

Color measurement for quality and consistency control in chocolates and ingredients using Sensegood spectrophotometer

Fermented beverages made from chocolate date back to 450 BC. [1] Cocoa seeds once had so much value that they were used as a form of currency. The relishing flavors and textures of chocolates are mind triggering. The chocolate also masks the unpleasant taste of tablets and encourages its usage for medicinal purposes. According to the Harvard School of Public Health, a few pieces of chocolate per month can make our life longer and sweeter.[2] Switzerland is the world's biggest consumer of chocolate, eating 19.4 pounds (8.8 Kg) per capita per anum.[3],[4]



Photo: Cocoa beans, powders and chocolates. Sensegood spectrophotometer assists in maintaining color quality attributes and appearance consistency in all production stages across wide spread plants. Image source: wallpaperaccess.com

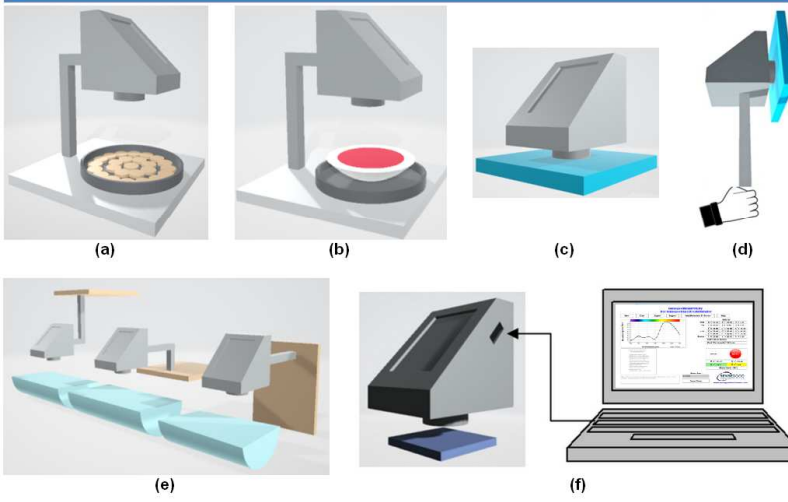
Importance of color measurement in chocolates:

Total chocolate market is expected to grow by 4.5%. Specifically super premium chocolate market is growing at 15.4% growth rate. [5] This justifies that the customers are ready to pay for quality, and demand is exponentially increasing for premium chocolates. Ingredients like spices or flavors like strawberry are often mixed to make chocolate indulging and mouth watering. Inconsistent color indicates process parameter variations and poor quality control of ingredients. Inconsistent product appearance results in variations in perceived flavor, and poor market acceptance which ultimately damages the brand reputation. To maintain the consistency in final chocolate textures, color quality control becomes the most essential part of each stage in production process.

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 management and quality control:

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



Reference – Regular: L*=51.41, a*=15.55, b*=22.12	Sample – Dutch: L*=33.30, a*=15.84, b*=11.51
$\Delta L^* = -18.11, \Delta a^* = +0.29, \Delta b^* = -10.61, \Delta E^* = 20.99$ Sample is Duller and Bluer (less Yellow) than reference. Alarm limit = 90%, MATCH: 79% Alarm triggered as Match % is below user set threshold of 90%	

Sensegood spectrophotometer for quality and consistency control in chocolates and ingredients

Photo: Reference can be saved in Sensegood spectrophotometer and can be recalled at any time to compare it with production batch sample. Sample can be roasted cocoa beans and cocoa nibs, cocoa powder, cocoa butter, final solid chocolate with ingredients, chocolate syrup, milk powder, spicing up additives or fruit flavor powders. In photo: Color measurement and finding match percentage in Regular acidic (left) and Dutch processed/ alkalized (right) cocoa powder.



Reference – Dark: L*=32.69, a*=7.96, b*=7.02	Sample – Brown: L*=35.75, a*=10.57, b*=16.45
$\Delta L^*=+3.06$, $\Delta a^*=+2.61$, $\Delta b^*=+9.43$, $\Delta E^*=10.25$ Sample is Brighter, Redder and Yellower than reference. Alarm limit = 96%, MATCH: 90% Alarm triggered as Match % is below user set threshold of 96%	

Sensegood spectrophotometer for quality and consistency control in chocolates and ingredients

Photo: Color has direct impact on perceived taste. Sensegood spectrophotometer provides information regarding color component differences in between sample and reference. This information assists in reprocessing for color adjustments. Setting and ensuring color tolerances dramatically enhances color quality control. In photo: Color measurement and finding match percentage to ensure color consistency in chocolates.

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. For an instance whiteness index can be used to know the whiteness attribute of milk powder.

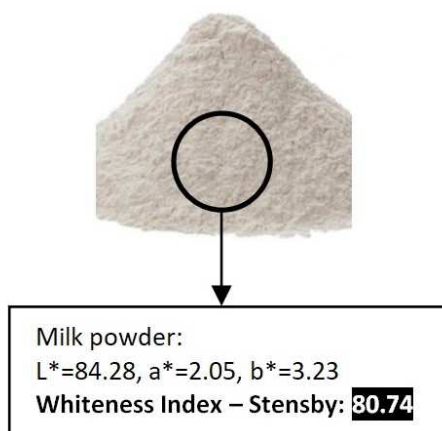


Photo: Using Sensegood spectrophotometer to measure Whiteness index of milk powder

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:

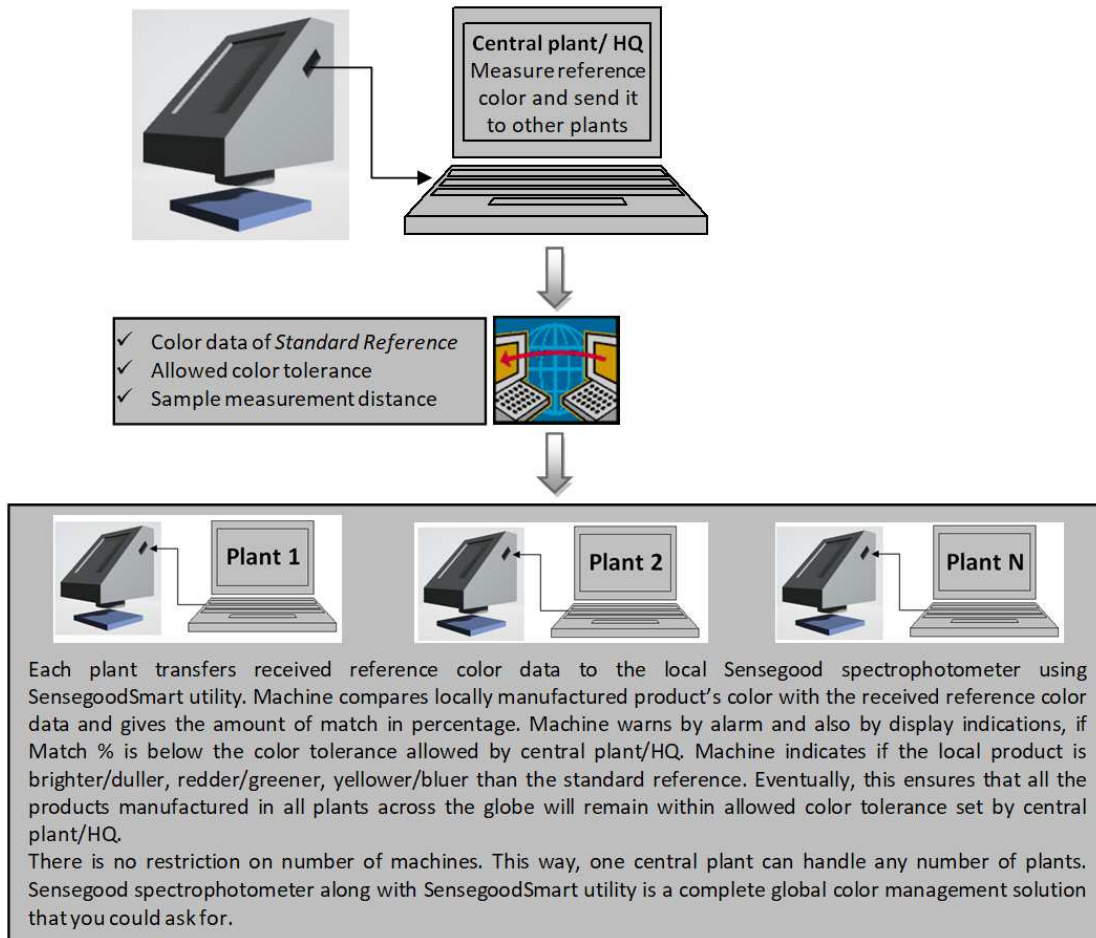


Photo: SensegoodSmart utility for color management across multiple production plants. Apart from this, SensegoodSmart utility enables user to store unlimited number of references to the computer. Any desired reference can be recalled and downloaded to Sensegood spectrophotometer whenever required. The 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:

[1] Watson, Traci (22 January 2013). "Earliest Evidence of Chocolate in North America". Science. Retrieved 3 March 2014.

[2] Series of articles published on chocolate benefits on health: Available at Harvard Health Publishing by Harvard Medical School, www.health.harvard.edu

[3] Jan Conway, Global chocolate consumption per capita in 2017, by country, Consumer Goods & FMCG statistics, Jan 28, 2020

[4] Global Cocoa & Chocolate Market 2019 By Manufacturers, Regions, Type And Application, Forecast To 2024, Absolute Reports, SKU ID : GIR-13813865 | Publishing Date : 04-Feb-2019 | No. of pages : 136

[5] Chocolate Candy Market in the U.S., 11th edition, Packaged Facts.

<https://www.packagedfacts.com/Chocolate-Candy-10268969/>



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