Application Note AN-RS-019

SERS Detection of Metanil Yellow in Turmeric

Protecting consumer safety with Misa

Metanil yellow (MY) is an azo dye used in the manufacture of external-use products such as textiles; however, it is prohibited from use as a food additive in many countries. Toxicology studies demonstrate that ingestion of MY results in significant neurological and multi-organ damage. Despite these hazards, MY is commonly used as an illicit colorant for enhancing the visual appeal of spices and legumes, most notably turmeric. Given the rising popularity of turmeric as a dietary supplement promising significant health benefits, routine safety tests must be readily available to ensure the integrity of turmeric-containing products. Ideal tests feature methods that are selective and sensitive, yet portable and convenient.

Misa (Metrohm Instant SERS Analyzer) achieves rapid and accurate detection of MY in a facile assay format.

INTRODUCTION

Misa is a versatile analytical tool for detecting banned colorants in foods. This application note details a simple, conservative extraction procedure for the detection of MY in turmeric.

REFERENCE MATERIAL AND LIBRARY CREATION

To establish a reference spectrum for MY, a pure standard in 50 mmol/L HCl is analyzed using gold nanoparticles (Au NPs). The unique SERS spectrum presented in Figure 1 can be used to create a library entry for MY.

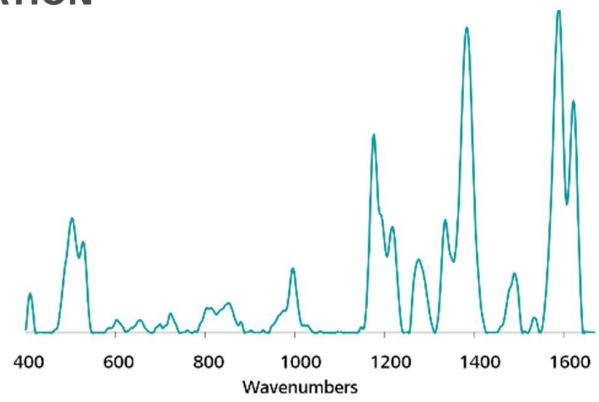

Figure 1. Standard Au NP SERS spectrum of Metanil Yellow.

EXPERIMENT

For simulated testing of MY in turmeric, solid MY was mixed thoroughly with commercially bought turmeric powder to yield a concentration range of spiked samples: 10 and 1 mg/g, 100 and 50 µg/g. MY was extracted by the addition of 1 mL 0.5 mol/L HCl to 100 mg of each sample in a glass vial. This suspension was shaken and allowed to settle for 10 minutes. Test samples were prepared by pipetting 100 µL of the HCl extract into vials containing 800 µL of Au NPs and 100 µL of 0.5 mol/L NaCl. Each vial was inverted to combine the components and then inserted into the vial attachment on Misa for analysis.

Table 1. Experimental parameters

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

RESULTS

Overlaid baseline-corrected spectra acquired for the spiked samples demonstrate detection of MY down to 0.1 mg/g (Figure 2). Reliable detection is based on prominent peaks at 504, 1176, 1383, and 1588 cm^{-1} in the spectrum.

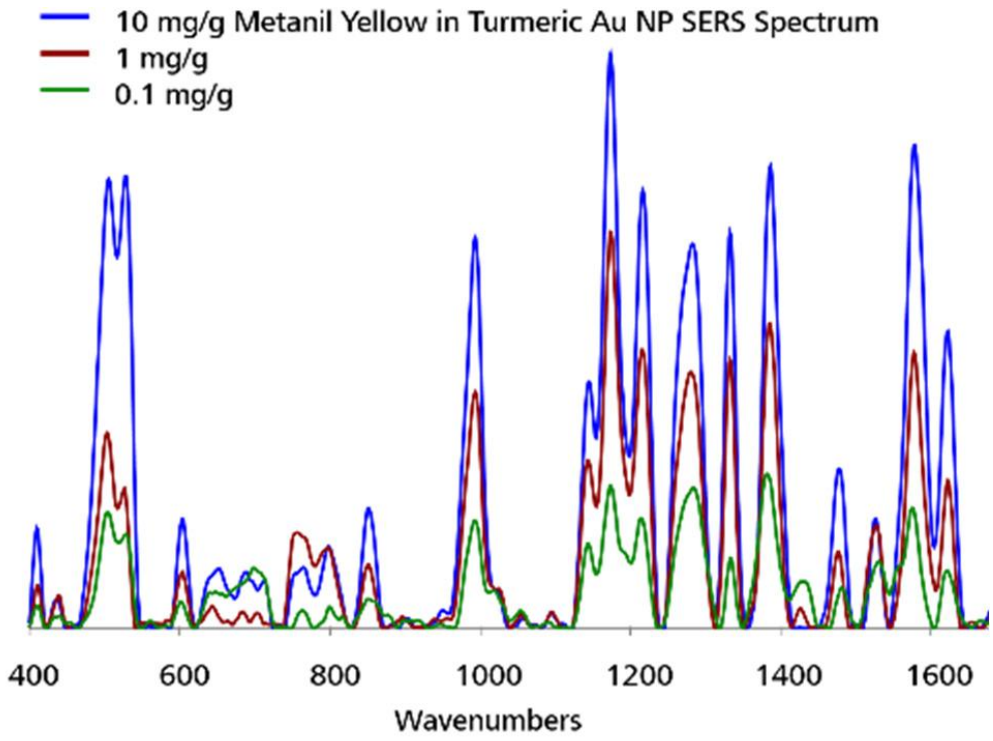

Figure 2. Detection range of MY with Misa and Au NPs.

FIELD TEST PROTOCOL

Detection of Metanil Yellow in the field

Using the large end of the scoop, add 3–4 scoops of sample to a 2 mL vial. Add HCl solution to the vial until halfway full. Cap and shake the vial gently to mix, and let sample rest for 5 minutes. Fill a *clean vial* halfway full with Au NPs.

Using pipettes, add 2 drops each of sample solution and NaCl solution to the Au NPs, then 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	
HCl solution	4 mL HCl in 100 mL water
NaCl solution	3 g NaCl in 100 mL water
Test settings	Use **ID Kit OP** on MISA

CONCLUSION

The rapid detection of MY in adulterated turmeric is demonstrated using Misa and Au NPs. This assay requires minimal user training, making it ideal for cost-effective, on-site QC testing in large food processing facilities, as well as distribution and receiving centers. Recently, the sensitive detection of MY in dal, a yellow split pea commonly used in Indian cuisine, with Metrohm Raman's portable Sierra spectrometer suggests potential for using Misa to screen a wide variety of foods prized for their intense yellow coloration.

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、食品添加和微量食品染物。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。