



Application Note AN-RS-027

Trace Detection of Thiram on Apples

Protecting consumer safety with Misa

Thiram is used extensively as a fungicide and parasiticide to prevent disease in crops and as an animal repellent to protect trees and ornamental plants. However, extensive toxicological studies conclude that chronic, high-level exposure can cause considerable organ damage to land and aquatic species. While only moderately toxic to humans through skin exposure and ingestion, thiram is highly toxic if inhaled. To reduce its negative effects on health and the environment, the US defines maximum residue limits that vary for different food crops. In contrast, the EU recently banned thiram and is

moving to use pesticides that carry reduced health risks.

Using Misa (Metrohm Instant SERS Analyzer), low level detection of thiram on apples is achieved with guided workflows adapted for use by diverse testers. Misa Cal software automatically processes results and achieves chemical identification by matching to either proprietary, user-created, or commercially available spectral libraries. Results can be geotagged and shared immediately with the accompanying chemical hazard information.

INTRODUCTION

This application note describes a simulated test procedure for detecting thiram residue on apple skin. The assay is based on the acquisition of

SERS-specific spectra for thiram using Misa and Metrohm Raman's proprietary silver P-SERS substrates.

REFERENCE SPECTRUM AND LIBRARY CREATION

To establish a reference spectrum, a pure thiram standard at a concentration of 500 $\mu\text{g/mL}$ in ethanol was analyzed using silver (Ag) P-SERS

strips. The unique SERS spectrum shown in **Figure 1** can be used to create a library entry for thiram.

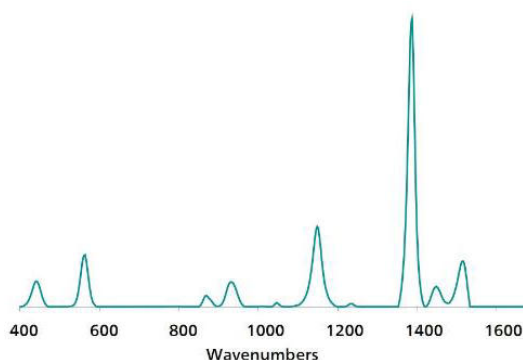


Figure 1. Standard SERS reference spectrum of thiram.

EXPERIMENT

To simulate rapid testing, 25 μL aliquots of 1000, 100, and 10 $\mu\text{g/mL}$ thiram in ethanol were applied to 2 cm^2 sections of apple skins washed with water and dried. After thorough drying of the test sections, Au P-SERS test strips were dipped in ethanol and immediately swabbed in a circular motion within treated sections on the apple skin. Each strip was dried for 5 minutes and then placed in the P-SERS attachment on Misa for measurement.



Table 1. Experimental parameters

Instrument		Acquisition	
Firmware	0.9.33	Laser Power	5
Software	Misa Cal V1.0.15	Int. Time	5 s
Misa Vial Attachment	6.07505.030	Averages	10
ID Kit - Ag P-SERS	6.07506.470	Raster	ON

RESULTS

Overlaid and baseline-corrected spectra acquired for swabs of an apple skin treated with

different concentrations of thiram show detection down to 10 µg/mL (**Figure 2**).

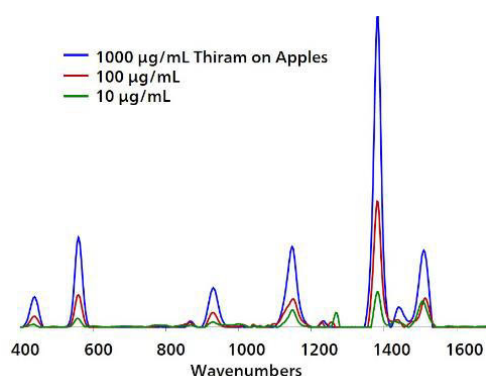


Figure 2. Overlaid baseline-corrected spectra acquired from Ag P-SERS swabs show detection of thiram on apple skins to 10 µg/mL.

FIELD TEST PROTOCOL

Detection of thiram in the field

Dip the printed end of a P-SERS strip into ethanol. *Touch only the unprinted back side of the swab with your gloved hands.* Use the moistened, printed side of the strip to swab the peel of an apple. Rub the strip in a circular

motion. After drying for 5 minutes, insert the Ag P-SERS strip, with the printed portion facing down and toward the instrument, into the P-SERS attachment 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	Ethanol
Test settings	Use ID Kit OP on MISA

CONCLUSION

Misa is a highly sensitive, cost-effective system for the unambiguous identification of pesticide residue on fruit. Its user-friendly analyses paired

with smart software in a compact, portable format make it a powerful solution for field detection of food 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。