



Parameter and Sample Type

Color of Water and Wastewater by Platinum-Cobalt Method at 455 nm

Introduction

This method utilizes a spectrophotometer to measure the absorbance of light as it passes through a sample at 455nm wavelength. The method can be used for water, wastewater, and other light colored liquids, with light absorption characteristics nearly identical with those of the platinum-cobalt color standards used.^{1,2,3}

References

1. Standard Methods for the Examination of Water and Wastewater, Method 2120C. www.standardmethods.org.
2. Bennet, L. & M. Drikas. 1993. The evaluation of color in natural waters. *Water Res.* 27:1209.
3. Hongve, D. & G. Akesson. 1996. Spectrophotometric determination of water colour in Hazen units. *Water Res.* 30:2771.
4. Standard Methods for the Examination of Water and Wastewater, Method 2120B.
5. Orion AquaMate 7000 Vis and Orion AquaMate 8000 UV-Vis User Guide.

Recommended Equipment

Thermo Scientific Orion AQ8000 or AQ7000 spectrophotometer; Water filters, pore size 0.45-microns; Sample cell - 50 mm glass cell (Cole-Parmer Cat. No. R-83301-07), or 25 mm vial (Orion AC3V25), or 24 mm vial (AC2V24).

Required Solutions

Platinum-Cobalt (Pt-Co) color standard solution, 500 PCU (Fisher SP120-500 or prepared by user⁴); Pt-Co color verification standard(s), per SOP, or near the expected sample color; deionized water (DI).

Solutions Preparation

Prepare verification standard(s) by diluting an appropriate volume of the 500 PCU Pt-Co standard with DI water in 100 mL volumetric flask. For example, to prepare a 50 PCU color standard, dilute 10 mL of 500 PCU Pt-Co color standard with DI water in 100 mL volumetric flask.

Meter Setup

Turn on the spectrophotometer. Allow warm up per the User Guide. Choose a sample cell size (50, 25, or 24mm). For example, 24 or 25 mm cells are convenient and inexpensive, while a 50 mm cell may achieve a lower detection limit. Select the desired cell holder position by pressing the cell position key⁵. Access the USB memory stick using a computer. Depending on the sample cell size, copy the

desired preprogrammed method* from the Orion folder to the Thermo folder. Remove the USB memory stick from the computer and insert it into the USB port on the front of the AquaMate. Select the method and load it. Press Run Test to start the analysis.

Calibration Verification

1. Open the sample compartment and insert the sample cell containing DI water (the blank) into the sample holder with the orientation mark forward (for round vials). Close the lid and press the Measure Blank key.
2. Empty and fill the same cell** with the prepared color standard (e.g. 50 PCU), and insert it into the sample holder, with the orientation mark facing forward. Close the lid, and press the Measure Sample key. Record the displayed result.
3. The reading for the calibration verification standard should be within the desired criteria, per your QA plan.

Sample Storage and Preparation

Samples must be analyzed within 48 hours of collection and should be stored at ≤ 6 degrees Celsius. Refer to EPA 40 CFR Part 136.3 for details. Warm samples up to room temperature before measurement. Do not adjust the sample pH as long as it is between 4 and 10. If not, adjust to pH 7, and note. Turbid samples should be filtered through a 0.45-micron filter. If samples are filtered, prepare a method blank by filtering DI water. Analysis of filtered samples gives "true" color. If the sample is not filtered, the result is considered "apparent" color. Dilute samples with color above 500PCU.

Sample Cell Storage and Cleaning

In order to obtain reproducible results, clean and store sample cell(s) per instructions in the AquaMate User Guide.

Sample measurement

Clean the cell by rinsing three times with DI water. Fill the clean sample cell with about 10 mL of a sample or a method blank. Open the lid and insert the sample cell into the sample holder, orientation mark facing forward. Close the lid, and press the Measure Sample key. Record the displayed result. Before leaving the test screen save the results to the USB stick, if desired. If reading is >500 PCU, dilute and retest. Multiply the reading by the dilution factor.

Quality Control (QC)

Run a calibration verification, duplicate samples, and method blank (if filter samples) with each batch or per your QA plan.

* For 50mm cell - CLRPT50, for 25mm - CLRPT25, for 24 mm - CLPT24. To make your own method, use the Standard Curve application described in Section 20 of the AquaMate User Guide.

**For best accuracy, use the same sample cell for measuring the standard, the blank, and the samples.

Results of Color Testing by Platinum-Cobalt Method on the AQ7000 and AQ8000 Spectrophotometers

Bias: readings of color standards in various light path length cells on AQ8000 and AQ7000 demonstrate good accuracy:

- Lower level standards (0 to 50 PCU) gave readings within 3 PCU of expected values.
- Higher level standards (250PCU and 500PCU) gave readings within 5% of expected values.

Precision: surface water sample readings at various concentrations on the AQ8000 and AQ7000 demonstrate good precision.

- Filtered (true color) and unfiltered (apparent color) readings for a turbid sample, a stream sample, and a low color stream samples showed precision near or less than 2% relative standard deviation (RSD) or precision less than 2 PCU standard deviation (for low color sample). See precision chart below.

Sample cell path length and precision: readings of true color in different surface water samples (see chart below) indicate good agreement between various cells (50mm, 25mm, and 24mm) and both meters. Good readings are achieved in all cases.

- True color readings on two different meters and three different cell sizes all agree to within 2.9% RSD (CV) for turbid sample (655 PCU), 3.8% RSD for stream water (85 PCU), and 4.5% RSD for the low color water (14 PCU). Therefore, both meters and all three cell sizes give similar readings. See sample cell path length chart below.

