



Application Note AN-RS-020

# Trace Detection of Auramine O in Curry Powder

## Protecting consumer safety with Misa

Auramine O (AO) is an industrial dye used for a broad range of manufactured products and as a fluorescent stain for detecting acid-fast bacteria in clinical specimens. Due to its intense yellow coloration, AO is also prized as an additive for enhancing the visual appeal of illicitly processed food products. Curry powder is a likely target for such adulteration, as it is a bright yellow mixture of several spices. Health hazards

associated with ingestion, and even improper handling of AO, include a high risk of several cancers, neural and liver toxicity, and even death. Despite bans on AO as a food additive, surveillance testing indicates its persistent use as an adulterant in foods and spices. Misa (Metrohm Instant SERS Analyzer) achieves the rapid and sensitive detection of AO in curry powder in a simple assay format.

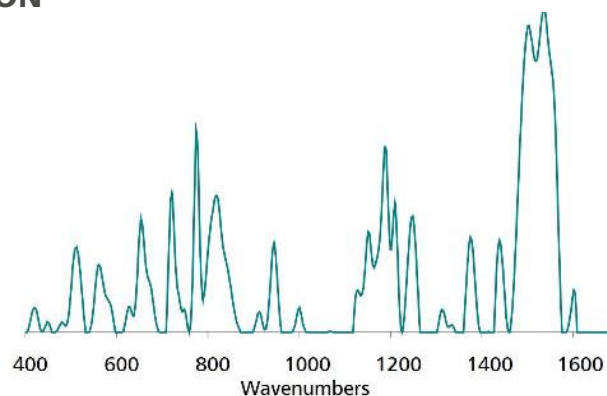
## INTRODUCTION

Misa is a versatile tool for the rapid and accurate detection of banned food colorants. This application

note details a facile extraction procedure for detecting AO in adulterated curry powder.

## REFERENCE MATERIAL AND LIBRARY CREATION

To establish a reference spectrum for AO, a pure standard in alkaline water (100 µg/mL, pH 13) was analyzed using gold nanoparticles (Au NPs). The unique SERS spectrum shown in **Figure 1** can be used to create a library entry for AO.



**Figure 1.** Standard SERS reference spectrum of Auramine O.

## EXPERIMENT

In a simulated test for AO in curry powder, solid AO was mixed with purchased curry powder to yield a concentration range of spiked test samples: 1000, 100, 10, 5, and 1 µg/g. Liquid extraction of AO was performed by adding 1 mL of 0.1 mol/L NaOH to 100 mg of sample in a glass vial. This slurry was mixed and allowed to rest for 2 minutes. Ethyl acetate (EA, 1 mL) and NaCl (100 mg) were added to the vial, which was then inverted gently a few times (*do not shake vigorously*) to promote extraction of AO into the EA layer. After 10 minutes, 50 µL of the top EA layer was added to a vial containing 400 µL of Au NPs and 50 µL of 0.5 mol/L NaCl. The vial was shaken to mix and immediately placed in the vial attachment on Misa for measurement.





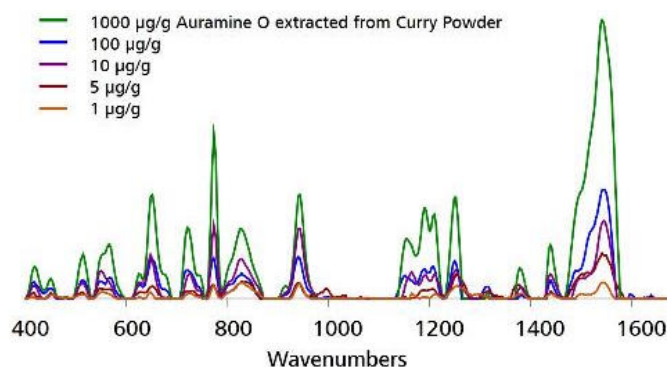
**Table 1.** Experimental parameters

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

## RESULTS

Overlaid, baseline-corrected SERS spectra of basic EA extracts of curry powder spiked with varying concentrations of AO demonstrate reliable detection

down to 1 µg/g (**Figure 2**). Note: Peaks in AO SERS spectra show solvent and pH-related shifts.



**Figure 2.** Detection range of AO with Misa and Au NPs.

## FIELD TEST PROTOCOL

### Detection of Auramine O in the field

Using the large end of the scoop, add 3–4 scoops of sample to a 2 mL vial. Add NaOH solution to the vial until halfway full. Add 3–4 scoops solid NaCl, then fill vial to the top with ethyl acetate. Cap and invert the vial a few times to mix, but *do not shake the vial vigorously*. Let the sample rest for 5 minutes, as

distinct layers will form. Fill a *clean vial* halfway full with Au NPs. Using pipettes, add 2 drops each of the *top layer* of the sample 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             |
| <b>Reagents</b>      |                              |
| NaOH solution        | 0.4 g NaOH in 100 mL water   |
| Solid NaCl           |                              |
| Ethylene acetate     |                              |
| NaCl solution        | 3 g NaCl in 100 mL water     |
| <b>Test settings</b> | Use ID Kit <b>OP</b> on MISA |

## CONCLUSION

The facile and sensitive detection of AO in adulterated curry powder is demonstrated using Misa. This analysis requires minimal user training and minimal consumables, making it an ideal analytical platform for on-site QC testing in food manufacturing,

shipping, and receiving facilities. Misa's portability and ease-of-use in trace detection of illicit colorants outperforms complex extraction and analysis procedures in a laboratory setting.

## CONTACT

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## CONFIGURATION



### MISA Advanced

Metrohm Instant SERS Analyzer (MISA) ist ein hochleistungsfähiges, tragbares Analysensystem zur schnellen Detektion / Identifizierung von illegalen Substanzen, Lebensmittelzusatzstoffen und Lebensmittelverunreinigungen im Spurenbereich. MISA verfügt über einen hocheffizienten Spektrographen, der mit der einzigartigen Orbital-Raster-Scan (ORS)-Technologie von Metrohm ausgestattet ist. Er hat einen minimalen Platzbedarf und eine verlängerte Batterielebensdauer, perfekt für Tests vor Ort oder mobile Laboranwendungen. MISA bietet verschiedene Laser-Klasse-1-Aufsätze für flexible Probenahmeoptionen. Der Betrieb des Analysators ist über BlueTooth oder USB-Konnektivität möglich.

Das MISA Advanced-Paket ist ein Komplettpaket, das es dem Anwender ermöglicht, SERS-Analysen mit Metrohms Nanopartikelösungen und P-SERS-Streifen durchzuführen.

Das MISA Advanced-Paket enthält einen MISA Vial-Aufsatz, einen P-SERS-Aufsatz, einen ASTM-Kalibrierstandard, ein USB-Minikabel, ein USB-Netzteil und die MISA Cal-Software zum Betrieb des MISA-Geräts. Ein robuster Schutzkoffer zur sicheren Aufbewahrung des Instruments und des Zubehörs wird ebenfalls mitgeliefert.



### ID Kit – Au NP

Das ID Kit - Au NP enthält die Komponenten, die ein Mira/Misa-Benutzer benötigt, um eine SERS-Analyse mit kolloidaler Goldlösung durchzuführen. Der Kit enthält einen Einwegspatel, eine Tropfpipette, Probenfläschchen und eine Flasche mit Gold-Kolloid