

Trace Detection of Carbendazim on Strawberries

Protecting consumer safety with Misa

Summary

Carbendazim (MBC) is a common fungicide approved for regulated use in agriculture globally, outside of the EU. Most MBC is found on fruits as surface contamination, the result of sprays applied prior to harvest. The US EPA has determined that concentrations below 80 g/mL in orange juice are not a health risk, while the EU restricts MBC levels to 10 ng/g (from imported produce) in foods intended for baby food production. Outside of this wide range of acceptance, it is agreed that MBC interrupts hormone production and can damage the testes in males. In the US, strawberries are the most common whole fruit to be contaminated with MBC, as determined by the USDA with GC/MS and LC/MS.

This Application Note describes a very simple test for surface MBC and provides library spectra demonstrating the sensitive detection of MBC with Misa (Metrohm Instant SERS Analyzer).

Configuration



2.950.0020 - MISA Advanced

Metrohm Instant SERS Analyzer (MISA) is a high performance, portable analyzer system used for rapid, trace level detection / identification of illicit materials, food additives and food contaminants. MISA features a high-efficiency spectrograph equipped with Metrohm's unique Orbital-Raster-Scan (ORS) technology. It has a minimal footprint and extended battery life, perfect for on-site testing or mobile laboratory applications. MISA offers various Laser Class 1 attachments for flexible sampling options. Analyzer operation is available through BlueTooth or USB connectivity. The MISA Advanced package is a complete package that allows the user to perform SERS analyses using Metrohm's nanoparticle solutions and P-SERS strips. The MISA Advanced package includes a MISA Vial Attachment, a P-SERS Attachment, a ASTM Calibration Standard, a USB Mini Cable, a USB Power Supply and MISA Cal software for operating the MISA instrument. A ruggedized protective case is also provided to securely store the instrument and accessories.



6.07506.440 - ID Kit – Au NP

The ID Kit - Au NP contains the components a Mira / Misa user requires to perform a SERS analysis using gold colloidal solution. The kit contains a disposable spatula, dropper, sample vials and a bottle of gold colloid.

Introduction

The most common agricultural use of MBC is a 500 g/mL spray applied in the field, 2–3 weeks preharvest. Detection of surface contamination is a very quick and easy assay, ideal for on-site testing with Misa.

Reference spectrum and library creation

To establish a reference spectrum for MBC, a pure standard in methanol is analyzed using gold nanoparticles (Au NPs). The unique SERS spectrum presented in **Figure 1** can be used to create a library entry for MBC.

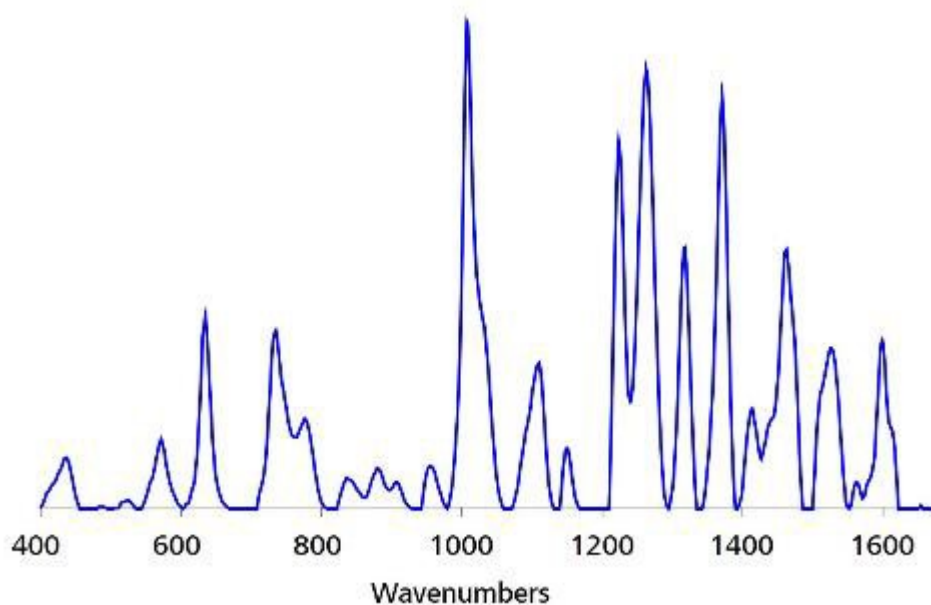


Figure 1. Standard SERS Au NP carbendazim reference spectrum.

Experiment



Purchased strawberries were washed with water prior to testing. A solution of 100 mg/L MBC in ethanol was sprayed onto whole strawberries to mimic a typical farm application. Once dry, each strawberry was rinsed with 4 mL of ethanol. The rinse volume was collected and concentrated to 1 mL by evaporation of solvent on a lab hot plate. Misa samples were prepared by adding 100 L of sample to 800 L of Au NP and 100 L 500 mmol/L NaCl.

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

A baseline-corrected spectrum acquired from whole strawberries sprayed with a 100 mg/L solution of MBC, then rinsed with ethanol agrees with the obtained MBC standard reference spectrum (Figure 2).

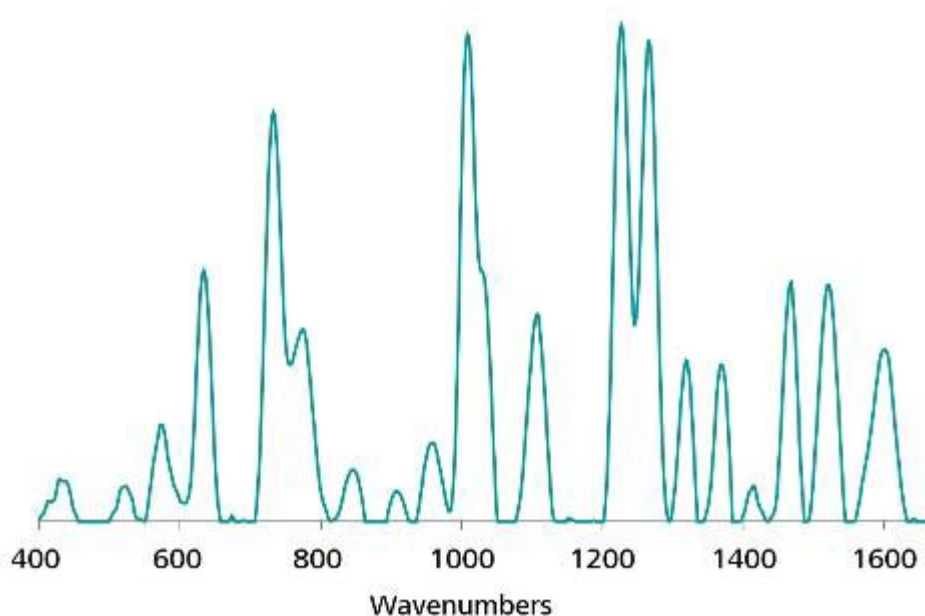


Figure 2. Detection of 100 mg/L MBC with Misa.

Field test protocol

Detection of carbendazim in the field

Place a whole fruit (e.g., strawberry, orange) into a glass beaker just large enough to contain it. Rinse with 4–6 pipettes full of ethanol. Remove fruit and reduce ethanol volume, by means of evaporation on a hot plate, to ~1 mL. Fill a *clean vial* halfway full with Au NPs. Using pipettes, add 2 drops each of reduced ethanol solution and NaCl solution to Au NPs, 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	
Ethanol	
NaCl solution	3 g NaCl in 100 mL water
Glassware	50–250 mL beaker
Test settings	Use ID Kit OP on MISA

Conclusion

Following adept detection of MBC on whole fruits, it is clear that Misa is an excellent solution for analysis of surface contamination of produce in any setting: at the farm, at the market, or at the processing plant. Want to confirm «organic» status? Pesticides, fungicides, and herbicides are all possible targets for Misa's powerful on-site analysis.

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