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Analizna kolorometrija - 3. del: Posebni indeksi (ISO/DIS 18314-3:2022)

Analytical colorimetry - Part 3: Special indices (ISO/DIS 18314-3:2022)

Analytische Farbmessung - Teil 3: Spezielle Indices (ISO/DIS 18314-3:2022)

Analyse colorimétrique - Partie 3: Indices spéciaux (ISO/DIS 18314-3:2022)

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Part 3:
Special indices

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC *256, Pigments, dyestuffs and extenders*.

This second edition cancels and replaces the first edition (ISO 18314:2015), which has been technically revised.

The main changes compared to the previous edition are as follows:

— former subclause 5.4, Relative black value, M_{yr} and former subclause 6.4, Relative grey value, G_{yr} have been deleted;

— former Clause 2, Symbols and abbreviated terms, has been updated and renumbered as Clause 4;

— Clause 2, Normative references, has been added;

— Clause 3, Terms and definitions, has been added;

— the text has been editorially revised and the normative references have been updated.

A list of all parts in the ISO 18314 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Analytical colorimetry —

Part 3:
Special indices

1 Scope

This document specifies different methods of calculating special indices, which are generally used to describe lightness respectively jetness of samples including chroma or hue within one colour-coordinate.

This document is applicable to tristimulus values and chromaticity coordinates calculated using colour-matching functions of the CIE 1964 standard colourimetric system. It is used for the specification of colour stimuli perceived as belonging to a reflecting or transmitting object where a one-dimensional value is required.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 18451-1, *Pigments, dyestuffs and extenders — Terminology — Part 1: General terms*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 18451-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Symbols and abbreviated terms

a, b	absolute parameters
FI	flop-index
G_C	hue dependent greyness value
G_Y	hue independent greyness value
$L^*(\varepsilon)$	CIELab-76 lightness value at the aspecular angle ε
M_C	hue dependent blackness value
M_Y	hue independent blackness value
W_{CIE}	is the CIE whiteness index

X, Y, Z	tristimulus values of a test stimulus
X_n, Y_n, Z_n	tristimulus values of a specific white colour stimulus
x, y	chromaticity coordinates of a test stimulus
x_n, y_n	chromaticity coordinates of a specific white colour stimulus
YI	yellowness index

5 Whiteness index

5.1 CIE whiteness index

$$W_{CIE} = Y + 800 \cdot (x_n - x) + 1\ 700 \cdot (y_n - y) \quad (1)$$

This formula is valid within the range of $40 < W_{CIE} < 5Y - 280$.

NOTE This formula follows CIE 015:2018 and ASTM E 313–20.

6 Yellowness index

$$YI = 100 \cdot \frac{a \cdot X - b \cdot Z}{Y} \quad (2)$$

The absolute parameters a and b depend on standard illuminant D65 and the standard observer 2° and 10°. See Table 1.

Table 1 — Parameters a and b for standard observer 2° and 10°

Standard observer	a	b
2°	1,298 5	1,133 5
10°	1,301 3	1,149 8

NOTE This equation follows ASTM E 313–20 and DIN 6167.

7 Blackness values

7.1 Hue independent blackness value, M_Y

$$M_Y = 100 \cdot \log \frac{Y_n}{Y} \quad (3)$$

NOTE This equation follows DIN 55979.

7.2 Hue dependent blackness value, M_C

$$M_C = 100 \cdot \left(\log \frac{X_n}{X} - \log \frac{Z_n}{Z} + \log \frac{Y_n}{Y} \right) \quad (4)$$

NOTE Hue dependent blackness value, M_C, describes higher jetness if there is a blue shade and lower jetness if the shade is brown.

7.3 Absolute contribution of hue, dM

$$dM = M_C - M_Y \tag{5}$$

NOTE dM describes the amount of blue shade in case of positive values and the amount of brown shade in case of negative values.

8 Greyness values

8.1 General

According to definition greyness values describe the admixtures of white and black pigments. They can be hue independent (G_Y) or hue dependent (G_C).

8.2 Hue independent greyness value, G_Y

$$G_Y = 100 \cdot \log \frac{Y_n}{Y} \tag{7}$$

8.3 Hue dependent greyness value, G_C

$$G_C = 100 \cdot \left(\log \frac{X_n}{X} - \log \frac{Z_n}{Z} + \log \frac{Y_n}{Y} \right) \tag{8}$$

8.4 Absolute contribution of hue, dG

$$dG = G_C - G_Y \tag{9}$$

NOTE dG describes the amount of blue shade in case of positive values and the amount of brown shade in case of negative values.

9 Flop-index

The flop-index (FI) is a special measure to characterize the angular variation of lightness of almost neutral metallic colour shades. Its formal definition is

$$FI = 2{,}69 \frac{[L^*(\varepsilon_1) - L^*(\varepsilon_3)]^{1{,}11}}{[L^*(\varepsilon_2)]^{0{,}86}} \tag{11}$$

The parameters (exponents, pre-factor) have been chosen in a way so that for conventional metallic pigments the order of magnitude is $FI \approx 10$. $L^*(\varepsilon)$ denotes the CIELab-76 lightness value at the aspecular angle ε with ε_1=15°, ε_2=45°, ε_3=110°.

NOTE This formula has been developed by D. H. Alman[1].

Annex A
(informative)

Considerations regarding black values

The impression of hue or colour intensity is a subjective sensory perception. Consequently, differentiation between jet-black paints is not totally without problems. A visual assessment is always significantly influenced by the ambient conditions and by the physical and mental state of the observer. For reliable determination, measurement equipment is required which provides reproducible results for the measurement range with minimum reflections.

Metrological assessment of the jetness is preferably performed using a spectral photometer with 45°:0° (or 0°:45°) geometry. Here the specimen is placed at an angle of 45° and generally subjected to circular illumination. The light reflected by the specimen is measured at an angle of 0°. The spectrophotometer might be selected in testing of calibration repeatability. The difference of standard value Y has to be lower than ±0,003 in the jetness area of Y = 0,04 until Y = 0,05.

The visual evaluation is influenced to a great extent by the ambient conditions and by the physical and mental state of the observer. It is consequently necessary to define and observe certain boundary conditions. As natural daylight is subject to continuous fluctuations, a standardised artificial light source has to be used that produces a light similar to that of daylight type D65 by filtering.

The observation angle has to correspond to the 45°:0° (or 0°:45°) geometry of the measuring instrument. As the light falls perpendicularly onto the paint coating, the observer views the specimen at an angle of 45°. The area around the specimens should be kept neutral. Reflections of other objects have to be avoided. Matt black specimen mountings and backgrounds and complete darkening of the examination room are of benefit for the evaluation of deep black specimens.