Colour, True, Single Wavelength - PBM

Parameter

Colour, True
Colour, True (pH 7)

Analytical Method

True Colour by Single Wavelength Spectrophotometer (450 – 465 nm)

Introduction

Colour in water results primarily from natural organic and humic matter. Humic acids selectively absorb UV blue and green wavelengths and, to a lesser degree the red and infrared region of the light spectrum. Colour also depends on factors that affect the solubility and stability of the dissolved and particulate fractions of water such as pH and temperature. Suspended particles such as colloids will also give waters an appearance of colour. Humic materials and the colour associated with them are removed from potable water supplies for both aesthetic and health reasons.

Method Summary

The platinum-cobalt method of measuring colour is given as the standard method, where the unit of colour being that produced by 1 mg/L platinum in the form of the chloroplatinate ion. True Colour is determined by filtering a sample through a 0.45 µm filter followed by comparison to platinum-cobalt standards. This comparison is determined from the light transmission characteristics of the filtered sample by means of a spectrophotometer in the region of 450 to 465 nm. This region is selected because the influence of turbidity following filtration is negligible at this wavelength.

Apparent Colour is determined without prior sample filtration (as per APHA 2120 A, only the Visual Comparison method should be used for Apparent Colour).

Colour in waters is pH dependent. Samples being tested for Colour should normally be tested concurrently for pH.

Because colour measurements are made for aesthetic reasons, pH adjustment is not normally recommended or necessary if the sample pH falls between 4 and 10. Even a small pH adjustment can change the solubility characteristic of substances and may interfere with colour measurements if particulate matter is formed. The default practice is for colour measurements to be conducted on samples as-received, without pH adjustment. If pH adjustment is required for a specific application, pH is adjusted to approximately pH 7, and colour is reported as such.

This method is performance-based. Laboratories may adopt alternative options to improve performance or efficiency provided that all stated performance requirements and prescribed (mandatory) elements are met.

MDL and EMS Codes

Analyte	Approx. MDL (units)	EMS Code
Colour, True	5 Colour Units	1052 1320
Colour, True (pH7)	5 Colour Units	n/a

Matrix

Freshwater, Seawater, Groundwater

Interferences and Precautions

Turbidity is the main interference for true colour measurement. For measurements of True Colour, turbidity must be removed by filtration with a 0.45 µm filter. The colour of water is extremely pH dependent, and generally increases at higher pH. Sample pH should normally also be tested when colour measurements are taken. For samples with extreme pH (outside pH 4 – 10), measurement of colour after adjustment to pH 7 may be more relevant (pH adjusted colour values must be reported as such).

Sample Handling and Preservation

Sample Containers: Glass or Plastic
Preservation: None

Stability

Holding Time: 3 days
Storage: Store at ≤ 6 °C

Procedure:

Prepare a Stock Platinum-cobalt standard (500 colour units):

Dissolve 0.249 g K_2PtCl_2 and 0.200 g $CoCl_2 \cdot 6H_2O$, along with 20 mL concentrated HCl in deionized water. Dilute to 200 mL in a volumetric flask. Pre-made certified reference materials are available for this test.

Prepare a set of calibration standards in the range of 0 to 500 CU. Use deionized water as the zero standard. Read absorbance for each standard within the wavelength of 450 to 465 nm. For spectrophotometers with fine wavelength adjustment, 456 nm is normally the preferred wavelength. Prepare a standard curve of CU versus absorbance. Matched spectrophotometer cells can be used where one cell is used to zero the instrument and the other to read samples.

For analysis of True Colour, filter samples through 0.45 µm filters. Read absorbance against the standard curve.

Dilute high colour samples to be within the standard curve.

If pH adjustment is required, adjust to approximately pH 7 (e.g. to within pH 6-8, using NaOH or H_2SO_4).

Refer to APHA method 2120 C. Color for further information and guidance.

Performance Requirements

Any analytical method options selected for this analysis must meet or exceed the performance requirements specified below.

Accuracy and Precision requirements apply to measures of long term method performance (averages and standard deviations). Achievement of these requirements is to be demonstrated during initial and ongoing method re-validation studies. They do not constitute acceptance criteria or Data Quality Objectives for individual Quality Control samples. For Initial Validations, averages of at least 8 Lab Control Samples or CRMs must be assessed (preferably taken from multiple analytical batches). Ongoing Re-validations (performance reviews) should assess QC data encompassing longer timeframes (e.g. 6 months to 1 year). A minimum frequency of 2 years is recommended for Ongoing Re-validations.

Accuracy Requirement: Laboratories must demonstrate method accuracy (measured as average recovery) of 100±10% or better for Lab Control Samples or certified reference materials at concentrations above ten times the MDL.

Precision Requirement: Laboratories must demonstrate method precision equal to or better than 10% relative standard deviation for Lab Control Samples at concentrations above ten times the MDL.

Sensitivity Requirement: Where possible, the method should generate Method Detection Limits that are less than 1/5 of applicable numerical standards. The method is not fit-for-purpose if an MDL exceeds a guideline, standard, or regulatory criteria against which it will be used for evaluation of compliance.

Quality Control

Summary of QC Requirements		
QC Component	**Minimum Frequency**	**Minimum Data Quality Objectives***
Method Blank	One per batch of 20	Less than reported DL
LCS or Reference Material	One per batch of 20	85 – 115%
Lab Duplicates	One per batch of 20	20% RPD
* Minimum DQOs apply at levels above 10x MDL. Report qualified data when DQOs are not met.		

Method Blank: Required. Minimum one per batch of up to 20 samples.

Lab Duplicates: Required. Replicate all components of the test from start to finish. Random duplicate selection, minimum 1 per batch of up to 20 samples.

Reference Material or Lab Control Sample: Required. For LCS, use a platinum-cobalt standard at a concentration above 10x MDL.

Prescribed Elements

The following components of this method are mandatory:

1. A UV/VIS spectrophotometer with wavelength of 450–465 nm, or an autoanalyzer with a filter within this range must be used.
2. True Colour must be measured on samples that have been filtered through a suitable 0.45 µm filter.
3. This method is not appropriate for measurements of Apparent Colour. Apparent Colour must be measured on unfiltered samples by the Visual Comparison method.
4. Any samples which are pH adjusted prior to measurement of colour must be clearly reported as such.
5. All QC and calibration criteria must be met. Over-range samples must be diluted (alternatively, minimum values may be reported if this meets end-use requirements).
6. Specified Performance Requirements are mandatory.

Apart from these limitations, and provided performance requirements are met, laboratories may introduce modifications to this method in order to improve quality or efficiency. Laboratories must disclose to their clients where modified or alternative methods are employed.

Refer also to the Visual Comparison method, which is another MOE approved technique for the measurement of True and Apparent Colour.

References

APHA Method 2120 C. Color (2011).

Revision History

Aug 15, 2014	Changed wavelength from 400 nm to 450-465 nm for consistency with APHA Method 2120 C. pH adjustment target changed to pH 7. Method changed to PBM format with prescribed elements and performance requirements. Effective date of this revision is Nov 1, 2014.
Dec 31, 2000	SEAM codes replaced by EMS codes. Out of print reference deleted.
1994	Publication in 1994 Laboratory Manual.