



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.

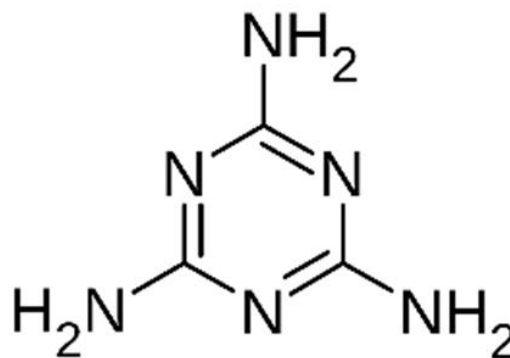


Figure 1. Melamine's nitrogen-rich structure.

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.

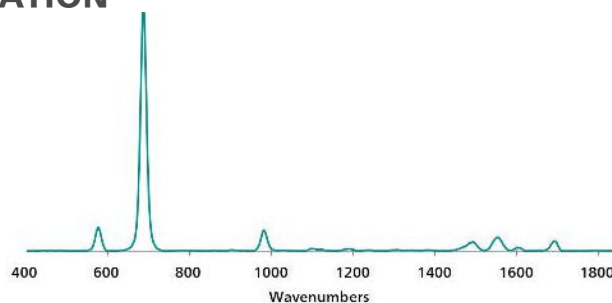


Figure 2. Standard Ag P-SERS reference spectrum of melamine.

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.

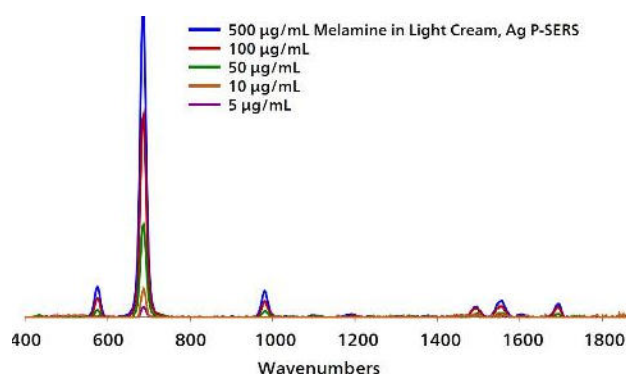
Table 1. Experimental Parameters

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) は、微量レベルでの違法物質、食品添加物、および食品汚染物質の迅速な検出 / 同定のための高性能な携帯可能分析システムです。MISAは、Metrohm 独自の軌道ラスタスキャン技術 (Orbital Raster Scan Technologie, ORS) を備えた高効率の分光器を有しています。これは省スペースで、より長いバッテリー寿命を持ち、現場やラボでの移動式用途にも完璧に適しています。MISA ではフレキシブルなサンプル採取を可能にする、レーザークラス1の様々なアタッチメントをご利用いただけます。アナライザーはBluetoothまたはUSBコネクタを介して操作可能です。

MISA Advanced パッケージは、ユーザーに Metrohmのナノ粒子溶液とP-SERSストリップを用いたSERS分析を可能にするコンプリートパッケージです。

MISA Advanced パッケージには、MISAバイアルアタッチメント、P-SERSアタッチメント、ASTM校正標準、USBミニケーブル、USB電源装置、ならびにMISA装置を操作するためのMISA Calソフトウェアが含まれます。装置と付属品を安全に保管するための頑丈な保護ケースも同梱されています。



ID - P-SERS (Ag P-SERS)

IDキット - Ag P-SERS には、Mira/MisaユーザーがP-SERS銀基板でSERS分析を行うのに必要なコンポーネントが含まれています。このキットには、使い捨てのへら、滴下ピペット、サンプルボトル、およびP-SERS 銀ストリップが2個含まれています。