Lab Essentials Information

Technical Data Sheet 1.08166.0001

UV/VIS Standard 6 – Holmium oxide solution for checking the wavelength of spectrophotometers, traceable to NIST

Application:

Modern spectrophotometers on being switched on normally go through a routine for setting the wavelength scale. In many cases, the deuterium emission line at 656.1 nm is used as a reference. The wavelength accuracy of other more distant wavelength, however, is rarely checked. Every spectrophotometer (including those of the same type) possesses specific fine characteristics with respect to wavelength accuracy; these extend over the entire wavelength range. These deviations can give rise to substantial errors in the results achieved when measuring in absorbance edges, analysing narrow-band spectra and when using classical single-wavelength methods.
For this reason, the deviations should be known over as large a wavelength range as possible and checked on a regular basis.

Standards:

Ph. Eur. (chapter 2.2.25.): "Verify the wavelength scale using the absorption maxima of holmium perchlorate solution. The permitted tolerance is ± 1 nm for the ultraviolet range and ± 3 nm for the visible range. Suitable certified reference materials may also be used."

"Holmium perchlorate Solution (1043101): A 40g/L solution of holmium oxide R in a solution of perchloric acid R containing 141 g/L of $HClO_4$."

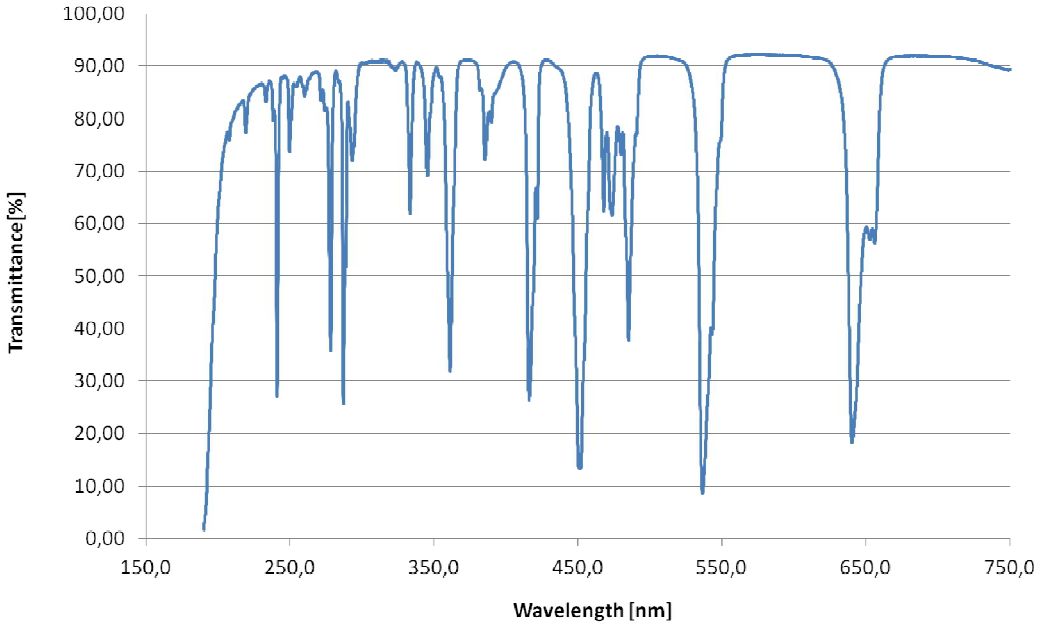
USP (851): "Detailed instructions for operating spectrophotometers are supplied by the manufacturers. To achieve significant and valid results, the operator of a spectrophotometer should be aware of its limitations and of potential sources of error and variation. The instruction manual should be followed closely on such matters as care, cleaning, and calibration of the instrument, and techniques of handling absorption cells, as well as instructions for operation. The following points require special emphasis."

"The wavelength scale may be calibrated also by means of suitable glass filters, which have useful absorption bands through the visible and UV regions. Standard glasses containing didymium (a mixture of praseodymium and neodymium) have been used widely, although glasses containing holmium were found to be superior. Standard holmium oxide solution has superseded the use of holmium glass. → National Institute of Standards and Technology (NIST), Gaithersburg, MD 20899: "Spectral Transmittance Characteristics of Holmium Oxide in Perchloric Acid," J. Res. Nalt. Bur. Stds. 90, No. 2, 115 (1985)"

ASTM (E275): "The absorption spectrum of holmium oxide solution is obtained similarly by measuring an approximately 4% solution of holmium oxide in 1.4 M perchloric acid (40g/L) in a 1-cm cell, with air as reference. For this material the transmittance minima of 18 absorption bands have been certified by a multi-laboratory inter comparison, at the highest level, allowing the peak value assignment as an intrinsic wavelength standard. "

Instrument check:

Spectrum of a holmium oxide solution for checking the wavelength



Interpretation of results:

This enlargement shows a section of a spectrum. The location of the transmittance minimum is dependent on the slit width of the spectrophotometer. In case of deviations, the analysis should first be checked and, if necessary, instrument service notified.