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Clear liquids — Estimation of colour by the platinum-cobalt scale —

Part 1: Visual method

Liquides clairs — Évaluation de la couleur au moyen de l'échelle platine-cobalt —

Partie 1: Méthode visuelle



Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 6271-1 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 10, *Test methods for binders for paints and varnishes*, in collaboration with ASTM D 01.34, *Naval Stores*. It has been harmonized with ASTM D 1209-97, *Standard Test Method for Color of Clear Liquids (Platinum-Cobalt Scale)*.

This first edition cancels and replaces ISO 6271:1997, which has been technically revised.

ISO 6271 consists of the following parts, under the general title *Clear liquids — Estimation of colour by the platinum-cobalt scale*:

- Part 1: Visual method
- Part 2: Spectrophotometric method

Introduction

ISO 2211, *Liquid chemical products — Measurement of colour in Hazen units (platinum-cobalt scale)*, is not suitable for use in the paint industry.

ISO 6271-1 differs from ISO 2211 in respect to:

- preparation of the stock solution for colour matching (in one way only);
- checking of the stock solution;
- use of tubes with greater viewing depth to obtain a more distinct difference between successive colour standards;
- the single test procedure given is more accurate.

The term “platinum-cobalt colour” used here is preferred over the terms “Hazen colour” and “APHA colour”.

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Clear liquids — Estimation of colour by the platinum-cobalt scale —

Part 1: Visual method

1 Scope

This part of ISO 6271 specifies a method for estimating the colour, in Pt-Co units, of clear liquids.

It is applicable to clear liquids having colour characteristics similar to those of the reference platinum-cobalt scale.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

Pt-Co scale

classification of the colour of a solution containing platinum, in the form of the hexachloroplatinate(IV) ion, and cobalt(II) chloride hexahydrate in specified concentrations

4 Principle

The colour of a sample of the product to be tested is compared with those of colour standards. The standard that most closely matches the colour of the sample is identified and the result is expressed in terms of Pt-Co units.

5 Reagents

During the test, use only reagents of recognized analytical grade and only water of at least grade 3 purity as defined in ISO 3696.

5.1 Potassium hexachloroplatinate(IV), K_2PtCl_6 .

5.2 Cobalt(II) chloride hexahydrate, $CoCl_2 \cdot 6H_2O$.

5.3 Hydrochloric acid, 38 % (by mass), $\rho = 1,19$ g/ml.

6 Apparatus

Ordinary laboratory apparatus and glassware, together with the following:

6.1 Colour comparison tubes, flat-bottomed, 100 ml capacity, fitted with optically clear ground-glass caps. The tubes shall be matched with respect to the colour and the thickness of the glass and shall have a graduation mark between 275 mm and 295 mm above the bottom. The tubes shall be selected so that the graduation mark heights match to within 3 mm.

6.2 Colour comparator, designed to permit visual comparison of light transmitted through the colour comparison tubes (6.1) along their longitudinal axis. The comparator shall be designed so that white light is passed through, or reflected off, a white glass plate and directed with equal intensity through the tubes, and shall be shielded so that no light enters the tubes from the sides.

6.3 Spectrometer, capable of measuring light transmittance at 430 nm, 455 nm, 480 nm and 510 nm with an accuracy of 0,005 transmittance or better.

6.4 Cells, of optical path length 10 mm, for use with the spectrometer (6.3).

7 Preparation of colour standards

7.1 Pt-Co stock solution, 500 Pt-Co units

Into a 400 ml beaker introduce 1,245 g of potassium hexachloroplatinate(IV) (5.1) and 1,000 g of cobalt(II) chloride hexahydrate (5.2). Add 100 ml of water and 100 ml of hydrochloric acid (5.3) and warm, if necessary, to obtain a clear solution. After cooling, transfer quantitatively to a 1 000 ml one-mark volumetric flask, dilute to the mark with water and mix well.

The stock solution prepared in this way shall have transmittances at 430 nm, 455 nm, 480 nm and 510 nm which lie within the limits specified in Table 1 when measured using the cells (6.4) in the spectrometer (6.3).

Table 1 — Transmittance (and absorbance) tolerance limits for 500 Pt-Co unit stock solution

Wavelength nm	Transmittance	Absorbance
430	0,759 to 0,776	0,110 to 0,120
455	0,716 to 0,741	0,130 to 0,145
480	0,759 to 0,785	0,105 to 0,120
510	0,861 to 0,881	0,055 to 0,065

7.2 Pt-Co standard matching solutions

Prepare a series of standard matching solutions covering the range required (see Table 2). Place the indicated volumes of stock solution (7.1) into a series of 100 ml colour comparison tubes (6.1), dilute to the mark with water and mix well. Cap the tubes, seal the caps with shellac or waterproof cement and mark the tubes with the corresponding Pt-Co number.

7.3 Storage

Store the stock solution (7.1) in a stoppered bottle in the dark. Under these conditions, this solution is stable for 1 year. The standard matching solutions (7.2) are stable for about 6 months when stored in the dark at room temperature. They must remain clear without any sediment but should preferably be prepared immediately before use.

Table 2 — Pt-Co standard matching solutions

Colour Pt-Co units	Volume of stock solution (7.1) ml
0	0
10	2
20	4
30	6
40	8
50	10
60	12
70	14
80	16
90	18
100	20
125	25
150	30
200	40
250	50
300	60
350	70
400	80
450	90
500	100

8 Sampling

Take a representative sample of the product to be tested, as described in ISO 15528.

9 Procedure

If the material shows any visual haziness, remove the haze by filtration, centrifugation, heating, ultrasonic treatment or any other suitable means (see Note).

If the haziness cannot be removed, the measured value will be unreliable and too high, and therefore unusable.

Pour into one of the colour comparison tubes (6.1) a quantity of the sample sufficient to fill it to the graduation mark. Avoid creating air bubbles when filling the tube. If air bubbles are formed and remain trapped, remove them by heating, vacuum, ultrasonic treatment or any other suitable means (see Note).

NOTE Some sample pretreatments can change the colour.

Cap the tube, place it in the comparator (6.2) and compare with the standard matching solutions (7.2) until the closest match is obtained.

Instruments are available that permit visual comparison of a liquid of a given depth of colour, with a moving tinted-glass disc corresponding to the different standard matching solutions. The use of such instruments, with their very stable standards, is permissible provided that the instrument gives correct values when checked against the colour standards prepared as described in Clause 7.

10 Expression of results

Express the colour of the sample as the colour, in Pt-Co units, of the standard matching solution (7.2) having the closest match to the sample. If the colour lies midway between two standard matching solutions, report the darker of the two.

If the colour characteristics of the sample differ from those of the standard matching solutions, so that a definite match cannot be obtained, report the range over which an apparent match is obtained and give a description of the observed colour, or report as "off hue".

11 Precision

11.1 General

The data given in 11.2 and 11.3 are applicable only to samples that match exactly the hue of the standards. Poorer precision will be obtained as the hue of the sample departs from that of the standards.

11.2 Repeatability limit (r)

The repeatability limit r is the value below which the absolute difference between two single test results, each the mean of duplicates, can be expected to lie when this method is used under repeatability conditions, i.e. when the test results are obtained on identical material by one operator in one laboratory within a short interval of time using the standardized test method. For this method, r is 5 %, with a 95 % probability.

11.3 Reproducibility limit (R)

The reproducibility limit R is the value below which the absolute difference between two single test results, each the mean of duplicates, can be expected to lie when this method is used under reproducibility conditions, i.e. when the test results are obtained on identical material by operators in different laboratories using the standardized test method. For this method, R is 15 %, with a 95 % probability.

12 Test report

The test report shall contain at least the following information:

- a) a reference to this part of ISO 6271 (ISO 6271-1);
- b) all details necessary to identify the product examined;
- c) whether any pretreatment was necessary;
- d) the result of the test as indicated in Clause 10;
- e) any deviation from the test method specified;
- f) the date of the test.

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