

Color measurement for quality and consistency control in dairy products using Sensegood spectrophotometer



Photo: Dairy product range. Sensegood spectrophotometer assists in maintaining color quality attributes and appearance consistency in all production batches across wide spread plants.

Dairy products mainly include:

- Milk, probiotic milk, flavored milk, butter milk, lassi
- Milk powder, infant formula powder, butter milk powder, custard
- Curd, yogurt, yogurt drink
- Cheese, paneer, butter, ghee, cream, mava/khoa
- Shrikhand, basundi, rabdi, faluda
- Peda, burfi, and other milk sweets
- Ice cream
- Whey, casein
- Non-dairy alternatives in same category: Soy milk, coconut milk, almond milk, rice milk, nut butters

Importance of color measurement in dairy products:


If product's color is not right, especially in dairy items; customer will not buy it. Color is an indication of quality and freshness. One judges a product by its color. Certain dairy items quickly fade their color on the shelf. Dull color is associated with staleness or exposed to contamination or oxidized product. Environmental stability and dispersion of food dyes are the factors that affect the color non-uniformity and variation. Color is the most important parameter that needs to be addressed as study reveals that the color can influence the perceived flavor. [1][2]

Dairy food consumers have flavor and color expectations. Strawberry milk should be a bright red hue while blueberry yogurt needs to be deep blue. Food colors perform many functions. They help to correct for color loss due to exposure to light, air, temperature extremes, and storage conditions. They also assist with correcting natural variations in color and may enhance colors that occur naturally in foods. Color is one of the first characteristics perceived by the senses and is used by consumers for the evaluation of the quality of food products. [3]

Instrumental color measurement:

Maintaining the authenticity of true color representation is the first preference for any manufacturer. In the process of visual color match; there are factors like eye fatigue, aging of the eye, stress, individual's different expressive perception toward color, and light source that affect the color match decision. Hence, it becomes difficult to make decision of accepting, reprocessing or rejecting the sample based on visual match. And this directly hampers the quality of the final product. While on other hand there are advantages of instrumental color quality control as it provides results with same accuracy, consistency and reliability.

SENSEGOOD SPECTROPHOTOMETER - UNIVERSAL (REFLECTANCE)



- ✓ Benchtop/ Tabletop: (a) (b) (Rotating sample platform)
- ✓ Handheld/ Portable: (c) (d)
- ✓ Online/ In-process: (e)
- ✓ Solid: (a) (c) (d) (e)
- ✓ Liquid: (b) (e)
- ✓ Paste: (b) (e)
- ✓ Powder: (a) (b) (e)
- ✓ Contact measurement: (c) (d)
- ✓ Non-contact measurement: (a) (b) (e) (Adjustable height)
- Works with:
 - ✓ 5V adapter (cell phone charger)
 - ✓ Power bank
 - ✓ Computer/ Laptop (f)
- ✓ Averaging
- ✓ Auto repeat measurement mode
- ✓ Color match percentage
- ✓ Color indices (whiteness, yellowness, ...)
- ✓ *SensegoodSmart*
– computer interface software utility

Sensegood spectrophotometer for color quality and consistency control in dairy products:

Understanding of how certain variables, such as production, processing and storage, impact the flavor and color of milk products is of great interest to dairy scientists. For this reason instrumental methods have been developed for the measurement of the color properties of milk products. Color measurement is usually made using mature technologies based on colorimeters or spectrophotometers; as cited by K. Cadwallader, Professor, Food Science and Human Nutrition, University of Illinois. [4]

Sensegood spectrophotometer is an analytical color measurement instrument that is widely accepted in the industry and research fraternity. From raw material to final product, it comprehensively evaluates the color attributes of various samples, including solids, liquids, powders and pastes. Large viewing area (sensor's field of view) and rotating sample platform averages out the sample and produces accurate repeatable color attributes. As a result, consistency can be maintained and quality standards can be met with less waste, time, and effort.

Sensegood spectrophotometer helps in picking even the slightest color difference over the production batches. It helps in finding difference between two colors and shows result in percentage match.



<p>Reference: $L^*=80.49, a^*=4.47, b^*=24.91$ WI: 19.17, YI: 51.56</p>	<p>Sample: $L^*=89.01, a^*=3.13, b^*=17.81$ WI: 44.97, YI: 35.52</p>
<p>$\Delta L^*=+8.52, \Delta a^*=-1.34, \Delta b^*=-7.10, \Delta E^*=11.17$ Sample is Brighter and Bluer (less Yellower) than reference. Alarm limit = 95%, MATCH: 89% Alarm triggered as Match % is below user set threshold of 95% * WI=WHITENESS INDEX (STENSBY), YI = YELLOWNESS INDEX</p>	

Sensegood spectrophotometer for quality and consistency control in dairy products

Photo: Color consistency control in dairy butter.

Color variation over different production batches indicates process variations and inconsistent ingredient quality which results in perceived flavor inconsistencies and ultimately customer dissatisfaction. To build and maintain a brand of repute; product's consistency is one of the most important parameter to be addressed. Reference can be saved in Sensegood spectrophotometer and can be recalled at any time to compare it with production batch sample. It provides information regarding color component differences in between sample and reference. This information assists in reprocessing for color adjustments.



<p>Sample (right) is Brighter, Redder and Yellower (less bluer) than reference (left). $\Delta E^*=7.55$, Alarm limit = 91%, MATCH: 92% Match % is better than user set threshold of 91%</p>
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Sensegood spectrophotometer for quality and consistency control in dairy liquids and pastes

Photo: Establishing color tolerance and finding color matching percentage in strawberry yogurt.



<p>Sample (right) is Duller, Redder and Yellower than reference (left). $\Delta E^*=12.21$, Alarm limit = 93%, MATCH: 88% Alarm triggered as Match % is below user set threshold of 93%</p>

Sensegood spectrophotometer for quality and consistency control in dairy sweets

Photo: Establishing color tolerance and finding color matching percentage in Peda – a dairy sweet.

If matching is poor; below set threshold, Sensegood spectrophotometer provides audible alarm and display indication on LCD to alert operator. Hence operator can quickly react and take appropriate action. The information assists for the prompt corrective action which eventually leads to quick process parameters control, increase in the throughput and maximization of equipment usage. This surely results into low operational cost with improved product quality, consistency and market acceptability.

Apart from color match percentage; Sensegood spectrophotometer provides color representation in terms of various indices such as – whiteness index, yellowness index to name a few. Index value is a single number that represents overall color attribute of a sample. Dairy scientists and producers rely on Sensegood spectrophotometer to study and research color correlations with product's quality and also for introducing appealing color products to the customers.

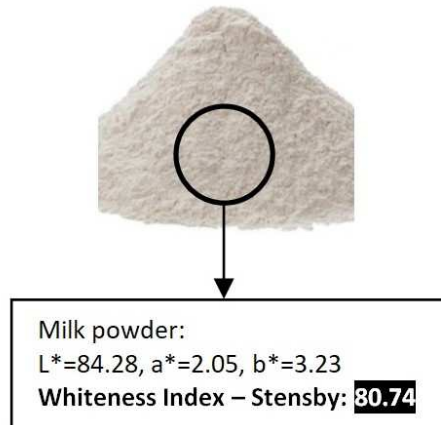


Photo: Using Sensegood spectrophotometer to measure Whiteness index in milk powder

Do more with Sensegood Spectrophotometer:

Sensegood spectrophotometer also incorporates continuous auto measurement mode. In this mode, it wakes up at user selectable intervals, takes measurement, compares the sample color with the saved reference, displays percentage match, and alarms to the operator with beeping sound in case if the matching percentage is below preset threshold. It has provision for averaging option in normal mode as well as in auto repeat measurement mode.

Measured CIE L*a*b* values indicate strength of color parameters like: bright or dull, red – green and yellow – blue respectively. Measured color is also represented as reflectance graph, peak wavelength and color temperature on color touch LCD. Sensegood spectrophotometer is non-messy non-contact type instrument which has benefit of measuring sample's color from a distance. Because of this, sensor's optical assembly remains scratch proof enabling long life in retaining calibration. Non-contact measurement avoids any sample contact and contamination on sensor measuring surface. Hygiene is maintained, as non-contact measurement avoids any food contact and bacterial accumulation on sensor measuring surface. Sensegood spectrophotometer is the versatile device that is engineered to work as handheld/portable, benchtop/table-top or in-process/online color measurement instrument.

SensegoodSmart utility:

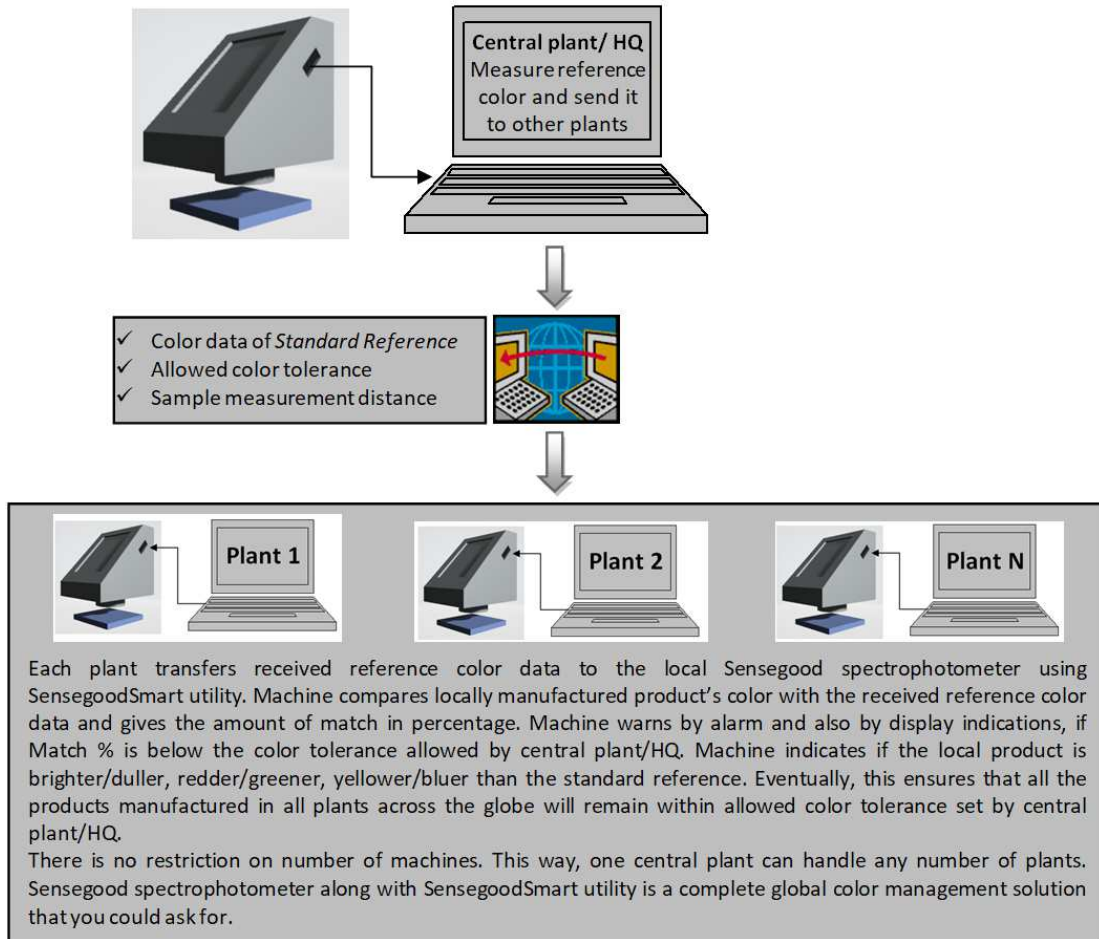


Photo: SensegoodSmart utility for color management across multiple production plants. Apart from this, SensegoodSmart utility enables user to store unlimited number of references to the computer. Any desired reference can be recalled and downloaded to Sensegood spectrophotometer whenever required. The utility provides all color related analytical information on single screen. This feature is even more desirable when using Sensegood spectrophotometer for in-process/online applications.

Sensegood spectrophotometer provides computer interface software *SensegoodSmart* which lets you to convey numeric color data across all production plants that may be located at multiple places across the globe. Each production plant uses Sensegood spectrophotometer to compare color attributes of the product manufactured in their plant with the numerical color information received from central plant or management. This enables them to reproduce each product consistently across all the plants. This feature is highly desirable for wide spread industry with plants at various places. It also assists in color consistency in packaging material supply chain.

References:

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- [2] Van Doorn, G.H., Wullemin, D. & Spence, C. Does the colour of the mug influence the taste of the coffee?. *Flavour* 3, 10 (2014). <https://doi.org/10.1186/2044-7248-3-10>
- [3] Giusti, M.M. and Wrolstad, R.E. (2003) Acylated Anthocyanins from Edible Sources and Their Applications in Food Systems. *Biochemical Eng. Journal*, 14, 217-225. [http://dx.doi.org/10.1016/S1369-703X\(02\)00221-8](http://dx.doi.org/10.1016/S1369-703X(02)00221-8)
- [4] Keith R Cadwallader, Chapter 7- Instrumental measurement of milk flavour and colour, *Improving the Safety and Quality of Milk Improving Quality in Milk Products*, Woodhead Publishing Series in Food Science, Technology and Nutrition, Mar 2010, Pages 181-206, Elsevier ISBN:9781845699437, 1845699432



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