HARRICK SCIENTIFIC PRODUCTS

No. 21150

AN INVESTIGATION OF COLORED SOLUTIONS USING THE IMMERSION PROBE

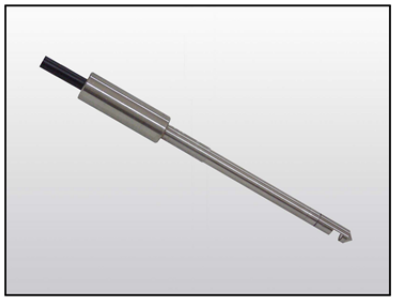

Figure 1. The Immersion Probe.

Figure 2. The FiberMate2™ fiber optic coupler.

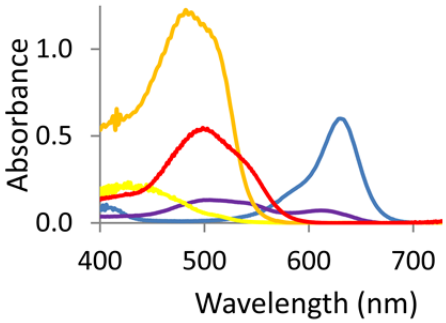

Figure 3. The transmission spectra of different flavors of Jell-O®: Lemon (yellow) Orange (orange), Grape (purple), Strawberry (red) and Berry Scary (red).

INTRODUCTION

UV-Vis-NIR spectroscopy is a powerful tool for color analysis of liquids. Sampling is frequently carried out in cuvettes inside an appropriate spectrometer but can also be done via fiber optic probes. These probes offer the advantage of remote sampling from the spectrometer, simplifying the experimental design for in-situ measurements. UV-Vis-NIR fiber optics probes can be integrated with conventional UV-Vis-NIR spectrometers with suitable fiber optic coupler or with a dedicated, compact fiber optic spectrometer.

This work demonstrates the use of an Immersion Probe coupled to a bench top spectrometer to analyze colored liquids situated in some distance away from the spectrometer.

EXPERIMENTAL

Five different flavors of Jello® were examined: Lemon, Orange, Grape, Strawberry, and Berry Scary. Samples were prepared by dissolving 1.5 g of each powder in 30 mL of water.

All the samples were analyzed using a Vis-NIR Immersion Probe with a 10-mm pathlength interchangeable tip (Figure 1). The probe, with its 2-m long fibers, was interfaced to the sample compartment of a commercial, bench top, double beam UV-Vis-NIR spectrometer using a Harrick FiberMate2 fiber optic coupler (Figure 2). The data were collected with a reduced slit height, a SBW of 0.7, an average time of 0.500 s, a data interval of 1.100, and scan rate of 132 nm/min over the wavelength range from 300 nm to 780 nm. For all measurements, the reference beam of the spectrometer was attenuated to reduce the imbalance in energy detected by the sample and reference beams. The baseline spectrum was collected with the Immersion Probe exposed to air. Then the probe was fully submerged in the sample for data collection. The probe was rinsed several times in water between samples.

RESULTS AND DISCUSSION

The measured spectra, shown in Figure 3, varied in the visible in accordance with the apparent colors of the solutions. The Jell-O® Orange and Strawberry powder solutions both produced strong absorption bands around 480-520 nm, consistent with their reddish colors. The Lemon solution has a distinct band near 400-430 nm, reflecting the solution's yellow color. The Berry Scary solution has a prominent peak around 620-630 nm, giving the solution its deep blue color.

applications note

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The Grape solution produced two broad, distinct peaks centered near 510 nm and 620 nm, indicative of the red and blue dyes found in the powder. Notably, these peaks are similar to the respective red and blue peaks of the Strawberry and Berry Scary spectra in position, though they exhibit lesser intensities. These findings likely indicate that the red and blue dyes present in Grape Jell-O® are present at a significantly lower concentration than those found in the Strawberry and Berry Scary flavors.

CONCLUSION

From the above, it is evident that the Immersion Probe is effective for analysis of colored liquids. Moreover, this work demonstrates the potential the Immersion Probe has, with its remote sampling capabilities, to accommodate a wide range of experimental designs for in-situ measurements.

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