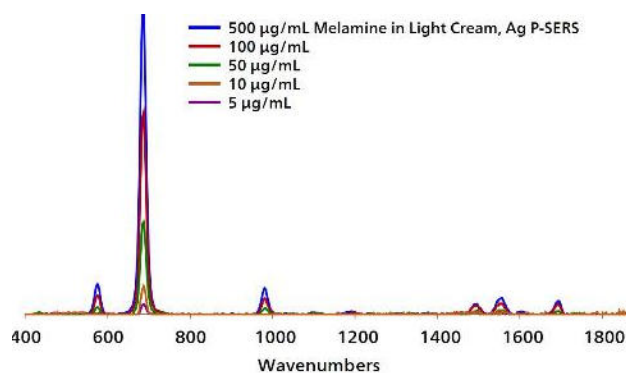
Table 1. Experimental Parameters

Instrument		Acquisition	
Firmware	0.9.33	Laser Power	5
Software	Misa Cal V1.0.15	Int. Time	5 s
Misa P-SERS Attachment	6.07505.030	Averages	5
ID Kit - Ag P-SERS	6.07506.470	Raster	ON

RESULTS

The overlaid spectra in **Figure 3** demonstrate reliable detection of melamine in light cream with Ag P-SERS

down to 5 µg/mL, based on the most prominent peak of melamine at 685 cm⁻¹.

**Figure 3.** Baselined, background-subtracted spectra of melamine in light cream at various concentrations.

FIELD TEST PROTOCOL

Detection of melamine in the field

Using a pipette, add 1 drop of raw dairy product onto the colored portion of a Silver P-SERS strip. Insert into

P-SERS attachment on Misa for measurement.

Table 2. Requirements for Field Test Protocol

ID Kit - Ag P-SERS	6.07506.470
includes:	Silver P-SERS
	Scoop
	Disposable pipettes
	2 mL glass vials
Reagents	None
Test settings	Use ID Kit OP on Misa

CONCLUSION

The detection of melamine in a distinctly challenging dairy product matrix has been demonstrated using Misa Ag P-SERS substrates.

Misa provides rapid, high-throughput, and cost-effective on-site identification of food contaminants and adulterants.

CONTACT

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CONFIGURATION



MISA Advanced

Metrohm Instant SERS Analyzer (MISA) ist ein hochleistungsfähiges, tragbares Analysensystem zur schnellen Detektion / Identifizierung von illegalen Substanzen, Lebensmittelzusatzstoffen und Lebensmittelverunreinigungen im Spurenbereich. MISA verfügt über einen hocheffizienten Spektrographen, der mit der einzigartigen Orbital-Raster-Scan (ORS)-Technologie von Metrohm ausgestattet ist. Er hat einen minimalen Platzbedarf und eine verlängerte Batterielebensdauer, perfekt für Tests vor Ort oder mobile Laboranwendungen. MISA bietet verschiedene Laser-Klasse-1-Aufsätze für flexible Probenahmeoptionen. Der Betrieb des Analysators ist über BlueTooth oder USB-Konnektivität möglich.

Das MISA Advanced-Paket ist ein Komplettpaket, das es dem Anwender ermöglicht, SERS-Analysen mit Metrohms Nanopartikellösungen und P-SERS-Streifen durchzuführen.

Das MISA Advanced-Paket enthält einen MISA Vial-Aufsatz, einen P-SERS-Aufsatz, einen ASTM-Kalibrierstandard, ein USB-Minikabel, ein USB-Netzteil und die MISA Cal-Software zum Betrieb des MISA-Geräts. Ein robuster Schutzkoffer zur sicheren Aufbewahrung des Instruments und des Zubehörs wird ebenfalls mitgeliefert.



ID Kit - Silber-P-SERS-Substrate (Ag P-SERS)

Das ID Kit - Ag P-SERS enthält die Komponenten, die ein Mira/Misa-Benutzer benötigt, um eine SERS-Analyse mit Silber-P-SERS-Substraten durchzuführen. Der Kit enthält einen Einwegspatel, eine Tropfpipette, Probenfläschchen und 2 Silber-P-SERS-Streifen.