



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

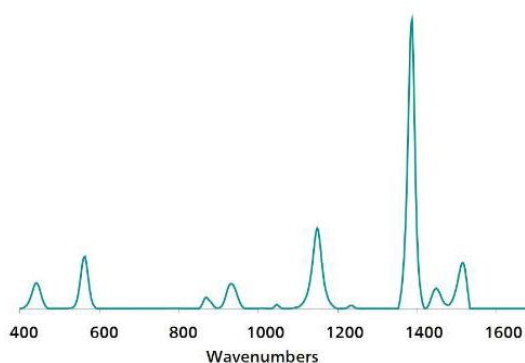
This application note describes a simulated test procedure for detecting thiram residue on apple skin. The assay is based on the acquisition of SERS-specific

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 µg/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 µg/mL thiram in ethanol were applied to 2 cm<sup>2</sup> 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.



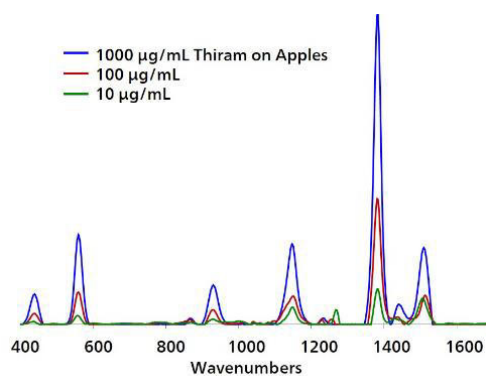
**Table 1.** Experimental parameters

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

Metrohm Suisse SA  
Industriestrasse 13  
4800 Zofingen

[info@metrohm.ch](mailto:info@metrohm.ch)

## CONFIGURATION



### MISA Advanced

Metrohm Instant SERS Analyzer (MISA) est un système d'analyse portable hautement performant pour détecter ou identifier rapidement des traces de substances illicites, d'additifs et de contaminants alimentaires. MISA possède un spectrographe très efficace doté de la technologie ORS (Orbital Raster Scan) unique de Metrohm. Son encombrement est minimal et la durée de vie prolongée de la batterie en fait le système d'analyse idéal pour les tests sur site ou les applications de laboratoire mobiles. MISA propose divers accessoires laser de classe 1 pour des options d'échantillonnage flexibles. L'appareil d'analyse peut fonctionner via la connectivité Bluetooth ou USB.

Le module MISA Advanced est un ensemble complet qui permet à l'utilisateur d'effectuer des analyses SERS avec les solutions de nanoparticules de Metrohm et des bandelettes réactives P-SERS.

Le module MISA Advanced contient un embout de flacon MISA, un embout P-SERS, un standard de calibration ASTM, un câble USB mini, un bloc d'alimentation USB et le logiciel MISA Cal pour le fonctionnement de l'appareil MISA. Une mallette de protection robuste est également fournie pour ranger l'appareil et ses accessoires en toute sécurité.



### Kit d'identification - substrats d'argent P-SERS (Ag P-SERS)

Le kit d'identification Ag P-SERS comprend les composants nécessaires à un utilisateur Mira/Misa pour une analyse SERS avec des substrats d'argent P-SERS. Le kit se compose d'une spatule à usage unique, d'une pipette compte-gouttes, d'un petit flacon d'échantillon et de 2 bandelettes réactives d'argent P-SERS.