

Application News

UV-Vis Spectrophotometer UV-1900i Plus

Using UV-1900i Plus to Evaluate Raw Materials for Chemical Products Based on the Hazen Color Scale

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User Benefits

- ◆ The color of liquid raw materials can be quantified in Hazen units.
- ◆ The spectral assessment feature in LabSolutions™ UV-Vis Color enables simple evaluation of samples based on the Hazen color scale.

■ Introduction

The ISO 6271:2015¹⁾ and the Japanese Industrial Standard (JIS) K0071-1:2017²⁾ describe how to measure colors in Hazen units (also called the platinum-cobalt scale or APHA color scale) to evaluate the color of chemical products. The Hazen color scale is used in quality controls and to evaluate the color of samples ranging from colorless or transparent to yellowish. These regulations stipulate preparing platinum-cobalt color standard solutions with 24 different fixed concentrations of potassium hexachloroplatinate (IV) and cobalt (II) chloride hexahydrate that range in color from 0 to 500 Hazen units and then using these standard solutions as reference criteria (Fig. 1). The Hazen unit value of a sample is determined either by visual comparisons against these standard solutions or by performing measurements with a colorimeter.

The prescribed method for measuring Hazen unit values with a colorimeter involves measuring the transmittance of the 24 platinum-cobalt color standard solutions, using these measurements to calculate XYZ tristimulus values, and preparing a calibration curve based on these values. Samples are then measured to calculate their tristimulus values, and the calibration curve is used to find the corresponding standard solution color and Hazen unit value.

LabSolutions UV-Vis Color is an optional software product for LabSolutions UV-Vis that includes a calibration curve created from platinum-cobalt color standard solutions that conform with ISO 6271:2015 and JIS K0071-1:2017. To evaluate a sample based on the Hazen scale, a user just has to analyze the sample, and LabSolutions UV-Vis Color will then calculate the corresponding Hazen unit value.

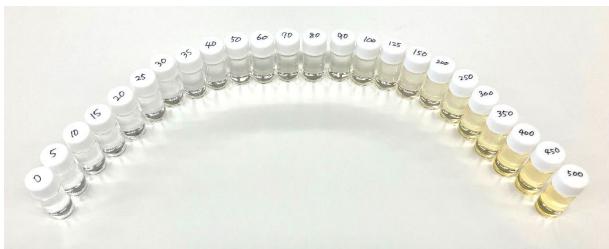


Fig. 1 Platinum-Cobalt Color Standard Solutions

■ Measuring the Transmission Spectra of Raw Materials for Chemical Products

In this analysis, glycerin and acetylacetone, liquids that are almost colorless and transparent and very difficult to distinguish by visual inspection, were measured (Fig. 2).



Fig. 2 Glycerin Sample (Left) and Acetylacetone Sample (Right)

Glycerin is used in many applications, including as a polymer and solvent, and its color is used as a parameter in quality controls. JIS K3351:2009 (Glycerines for industrial use)³⁾ stipulate the Hazen unit value of 20 or below as an appearance criterion for glycerin.

The molecular structure of acetylacetone includes double bonds, and it is known to polymerize when exposed to light. Because it turns increasingly yellow during polymerization, the degree of acetylacetone polymerization can be determined by its color. JIS K8027:2020 (Acetylacetone (Reagent))⁴⁾ stipulates the Hazen unit value of 100 or below for the appearance criterion for acetylacetone.

Based on the stipulations of ISO 6271:2015 and JIS K0071-1:2017, the transmittance of glycerin and acetylacetone was measured using pure water as a control and a cell with an optical path length of 50 mm. To perform measurements with a 50-mm optical path length cell, a long optical path cell holder was attached to the UV-1900i Plus UV-Vis spectrophotometer. The UV-1900i Plus system used to perform these measurements is shown in Fig. 3.



Fig. 3 UV-1900i Plus

Glycerin and acetylacetone were analyzed using the conditions shown in Table 1 and the resulting transmittance spectra are shown superimposed in Fig. 4. Since ISO 6271:2015 and JIS K0071-1:2017 stipulate using pure water as a control, a cell with pure water was used for baseline correction before the transmittance of the sample liquids was measured.

Table 1 Conditions for Transmission Spectra Measurement

Equipment:	UV-1900i Plus Long-path rectangular cell holder
Measured Wavelength Range:	380 to 780 nm
Sampling Interval:	1.0 nm
Scanning Speed:	Fast
Slit Width:	1 nm

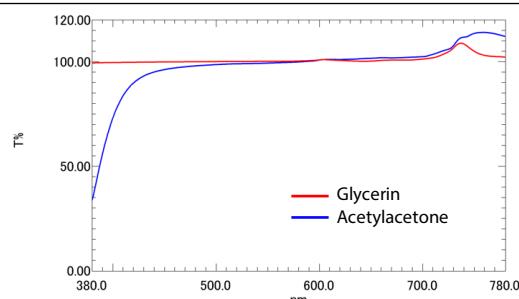


Fig. 4 Transmittance Spectra of Glycerin and Acetylacetone

