



Colour Scales

Introduction- Colour Scales

Grading techniques are widely used to assess product colour by comparison with a representative series of fixed colour standards. For many product types, a characteristic set of standards was agreed and adopted to aid colour control and the communication of colour specifications; the result is a selection of traditional colour grading scales that have been adopted as industry standards and are still in common use today.

Please checkout our [website](#) and Colour Communication Guide for additional details.

Acid Wash Colour (ASTM D848)

Colorimetric test used for quality control of industrial aromatic hydrocarbons such as benzene, toluene, xylenes and refined solvent naphthas.

Instrument: [PFXi-195](#)

Instrument: [Comparator System 2000](#)

ADMI Colour (American Standard Methods 2120 E)

Developed by the American Dye Manufacturers Institute, the ADMI scale uses a spectral or a tristimulus method to calculate a single colour value that is independent of hue. It is typically used for tinted effluents with colour characteristics that are significantly different from the widely used Pt-Co/Hazen/APHA/Hazen Units.

Instrument: [PFXi-195](#)

AOCS-Tintometer® Colour (AOCS Cc 13b, the Wesson Method; AOCS Cc 13j)

Modified red and yellow version of the Lovibond® RYBN Colour scale used for fats, oils and derivatives; it uses the AOCS-Tintometer® Red scale, which is not the same as the Lovibond® standard Red scale.

Instrument: [PFXi-995](#), [PFXi-950](#) & [PFXi-880](#)

Instrument: [AF710-3](#)

ASBC Colour

American standard for colour grading of beers; related to EBC Colour by the equation $ASBC = 0.375 \text{ EBC Colour} + 0.46$.

Instrument: [PFXi-195](#)



ASTM Color (ASTM D 1500, ASTM D 6045, ISO 2049, IP196)

For petroleum products defined by 16 glass standards of specified luminous transmittance and chromaticity, graduated in steps of 0.5 from 0.5 for the lightest colour to 8.0 for the darkest. Used for products such as lubricating oils, heating oils, diesel fuel oils and petroleum waxes.

Instrument: [PFXi-995, PFXi-950 & PFXi-880](#)

Instrument: [PFXi-195](#)

Instrument: [Petroleum Oils Comparator, AF650](#)

Instrument: [Comparator System 2000 \(limited range\)](#)

Barrett Scale

Ranges from colourless to brown for grading of resins, shellacs and tar products. Based on a series of solutions made from varying proportions of cobalt chloride, ferric chloride and potassium chromate in hydrochloric acid solution.

Instrument: [Comparator System 2000](#)

beta Carotene (BS 684 Section 2.20)

Direct measurement of beta carotene content of oils in ppm.

Instrument: [PFXi-995, PFXi-950 & PFXi-880](#)

Chinese Pharmacopoeia (CP) Colour

Chinese scale for grading pharmaceutical solutions, divided into five colour series: Yellowish green (YG1 - YG10); Yellow (Y1 - Y10); Orange Yellow (OY1 - OY10); Orange Red (OR1 - OR10); Brownish Red (BR1 - BR10).

Instrument: [PFXi-195](#)

Chlorophyll A & B (AOCS Cc 13d)

Direct measurement of chlorophyll A & B content of oils in ppm.

Instrument: [PFXi-995, PFXi-950 & PFXi-880](#)

Dichromate Colour Index (DGF C-IV 4d discontinued)

Oils and fats where colours are similar to potassium dichromate solutions.

Instrument: [Comparator System 2000](#)

Dyed Aviation Gasoline (ASTM D 2392)

Used to determine the colour acceptability of aviation gasoline that has been dyed for easy identification of grade. Lovibond® glass filters are available for minimum and maximum limits of red, blue, green, brown and purple dyes.

Instrument: [Comparator System 2000](#)



EBC Colour (Analytica)

Developed by the Institute of Brewing and the European Brewery Convention, this colour scale ranges from 2 - 27 units, with yellowish paler colour at the low end and reddish brown liquids at the upper end of the scale. Used for beers, malt worts, caramels and similarly coloured liquids such as vinegar. If the sample falls outside this range (eg concentrates, syrups) then sample dilution and, in the case of visual EBC, a different path length cell, can be used to bring the reading within the EBC range.

Instrument: [PFXi-195](#)

Instrument: [EBC Comparator 3000](#)

Instrument: [Comparator System 2000](#)

European Pharmacopoeia (EP) Colour

European scale for grading pharmaceutical solutions, divided into five colour series: Red (R1 - R7); Yellow (Y1 - Y7); Brown (B1 - B9); Brown/Yellow (BY1 - BY7); Green/Yellow (GY1 - GY7).

Instrument: [PFXi-995](#), [PFXi-950](#) & [PFXi-880](#)

Instrument: [PFXi-195](#)

Instrument: [Comparator System 2000](#)

FAC Colour (AOCS Cc 13a)

Approved by the Fats Analysis Committee of the American Oil Chemists Society for grading dark coloured oils, fats and tallows. It includes 26 colour standards divided into 5 groups: Scale 1 (1, 3, 5, 7, 9) for lighter coloured fats; Scale 2 (11, 11a, 11b, 11c) predominantly for yellow fats; Scale 3 (13, 15, 17, 19) for dark fats (red cast); Scale 4 (21, 23, 25, 27, 29) for very dark fats, predominantly green; Scale 5 (31, 33, 35, 37, 39, 41, 43, 45) for very dark fats, predominantly red.

Instrument: [PFXi-995](#), [PFXi-950](#) & [PFXi-880](#)

Instrument: [PFXi-195](#)

Instrument: [FAC Comparator 3000](#)

Gardner Colour (ASTM D 1544, ASTM D 6166, AOCS Td 1a, MS 817 Part 10)

Colours range from light yellow to red defined by the chromaticities of glass standards numbered from 1 for the lightest to 18 for the darkest. Used for chemicals and oils including resins, varnishes, lacquers, drying oils, fatty acids, lecithins, sunflower oil and linseed oil. The current Gardner scale was specified in 1963; Lovibond® glass filters are also available for earlier 1953 and 1933 versions.

Instrument: [PFXi-995](#), [PFXi-950](#) & [PFXi-880](#)

Instrument: [PFXi-195](#)

Instrument: [Gardner Comparator 3000](#)

Instrument: [Comparator System 2000](#)



Haemoglobin Content of Blood (Harrison's Method)

Estimation of blood haemoglobin levels by comparing undiluted blood with precalibrated colour standards.

Instrument: [Comparator System 2000](#)

Hess-Ives Colour Units (DGK F050.2)

Based on spectrophotometric measurement of clear liquids using red, green and blue/violet regions of the spectrum. The three percentage transmittances are corrected to a single figure termed Hess-Ives colour units. It is used for products such as chemicals and surfactant liquids.

Instrument: [PFXi-995, PFXi-950 & PFXi-880](#)

Instrument: [PFXi-195](#)

Honey Colour (Pfund Equivalent)

For grading commercial honeys, ranging from pale yellow through amber to deep red and based on Pfund values in millimetres. The US Department of Agriculture (USDA) has established its own descriptive colour classification for extracted honey, which is based on Pfund values.

Instrument: [Comparator System 2000](#)

ICUMSA Colour Index (ICUMSA GS1-7, ICUMSA GS2/3-9)

Photometric methods for colour grading of filtered sugar solutions based on the transmittance of the solution at a known concentration (Brix value) and at the specified wavelength of 420 nm for white sugars and other light coloured products or 560 nm for darker coloured products.

Instrument: [PFXi-880/S](#)

Instrument: [PFXi-195](#)

International Fruit Juice Union (IFU) Colour

Developed in Europe for fruit juices and concentrates with a yellow/amber colour such as apple, pear and white grape. Colour values range from 1 to 25.

Instrument: [Comparator System 2000](#)



Iodine Colour (DIN 6162)

The colour ranges from yellow to brown defined by specified dilutions of an iodine solution, ranging from 1 for the lightest colour to 500 for the darkest. Used mainly in European countries for solvents, plasticisers, resins, oils and fatty acids. For colours registering 1 or less on the Iodine scale, the Platinum-Cobalt Units are applicable.

Instrument: [PFXi-195](#)

Instrument: [Comparator System 2000](#)

IP Units (IP 17Method B)

Used for determining the colour of petroleum products with a restricted range of 14 compound glasses ranging from Water White (0.25) to Standard White (4.0) known as IP standard colour glasses.

Instrument: [PFXi-995](#), [PFXi-950](#) & [PFXi-880](#)

Klett Colour (blue filter KS-42) (AOCS Dd 5)

Colour of LAS as used in detergents and surfactants.

Instrument: [PFXi-995](#), [PFXi-950](#) & [PFXi-880](#)

Instrument: [PFXi-195](#)

Kreis Value

A colorimetric test that uses the colour produced by the action of chemical reagents as a quantitative assessment of oxidative rancidity of fats and oils.

The test has been devised so that the colour intensity of the treated sample is reduced to 5 Lovibond® Red units or less, either by reducing the path length of the sample cell or by dilution. Kreis values which indicate the level of rancidity are obtained using a simple equation based on Lovibond® Red units, the path length of cell in cm and the concentration of the oil. The results are reported to be reproducible to 5 - 10%. Using this test, deterioration due to oxidation may be detected at a very early stage; fresh fats and oils that have not been kept under oxygen-free conditions give a positive reaction.

Instrument: [PFXi-995](#)

Instrument: [Model F](#)

Lovibond® RYBN Colour (AOCS Cc 13e, AOCS Cc 13j, ISO 15305, MS 252: Part 16, IP17 Method A)

Based on 84 calibrated glass colour standards of different densities of magenta (red), yellow, and blue, graduating from desaturated to fully saturated. Sample colours are matched by a suitable combination of the three primary colours together with neutral filters, resulting in a set of Lovibond® RYBN units that define the colour. Since several million combinations are possible, it is possible to match the colour of almost any sample; it



is particularly popular for measuring the colour of oils and fats, chemicals, pharmaceuticals and syrups.

Instrument: [PFXi-995, PFXi-950 & PFXi-880](#)

Instrument: [Model F](#)

Maple Syrup

Descriptive scale for maple syrups available as two versions, one approved by the US Department of Agriculture (USDA) and the other approved by the Vermont Department of Agriculture.

Instrument: [Comparator System 2000](#)

Paint Research Station (PRS) Colour

An arbitrary scale originally developed for varnishes but also used for grading shellacs.

Instrument: [Comparator System 2000](#)

Platinum-Cobalt/Hazen/APHA Colour (ASTM D 1209)

For clear, light yellow liquids, defined by specified dilutions of a platinum-cobalt stock solution, ranging from 0 at the light end of the scale to 500 at the darkest. Used extensively in the water industry but also for clear oils, chemicals and petrochemicals such as glycerine, plasticisers, solvents, carbon tetrachloride, and petroleum spirits.

Instrument: [PFXi-995, PFXi-950 & PFXi-880](#)

Instrument: [PFXi-195](#)

Instrument: [Comparator System 2000](#)

Rosin - French (Bordeaux) Colour

Little used scale for grading rosins, comprising 10 standards - super crystal, crystal, 7A, 6A, 5A, 4A, 3A, 2A, Y, X - for direct comparison with rosin samples.

Instrument: [Rosin Comparator 3000 \(Bordeaux\)](#)

Rosin – Indian

Little used scale for grading rosins

Instrument: [Rosin Comparator 3000 \(Indian\)](#)



Rosin - US Naval Stores (ASTM D 509)

The most widely used method for assessing the colour quality of rosins. The basic scale includes 15 colour standards varying in colour from yellow to reddish orange, each assigned letters - XC (lightest), XB, XA, X, WW, WG, N, M, K, I, H, G, F, E, D (darkest). FF is a special additional grade used for dark wood resins. The official colour standards are in the form of coloured glasses mounted in cubes for direct comparison with rosin samples.

Instrument: [PFXi-195](#)

Instrument: [Rosin Comparator 3000 \(US Naval Stores\)](#)

Rubber Latex Film Colour (ASTM D 3157, ISO 4660, MS 1359: Part 5, BS1672)

Ranges from 1 to 16 arbitrary steps for grading of rubber latex films.

Instrument: [Comparator System 2000](#)

Saybolt Colour (ASTM D 156, ASTM 6045)

Saybolt Colour is used for grading light coloured petroleum products including aviation fuels, kerosine, naphthas, white mineral oils, hydrocarbon solvents and petroleum waxes. The scale ranges from -16 (darkest) to +30 (lightest) where the number is derived by finding the height of a column of the sample, which visually matches the appropriate one of three glass standards.

Instrument: [PFXi-995, PFXi-950 & PFXi-880](#)

Instrument: [PFXi-195](#)

Series 52 (Brown) Scale

The standard version of this scale includes a series of 23 amber/brown glasses although other values are also available. Also known as ° Lovibond® in the US, the Series 52 Scale was originally designed for the brewing and distilling industries. EBC Colour has largely superseded it for the grading of beers in Europe but it is still used for beers in the US and for whiskies. It is also suitable for sugars solutions and syrups.

Instrument: [PFXi-195](#)

Instrument: [Comparator System 2000](#)

Tanning

International Society of Leather Technologists and Chemists' Official Method SLC119

Colour measurement of tanning extracts.

Instrument: [Tanning Colorimeter](#)



US Pharmacopoeia (USP) Colour

US scale for grading pharmaceutical solutions ranging from A to T.

Instrument: [PFXi-995, PFXi-950 & PFXi-880](#)

Instrument: [PFXi-195](#)

Instrument: [Comparator System 2000](#)

Yellowness Index (ASTM E 313)

Primarily for the determination of the degree of yellowness under daylight illumination. Calculated from X Y Z tristimulus values.

Instrument: [PFXi-195](#)

Introduction- Colour Spaces and Spectral Data

When a standard Colour Scale is not available or unsuitable for a specific application the use of Colour Spaces is recommended. These are a more flexible means of specifying standards and describing colour differences. For details of suitable instrumentation please contact The Tintometer Ltd (www.lovibondcolour.com)

X Y Z tristimulus values (x y Y chromaticity co-ordinates)

The coordinates x, y, and z are derived from XYZ values by the following calculation such that $x+y+z = 1$

$$x = X/(X + Y + Z) \quad y = Y/(X + Y + Z) \quad z = Z/(X + Y + Z)$$

The values of x and y can then be used to pinpoint a colour in the x y coordinate system.

The x and y chromaticity coordinates are generally reported along with the value of luminance factor Y.

CIE L*a*b* colour space

The a* axis runs from green to red, the b* axis runs from yellow to blue and L* (lightness) runs from black to white. As the L*a*b* Diagram is a three dimensional diagram, the colour difference between two points can be obtained in all directions.

L*C*h colour space

The coordinates L*, C* (chroma) and h (hue angle) are derived from the following calculation:

$$L^* = L^*$$

$$C^* = \sqrt{a^{*2} + b^{*2}}$$

$h = \arctan(b^*/a^*)$ where h is the angle measured from the positive a* axis in the anti-clockwise direction.



CIE u'v'Y colour space

The u' v' chromaticity co-ordinates were derived to aid the prediction of the magnitude of the perceived colour difference between two objects that are found to mismatch in colour. These modify the x and y chromaticity co-ordinates so that the colour difference anywhere in the diagram will have the same appearance of difference.

Delta E colour difference

This colour difference is expressed as DE where a value of 1.0 approximates to a just perceptible colour difference.

Transmittance

The ratio of transmitted flux to incident flux under specified conditions.

Absorbance

The ratio of absorbed radiant flux to the incident flux.

Optical density

Logarithm to the base 10 of the reciprocal of the transmittance.