

# Trace Detection of Carbendazim on Strawberries

## Protecting consumer safety with Misa

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 a concentrations below 80  $\mu\text{g/mL}$  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).

## INTRODUCTION

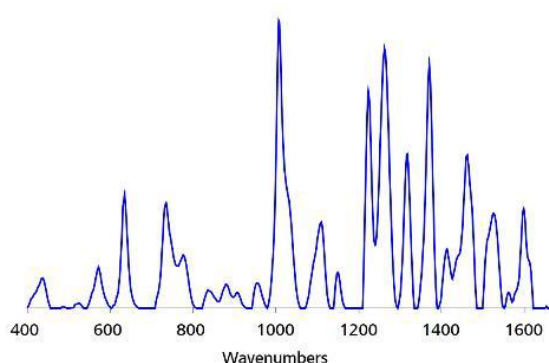
The most common agricultural use of MBC is a 500 µg/mL spray applied in the field, 2–3 weeks preharvest. Detection of surface contamination

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 µL of sample to 800 µL of Au NP and 100 µL 500 mmol/L NaCl.



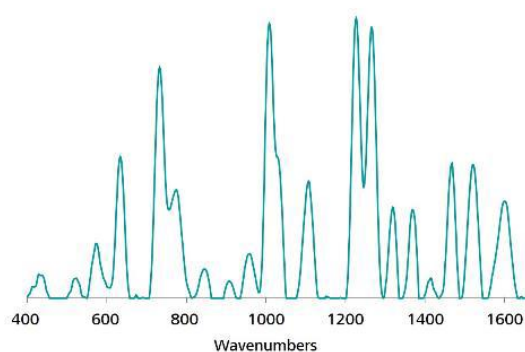
**Table 1.** Experimental parameters

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.

## CONTACT

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## CONFIGURATION



### MISA Advanced

Metrohm Instant SERS Analyzer (MISA) 是一款高性能、便携式分析系,可快速/定非法物、食品添加剂和微量食品染料。MISA 的特点是配了 Metrohm 独特的道光栅描 (ORS) 技的高效光。其空需求最小和并且池寿命有所延,是或移室用的理想。MISA 提供各 1 激光附件,可活取。分析可通 Bluetooth 或 USB 接行。MISA Advanced 套件是一个完整套件,其作用是用能用 Metrohms 米粒溶液和 P-SERS 条行 SERS 分析。MISA Advanced 套件包含了一个 MISA 小管附件、一个 P-SERS-附件、一个 ASTM 校正准件、一个 USB 迷、一个 USB 供元和用于行 MISA 器的 MISA Cal 件。随供了一个用来安全保管器和附件的固保箱。



### ID – Au NP

ID 套件 - Au NP 包含了 Mira/Misa 用使用体金溶液行 SERS 分析所需的件。套件包含了一个一次性抹刀、一个移液管、品小瓶和一个含金体的瓶子。