

ICUMSA SUGAR COLOR



The ICUMSA color scale is used to measure the grade and quality of the sugar. The color of sugar directly relates to the degree of refining that is applied to it – raw sugars being dark brown in color while highly refined sugars are white. As a general guide:

- ICUMSA 45 - White Refined Sugar (also called "London White")
- ICUMSA 100 - 150 – Crystal Sugar
- ICUMSA 600 - - Raw Sugar

It should be noted that there are regional variations in the way ICUMSA color is applied to various sugar grades, but the methods of measurement are generally the same.

The International Commission for Uniform Methods of Sugar Analysis (ICUMSA) describe several methods for the colorimetric determination of filtered sugar solution at a known concentration (the sugar solution's Brix value). Note, however, that it really is not the "whiteness" of the solution that is being measured—it is actually the solution's yellowness. The larger the ICUMSA color score for a sugar solution, the more yellow the color. Even in highly-refined white glucose sugars, there are trace amounts of yellowness due to residual trace amounts of molasses from the refining process or from the aging of glucose into diglycerides.

Sugar color is also expressed in RBU (Reference Base Units) but this unit requires a reference point for comparative purposes and this reference point can vary from company to company.

TRADITIONAL METHODS

Color is traditionally measured offline in a QC laboratory at the sugar refinery. Samples are taken from the plant and the color is determined by experimental method. Methods GS 1/3-7, GS 2/3-10 and GS 2/3-10, published by ICUMSA, describe the test and measurement process. A sugar sample is dissolved in water to create a 50 Brix solution and its optical absorbance measured in a spectrophotometer at 420nm. The ICUMSA Sugar Color Score of the sugar sample is then calculated using the following equation:

$$\text{ICUMSA 420 Sugar Score} = (\text{Absorbance}_{420\text{nm}} * 1000) / \text{cb}$$

where:

- c* = concentration of sugar solution in g/mL (50 Brix)
- b* = cell path length expressed in cm.

ICUMSA recommends that optical cells with 1, 2 or 5 cm optical path lengths are used, the path length being selected using the following recommendations:

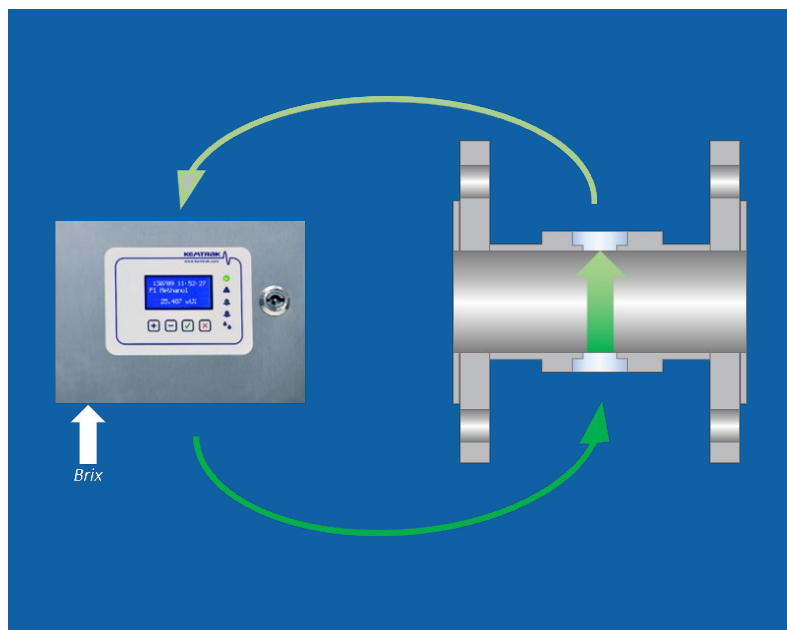
ICUMSA Color Score Range	Optical Path Length (cm)
100-200	5
200-500	2
500-13,000	1

The problem with measuring the sugar score offline is that the results may not be known for several hours or more after the sample has been taken. Should the results show that the sugar does not meet required color specification, it is often too late to do anything about it. This leads to inferior product and can be costly. Ideally, the ICUMSA color score should be measured directly on line in the sugar solution in real time and made available to plant operations before crystallization. Online measurement of ICUMSA color can be used to control the sugar refining process and provide valuable quality control information to plant operators. It has always been difficult to reliably measure ICUMSA color online because:

1. the method is dependent upon the sugar concentration being 50 Brix (50% sugar solids in water)
2. the method relies upon a filtered sample without particulate

Neither of these conditions can be guaranteed to be present within the process.

Earlier optical instruments were used to trend sugar color but still relied upon laboratory testing to establish the baseline sugar score. Any movement in the trend indicated an increase or decrease in color. Another issue commonly



found with traditional optical instruments is window fouling. Any build up on the optical window surfaces has the effect of increasing the color indication of the sugar solution.

This could require continuous manual adjustment to counteract and therefore often did not really help in the operation of the process plant. Inline filtering is used to remove particulates and other contaminants from the sugar solution. However, particulates also absorb light and in traditional instruments, inefficient referencing could cause a false positive color reading in the event of filtration failure.

THE KEMTRAK SOLUTION

The Kemtrak DCP007 inline colorimeter is the ideal solution for the real-time measurement of ICUMSA color because it can:

- correct sugar concentration to 50 Brix
- nullify the effects of particulate and other contaminants in the sample stream

The crucial functions above allow the DCP007 colorimeter to provide an actual ICUMSA color score in real time that will match offline sample measurements. The advantages to sugar processing operations are immense, as any change in color of the feed solution can be seen immediately and swift action taken to correct it, ensuring product quality and value is protected and improved.

To correct for sugar solution concentration, the Kemtrak DCP007 unit has the facility for input of the actual flowing sugar concentration. This can be done in several ways:

1. from a refractometer (or other densimeter)
2. from the control system as an analog signal or through Modbus
3. via manual concentration entry through the instrument keypad (where online measurement is not available).

Knowing the actual sugar solution concentration in real time means the correct color score at 50 Brix can be calculated. The baseline measurement system of the Kemtrak DCP007 is absorbance. This measurement can be correlated to any units, so the instrument can be configured to work in units such as IU or RBU with ease.

The Kemtrak unit has a built-in advanced light reference system that not only monitors and corrects for particulate in the stream, but also for optical window fouling, a common problem with optical instruments. In correcting for these effects, the sugar color reported is just that, the sugar color as if it were a filtered sample in the lab.

The Kemtrak DCP007 is fiber-optic based and has no electrical or electronic components on the measurement cell. Advanced light control techniques are employed to ensure the same amount of light is always transmitted through the sample and a robust referencing method removes effects from contaminants/particulates in the sample to prevent false positive readings. Light sources have long life (>10 years) and with inherent drift free measurement, the DCP007 requires little or no maintenance to provide reliable, trouble-free operation for many years.



KEMTRAK COLORIMETERS PROVIDE:

- Drift Free Measurement
- Low Noise
- Automatic Brix Correction
- Accurate Color Reporting
- Low Maintenance

GET IN TOUCH

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