



Application Note AN-RS-028

SERS Detection of Brilliant Blue

Overcoming fluorescence issues with Misa

Brilliant Blue (BB) FCF, more commonly known as FD&C Blue #1, is the most commonly used blue dye worldwide for food and beverages. It is generally accepted as safe and non-toxic. Aside from foods labelled as organic or as free from artificial dyes, there is little objection to the use of BB at levels at or exceeding 100 $\mu\text{g/g}$ in foods.

This application for Misa (Metrohm Instant SERS Analyzer) is unique. The benefit is twofold — successful detection of a fluorescent dye, and a unique sample cleanup technique that permits detection of a target that does not exhibit a

strong SERS signal and is present in a complex matrix. It is well known that Raman identification can be overwhelmed by fluorescence, and sometimes SERS can be used as an alternative method of detection. In addition to being a strongly fluorescent dye, BB has a weak SERS signal; detection of such targets often requires extensive sample extraction before the SERS signal is detectable. While Misa successfully detects BB in direct sampling, this application describes a simple extraction method that improves detectability of BB with Misa.

INTRODUCTION

This application note describes a procedure for detection of BB in a flavored drink mix. The assay is based on the acquisition of SERS-specific

spectra for BB in aqueous and chloroform extracts using Misa and gold nanoparticles (Au NPs).

REFERENCE SPECTRUM AND LIBRARY CREATION

To establish a reference spectrum, pure BB standard at a concentration of 500 $\mu\text{g/mL}$ in water was analyzed using Au NPs. The unique

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

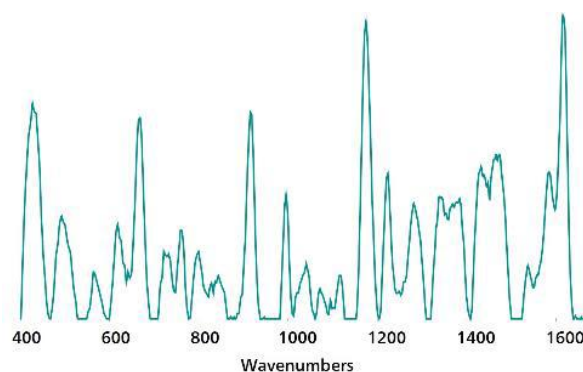


Figure 1. Standard Au NP SERS reference spectrum for Brilliant Blue.

EXPERIMENT AND RESULTS

In a direct test for the presence of BB in a flavored drink mix, 100 mg of «blue raspberry» drink mix was dissolved in 1 mL of water. 50 μL of this solution was added to a vial containing 450 μL of Au NPs, followed by 50 μL of 0.5 mol/L NaCl. The vial was briefly shaken and inserted into the vial attachment on Misa for measurement.

The resulting spectrum, seen in **Figure 2**, shows some peak agreement with the reference spectrum. However, **Figure 2** differs in intensity and shape from the reference spectrum of BB, due to the complex sample matrix. Signals from other components in the mix can compromise library matching and target identification; thus, a simple extraction process was employed to improve the SERS signal for BB.



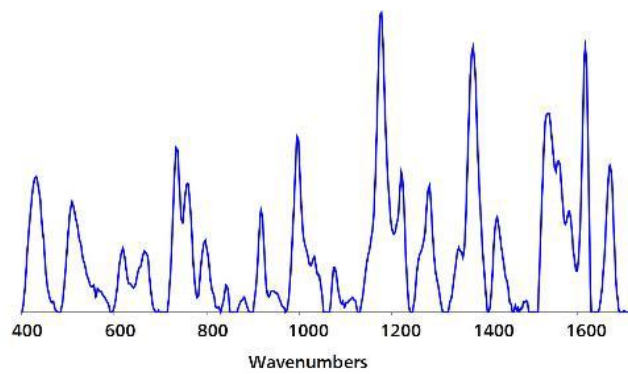


Figure 2. Direct Au NP interrogation for BB in a flavored drink mix.

In a glass vial, 40 mg of sample was dissolved in 1 mL of benzethonium chloride solution (2 mg/mL in water). Benzethonium Cl is a cationic surfactant used to capture the anionic dye. Chloroform (0.5 mL) was added to this vial, the mixture was vortexed for 30 seconds, and then rested for 5 minutes to permit phase separation. 200 μ L of the lower chloroform layer was

carefully transferred by pipette to a fresh vial, which was placed on a hot plate for evaporative drying. Afterward, 450 μ L of Au NPs and 50 μ L of 0.5 mol/L NaCl were added to the dried residue. This vial was capped, shaken to mix, and immediately placed into the vial attachment on Misa for measurement.

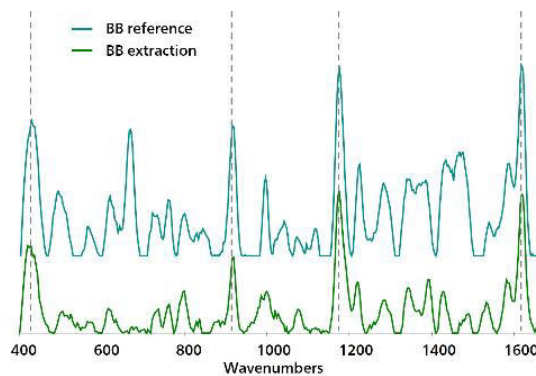


Figure 3. A comparison of the Au NP reference spectrum for BB with the BB spectrum obtained after chloroform extraction.

The stacked spectra in **Figure 3** confirm that this simple sample cleanup yields a BB spectrum with

a profile much closer to the reference spectrum.

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 |

FIELD TEST PROTOCOL

Detection of Brilliant Blue in the field

Using the large end of the scoop, add 3–4 scoops of sample to a 2 mL vial. Using clean pipettes for each reagent, add benzethonium Cl solution to the vial until halfway full, followed by 10 drops of chloroform. Cap and shake the vial vigorously to mix, then let sample rest for 5 minutes. Using a pipette, carefully remove a

portion of the *lower layer* and add 8 drops of this extract to a *clean vial*, then evaporate the solvent via heating on a hot plate. Fill this vial halfway with Au NPs, add 4 drops of NaCl solution, and then cap and shake the vial gently to mix. Insert into the 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 | |
| Benzethonium Cl | 0.2 g in 100 mL water |
| Chloroform | |
| NaCl solution | 3 g NaCl in 100 mL water |
| Test settings | Use ID Kit OP on MISA |

CONCLUSION

Misa successfully confirms the presence of a fluorescent dye in a complex food matrix. The identification of **Brilliant Blue** in a flavored drink mix is unique in that it overcomes fluorescence while avoiding extensive sample cleanup,

advanced spectral processing, and the complexity and expense of laboratory instrumentation. Contact Metrohm Raman for advice in adapting your custom application for Misa.

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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。