



Application Note AN-RS-025

茶叶中百草枯的痕量检测

Protecting consumer safety with Misa

Paraquat is a highly effective herbicide used to manage weeds in agricultural operations. It is also exceptionally toxic, causing debilitating health effects that can result in delayed death after exposure. In China alone, it is estimated that over 5000 deaths each year are attributed to exposure during application and production of paraquat. In recognition of paraquat's danger, the EU and several other countries have banned its use for any application. The US EPA permits limited use of paraquat by licensed

applicators. Despite tight regulation, paraquat continues to be produced and is liberally used as an herbicide in over 100 countries without regulatory oversight.

Testing for paraquat typically requires involved sample processing and analysis by trained chemists using expensive laboratory instruments such as HPLC, CE, and LC/MS. Misa achieves trace level detection of paraquat residue in tea leaves in a fully integrated, portable, smart system for easy on-site testing by non-technicians.

INTRODUCTION

This application note describes a simple procedure for trace detection of paraquat on tea leaves, based on the acquisition of SERS spectra

of paraquat in chloroform extracts using Misa and gold nanoparticles (Au NPs).

REFERENCE SPECTRUM AND LIBRARY CREATION

To establish a reference spectrum, pure paraquat standard at a concentration of 1 µg/g in water was analyzed using Au NPs. The unique

SERS spectrum shown in **Figure 1** can be used to create a library entry for paraquat.



Figure 1. Standard reference SERS Au NP spectrum of paraquat.

EXPERIMENT

Serial dilutions of paraquat in water were added to 0.1 g aliquots of finely ground tea in glass vials to yield a concentration range of spiked test samples: 50, 25, 10, 5, and 1 µg/g, 100 and 50 ng/g. These samples were dried at 80 ° C, and 1 mL of chloroform was added each vial. Each sample was shaken for thorough wetting of the ground tea leaves and rested for 15 minutes to facilitate settling and extraction. After waiting the required time, 10 µL of chloroform extract was decanted to a fresh vial, dried briefly, and resuspended in 450 µL of Au NPs and 50 µL of 0.5 mol/L NaCl. Sample vials were gently shaken and immediately placed into the vial attachment on Misa for measurement.



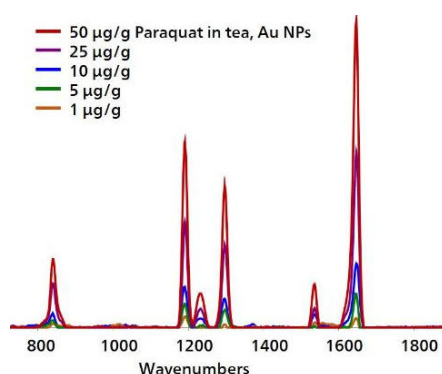
Table 1. Experimental parameters

Instrument		Acquisition	
Firmware	0.9.33	Laser Power	5
Software	Misa Cal V1.0.15	Int. Time	1 s
Misa Vial Attachment	6.07505.040	Averages	10
ID Kit - Au NP	6.07506.440	Raster	ON

RESULTS

Overlaid Au NP SERS spectra acquired for a range of paraquat-spiked tea samples demonstrate detection down to 1 µg/g (Figure

2). Spectra were baseline-corrected and background-subtracted with Misa Cal software.

**Figure 2.** SERS spectra for a concentration range of paraquat in tea.

Detection of paraquat in the field

If tea leaves are very large, then grind, crush, or chop them. Using the large end of the scoop, add 3–4 scoops of sample to a 2 mL vial. Add chloroform to the vial until halfway full. Cap and shake the vial gently to mix, then let sample rest for 15 minutes. Fill a clean vial ~1/2 full with Au NPs. Using a pipette,

add 2 drops of chloroform extract to a *clean vial* and remove the solvent with evaporative heating. Fill this vial halfway full with Au NP solution, add 1 drop of NaCl solution, and shake 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		
Chloroform		
NaCl solution	3 g NaCl in 100 mL water	
Test settings		Use ID Kit OP on MISA

CONCLUSION

The level of detection reported here for paraquat on tea leaves is significantly lower than the permissible levels of residue allowed for most vegetable, herb, and fruit crops. Sampling with Misa is simplified with onboard operating procedures that automate

acquisition parameters, sample processing, and results reporting. Misa's dedicated software, Misa Cal, can be used for spectral processing, library matches, and results sharing.

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CONFIGURATION



MISA Advanced

Metrohm Instant SERS Analyzer (MISA) 是一款高性能、便携式分析系统,可快速检测/鉴定非法物质、食品添加剂和微量食品污染物。MISA 的特点是配备了 Metrohm 的轨道光栅扫描 (ORS) 技术设备的光谱仪。其空间需求小和并且电池寿命有所延长,适用于现场测试或移动实验室应用。MISA 提供各种 1 级激光附件,可灵活选择取样。该分析仪可通过 Bluetooth 或 USB 连接运行。

MISA Advanced 套件是一个完整套件,其作用是让用户能用 Metrohms 纳米颗粒溶液和 P-SERS 试剂条进行 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 校正标准件、一个 USB 迷你电缆、一个 USB 供电单元和用于运行 MISA 仪器的 MISA Cal 软件。还随供了一个用来安全保管仪器和附件的坚固保护箱。



ID – Au NP

ID 套件 - Au NP 包含了 Mira/Misa 用户使用胶体金溶液进行 SERS 分析所需的组件。该套件包含了一个一次性抹刀、一个移液管、样品小瓶和一个含金胶体的瓶子。