Is there any benefit in using 1.0 nm compared to 1.5 nm spectral bandwidth for solid or liquid analysis?

Application note

Pharmaceutical QA/QC

Authors

Jan Wülfken

Agilent Technologies
Waldbronn, Germany

Rob Wills

Agilent Technologies
Cheadle, UK

Introduction

UV-Vis absorbance of solid and liquid samples produces spectra with naturally broad peaks that are typically in the order of 20 nm or more from side to side. The widely accepted practice for UV-Vis measurements is to use an instrument spectral bandwidth (SBW) setting approximating to one tenth of the natural bandwidth of the analyte. Therefore for solid and liquid analysis, using a SBW of less than 2 nm is commonplace, and satisfies the requirements of the European (EP), British (BP) and United States (USP) Pharmacopoeia. There is a commonly held misconception that a smaller SBW equates to more accurate and repeatable analyses. In fact, using a smaller SBW than required can lead to poorer quality data or increased data collection times, due to less light reaching the sample.

The other misconception is that a 1 nm SBW is required to satisfy the EP, BP and USP requirements. There is no statement that dictates the SBW in these pharmacopoeia regulations other than to ensure an appropriate SBW is used to pass instrument performance tests such as Stray Light — where a 1.5 nm SBW will be more than sufficient.

In this application note we will compare two spectra of a certified holmium perchlorate solution (supplied by Starna Scientific) measured across the range 200 to 800 nm. One is measured on the Cary 60 spectrophotometer with a fixed spectral bandwidth of 1.5 nm and the other is measured on a Cary 300 instrument with 1 nm SBW. All other measurement parameters (scan speed, signal averaging time, and so forth) were the same for both scans. The results show that there is no technical advantage in using the smaller SBW.

Results

Figure 1 shows an overlay of the two measured spectra across the full range 200 to 800 nm. No differences between the two spectra can be observed.

Figure 2 is an expanded view of the peaks at 640.4 nm.

Figure 3 is an expanded view of the cluster of peaks between 400 and 500 nm.

It is clearly evident from these three figures that the two spectra perfectly overlay, and therefore using a SBW of 1 nm provides no technical advantage.

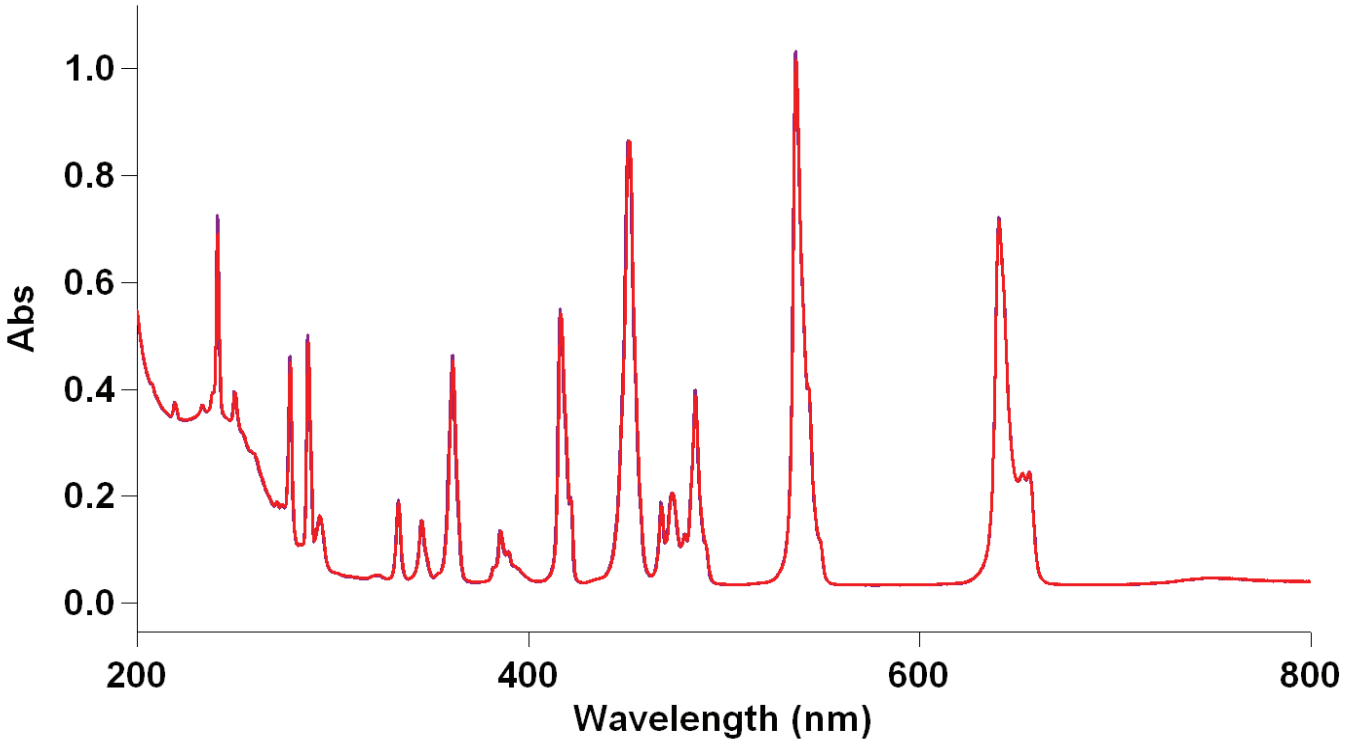

Figure 1. Scan of a certified solution of holmium perchlorate from 200 to 800 nm using the Cary 60 (red trace) at 1.5 nm SBW and the Cary 300 (blue trace) at 1 nm SBW

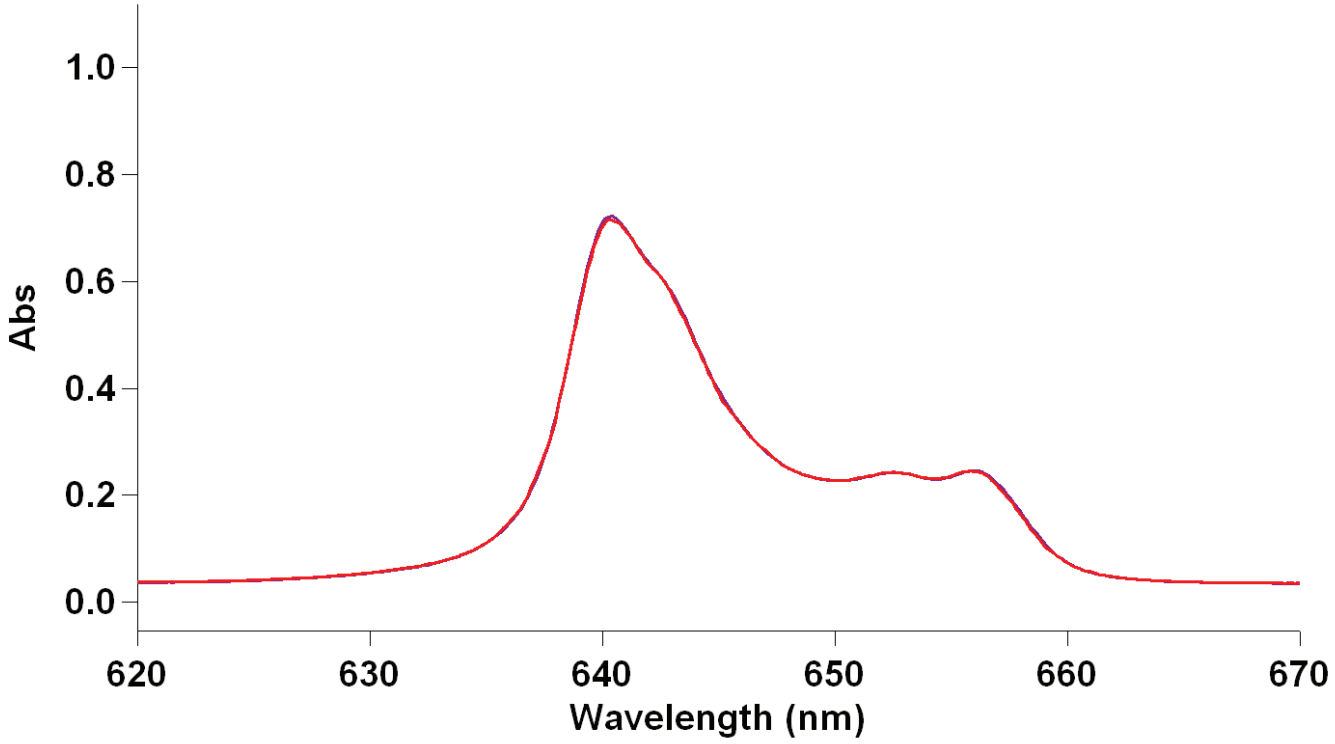

Figure 2. Expanded view around the 640.4 nm peak. Cary 60 (red trace) at 1.5 nm SBW and Cary 300 (blue trace) at 1 nm SBW

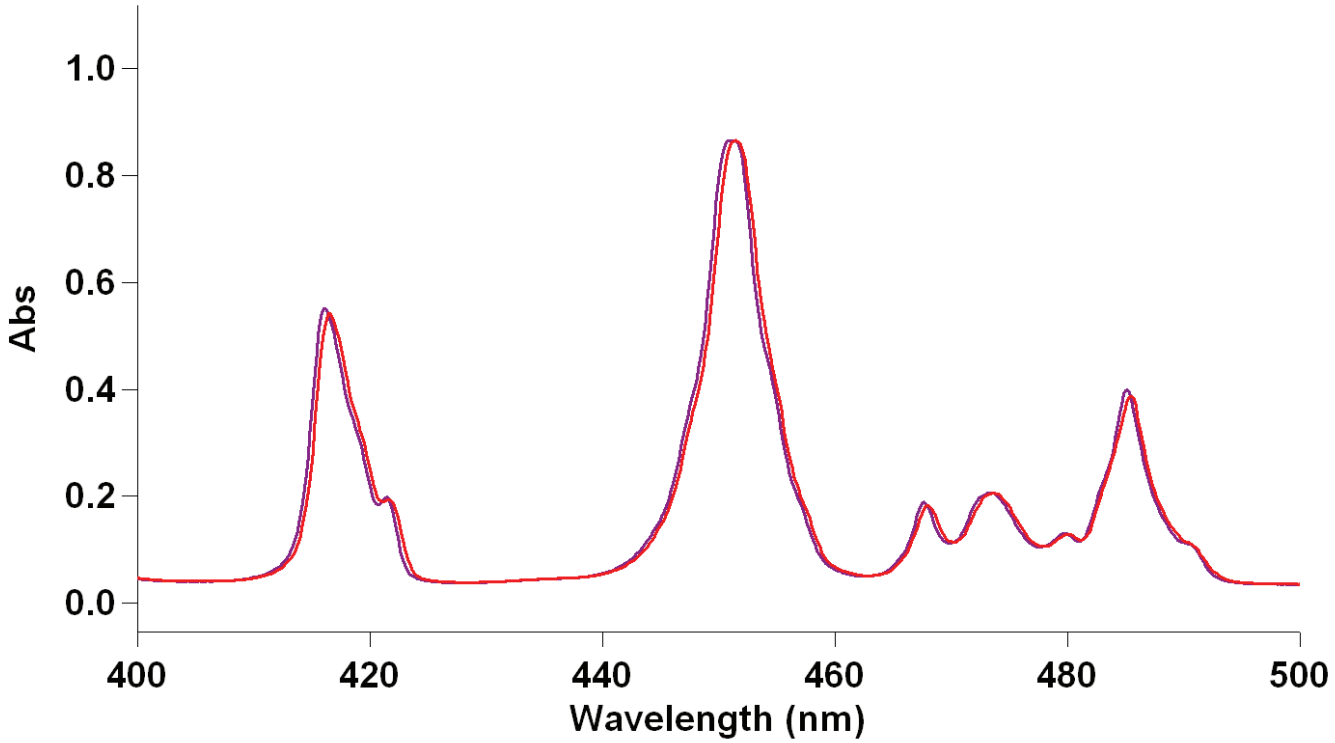

Figure 3. Expanded view of the 400 to 500 nm range of the collected spectra. Cary 60 (red trace) at 1.5 nm SBW and Cary 300 (blue trace) at 1 nm SBW

Summary

From a technical perspective, this report clearly demonstrates that there is no performance advantage to be gained in reducing the SBW. Measuring the spectra of holmium perchlorate determines wavelength accuracy, and the performance specifications of both the Cary 60 and the Cary 300 meet all major pharmacopeia requirements. Therefore, the use of either a 1.0 nm or a 1.5 nm SBW setting can ensure compliance with the demands of the European, British and United States Pharmacopoeias (EP, BP and USP). The Validate application of the Cary WinUV software package provides the methods and instrument settings for the EP, BP and USP tests, enabling these results to be confirmed.

This test forms part of the Global Suite of Operational Qualification tests provided by Agilent Enterprise Edition Compliance Services that ensures all Agilent's UV-Vis hardware meets the core performance specifications for UV-Vis systems.

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Agilent Technologies