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Sensory analysis — Guidelines for sensory assessment of the colour of products

Analyse sensorielle — Lignes directrices pour l'évaluation sensorielle de la couleur des produits

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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 11037 was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 12, *Sensory analysis*.

This second edition cancels and replaces the first edition (ISO 11037:1999), which has been technically revised.

Introduction

For standardized colour comparison, it is necessary to have an assessor with normal colour vision and to have reproducible illumination and viewing conditions. It is usual to match colours to a standard in daylight, but the spectral composition of daylight varies considerably. Although it is difficult to control precisely the spectral distribution of artificial light sources, individual sources are more stable over a limited period than daylight and therefore enable more reproducible colour comparisons to be made.

Unless otherwise agreed, the methods specified in this International Standard use diffuse daylight or an artificial daylight source representative of a phase of daylight with a correlated colour temperature of 6 500 K (CIE standard illuminant D65) for routine comparisons. If there is a dispute, the comparison should always be made under the specified artificial light.

Standards produced by the Commission Internationale de l'Éclairage (CIE) and other documents (see the bibliography) are a primary source of internationally accepted and agreed data for light and lighting, for which international harmonization requires unique definitions. Note that, in documents relating only to visual judgements, the term “observer” is frequently used in place of “assessor”.

Sensory analysis — Guidelines for sensory assessment of the colour of products

1 Scope

This International Standard establishes guidelines for the sensory evaluation of the colours of products. The procedures specified are applicable to solid, semi-solid, powder and liquid products, which can be opaque, translucent, cloudy or transparent in nature, as well as matt or glossy.

General information is also given about the viewing and lighting conditions to be used in various situations in sensory analysis, such as difference testing, profile analysis and grading methods, performed by panels of selected assessors or by individual experts in special situations.

This International Standard does not deal with consumer testing or with assessment of the metamerism of colours of food products.

NOTE 1 Metameric matches are described in Annex A.

NOTE 2 Particular products can be subject to specific International Standards for their sensory analysis, e.g. ISO 3591[1], which specifies a wine-tasting glass.

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 5492, *Sensory analysis — Vocabulary*

ISO 6658, *Sensory analysis — Methodology — General guidance*

ISO 8586[1)], *Sensory analysis — General guidance for the selection, training and monitoring of selected and expert assessors*

ISO 8589, *Sensory analysis — General guidance for the design of test rooms*

IEC 60050-845|CIE 17:1987, *International electrotechnical vocabulary — Chapter 845: Lighting|International lighting vocabulary*

1) To be published. (Revision of ISO 8586-1:1993 and ISO 8586-2:2008)

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5492 and IEC 60050-845|CIE 17 and the following apply.

3.1
visual sensory assessor, noun
observer, noun
any person taking part in a sensory evaluation of product colour

NOTE Adapted from ISO 5492:2008, 1.5.

3.2
hue
attribute of a visual sensation according to which an area appears to be similar to one of the perceived colours, red, yellow, green and blue, or to a combination of two of them

[IEC 60050-845|CIE 17:1987, 02-35]

3.3
photopic vision
vision by the normal eye when it is adapted to levels of luminance of at least several candelas per square metre

NOTE The cones are the principal active photoreceptors in photopic vision.

[IEC 60050-845|CIE 17:1987, 02-09]

3.4
metameric colour stimuli
metamers
spectrally different colour stimuli that have the same tristimulus values

NOTE The corresponding property is called “metamerism”.

[IEC 60050-845|CIE 17:1987, 03-05]

3.5
colour rendering
effect of an illuminant on the colour appearance of objects by conscious or subconscious comparison with their colour appearance under a referent illuminant

[IEC 60050-845|CIE 17:1987, 02-59)]

3.6
colour rendering index
measure of the degree to which the psychophysical colour of an object illuminated by the test illuminant conforms to that of the same object illuminated by the reference illuminant, suitable allowance having been made for the state of chromatic adaptation

[IEC 60050-845|CIE 17:1987, 02-61]

3.7
colour matching
action of making a colour stimulus appear the same in colour as a given colour stimulus

[IEC 60050-845|CIE 17:1987, 03-16]

3.8
luminance threshold
lowest luminance of a stimulus which enables it to be perceived

NOTE The value depends on field size, surround, eye state of adaptation (pupil), and other viewing conditions.

[IEC 60050-845|CIE 17:1987, 02-45]

3.9
defective colour vision
anomaly of vision in which there is a reduced ability to discriminate between some or all colours

[IEC 60050-845|CIE 17:1987, 02-13]

3.10
viewing conditions
conditions under which a visual observation is made, including the angular subtense of the specimen at the eye, the geometric relationship of source, specimen, and eye, the photometric and spectral character of the source, the photometric and spectral character of the field of view surrounding the specimen, and the state of adaptation of the eye

[ASTM E284:2009[7]]

3.11
chromatic colour
perceived colour possessing hue

NOTE 1 In everyday speech, the word "colour" is often used in this sense to differentiate from white, grey or black.

NOTE 2 The adjective "coloured" usually refers to chromatic colours.

NOTE 3 Adapted from IEC 60050-845|CIE 17:1987, 02-27.

3.12
chromatic adaptation
change in visual hue after viewing coloured surfaces or lights

3.13
adaptation
process allowing the eye to function in a wide range of illuminance levels by modifying its sensitivity through changes in pupil aperture and photochemical changes in the retina

NOTE Adaptation to darkness takes longer than adaptation to brightness.

3.14
daylight illuminant
illuminant having the same or nearly the same relative spectral power distribution as a phase of daylight

[IEC 60050-845|CIE 17:1987, 03-11]

3.15
illuminance (at a point on a surface)
ratio of the luminous flux incident on an element of surface that contains the point and the area of that element

[IEC 60050-845|CIE 17:1987, 10-100]

4 Test conditions

4.1 General

General conditions established in ISO 6658 shall be taken into account.

Observations should be performed in a suitable place under strictly controlled conditions of lighting (type, level, direction), and of the surroundings of the viewing area and the geometric conditions (i.e. the relative positions of the light source, sample, and eye). The ideal viewing environment is a viewing box with self-contained illumination designed for colour matching (see Figure B.1). For less exacting colour assessment, or where the facilities available or the nature of the samples make that impracticable, viewing may take place in a booth or in an open space.

4.2 Test room

Ensure that the general guidance for the design of test rooms for sensory analysis given in ISO 8589 is complied with.

4.3 Working area

All surfaces in and around the working area should be achromatic to avoid colour contrast effects or colour adaptation by the assessor and to avoid influencing the chromatic characteristics of illumination reflected or diffused off it. For most surfaces, a light grey colour with a reflectance not lower than 0,5 is recommended.

The luminance should be moderate and even, with an optimum wall luminance of approximately 100 cd/m^2.

The luminance of the viewing area should be equal to or slightly higher than that of the surroundings.

The requirements are most important close to the viewing area and can be relaxed for the surroundings, especially if the samples are assessed in a viewing box with self-contained illumination.

The interior of a booth for general use should be painted a matt neutral grey with a luminance factor of about 15 % (e.g. Munsell reference N4 and N5). However, when mainly light colours and near-white colours are to be compared, the interior of the booth may be painted so as to have a luminance factor of 30 % or higher (e.g. Munsell reference N6) in order to give a lower brightness contrast with the colour to be examined.

4.4 Lighting

4.4.1 General

Samples that appear identical in colour under one illuminant may appear different under another.

It is recommended that the minimum CIE colour rendering index R_a of light for colour assessment in sensory laboratories be 90, compared to CIE standard illuminant D65.

For routine colour matching, artificial daylight may be used and exceptionally natural daylight may be used. Because the quality of natural daylight is variable and the assessors' judgements are likely to be affected by surrounding coloured objects, for referee purposes closely controlled artificial illumination in a colour-matching booth shall be used. The assessor shall wear clothing of a neutral colour, and no strongly coloured surfaces, other than the test samples, shall be permitted in the field of view.

4.4.2 Natural daylight illumination

Diffuse daylight, preferably from a partially cloudy north sky in the northern hemisphere and a partially cloudy south sky in the southern hemisphere, and not reflected from any strongly coloured object (e.g. a red brick wall or green tree), shall be used.

Direct sunlight shall be avoided.

4.4.3 Artificial daylight illumination

4.4.3.1 General. The artificial sources specified in 4.4.3.2 and 4.4.3.3 shall be used.

4.4.3.2 Source approximating the CIE standard illuminant D65 (representing average daylight including the ultraviolet region, with a correlated colour temperature of approximately 6 500 K).

NOTE 1 At the time of publication, no source is certified for CIE standard illuminant D65 but "artificial daylight" fluorescent tubes with a colour rendering index higher than 90 are widely used as an approximation to D65.

NOTE 2 The spectral distribution of CIE standard illuminant D65 approximates average natural daylight better than the CIE standard illuminant C.

Practical sources (daylight simulators for colorimetry) shall be used, whose quality of simulation of daylight have been assessed with the method described in CIE 51[16].

The quality of illumination shall conform to the more stringent requirements for category BC (CIELAB) or better.

These sources shall be manufactured to meet the appropriate specification and the manufacturer shall declare the average number of running hours during which the product conforms to the specification.

4.4.3.3 CIE standard source C (approximating standard illuminant C, representing partially cloudy sky daylight without ultraviolet component, with a correlated colour temperature of 6 770 K).

This is used only when specifically required, e.g. for colour matching of food samples with a colour atlas.

For further information see Annex C.

4.4.4 Other artificial sources

CIE standard source A is a gas-filled tungsten filament lamp representing Planckian radiation (black body or total radiator) at a correlated colour temperature of about 2 856 K.

It is used only when specifically required, e.g. in evaluating the metamerism of coloured materials (see Annex A).

4.5 Illuminance

The illuminance on the sample and on any colour standards used should be between 800 lx and 4 000 lx, a figure towards the upper end of the range being desirable only for dark colours. For comfortable viewing of most colours, illuminance between 1 000 lx and 1 500 lx is desirable.

Glare, either from the light source or other reflecting areas, should not interfere with the assessor's vision.

4.6 Geometric conditions for illumination and viewing

4.6.1 Opaque or translucent samples

Changes in illuminant, sample or assessor's eye position can influence the results obtained. For this reason, it is necessary for the geometry to be standardized.

To minimize direct reflection of light from the surface, it is necessary for the angle between the assessor's line of sight and the surface of the sample to differ from the angle at which light from the illuminant strikes the surface.