Color measurement for quality and consistency control in food dyes (food colorants) using Sensegood spectrophotometer

Importance of color in food:

Food color plays an important role by visually stimulating our appetite. Off colored foods are generally considered inferior in quality hence colors are added. Colors can also protect vitamins and flavors that may be affected by sunlight during the storage. By using colors, the natural color of dish gets enhanced. And most importantly, study reveals that the color of the food can influence the perceived flavor [1], [2], [3].

Dehydrated powders – Natural food dyes:

Color measurement using Sensegood spectrophotometer in food dyes: From top left in sequence: Spray dried powder of chikoo (sapota), mango, jamun (black plum), tomato, bottle gourd, ginger, lemon, pomegranate, beet root, banana, water melon, pineapple, papaya (carica), garlic, carrot, orange, coriander, potato, spinach, red onion.

Natural colors come from fruit, vegetables, roots, plants, algae, animal or mineral that is capable of coloring the food or drug. Natural powder color is extracted by spray drying of fruits and vegetables.
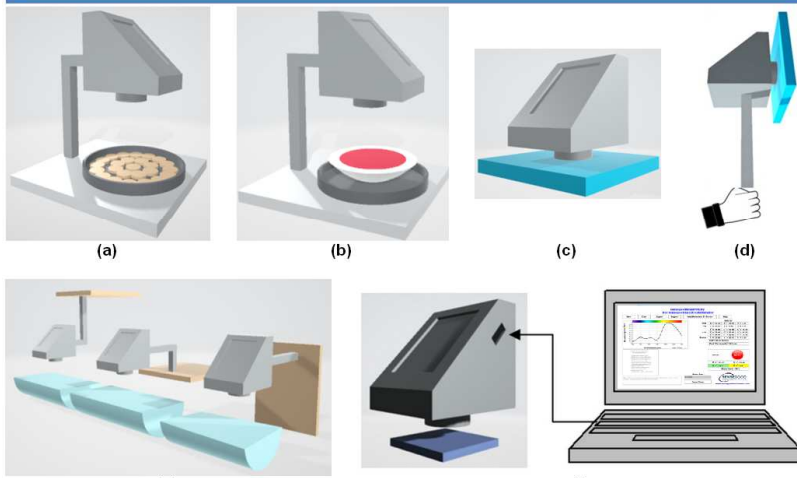
Artificial food dyes:

Artificial food dyes are made from chemical reactions. They are responsible for the bright colors of candy, sports drinks and baked goods. They are even used in certain brands of pickles, smoked salmon and salad dressing, as well as in medical – including pills and capsules colors.

Regulatory agencies, like the US Food and Drug Administration (USFDA) and the European Food Safety Authority (EFSA) give permissions for the artificial food dyes which do not pose significant health risks. Some of the common food colors are:

- Red No. 3 (Erythrosine)
- Red No. 40 (Allura Red)
- Yellow No. 5 (Tartrazine)
- Yellow No. 6 (Sunset Yellow)
- Blue No. 1 (Brilliant Blue)
- Blue No. 2 (Indigo Carmine)

Amongst these, the most popular food dyes are Red 40, Yellow 5 and Yellow 6. These three make up to 90% of all the food dyes that are used in the US [4].

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 to maintain quality and consistency in food dyes:
Sensegood spectrophotometer is analytical color measurement instrument that is widely accepted in industry and research fraternity for reliability. 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 is the versatile device that is engineered to work as handheld/portable, benchtop/table-top or in-process/online color measurement instrument.

Be it natural or artificial color, maintaining the authenticity of true color representation of food dye is the first preference for any manufacturer. Sensegood spectrophotometer helps in picking up even the slightest change in food dye color over the production batches. Sensegood spectrophotometer helps in finding difference between two colors and shows result in percentage match. This helps particularly in maintaining consistency in mixed color sample lots.

| Reference – Mix-1: | Sample – Mix-2: |
| L*=46.29, a*=30.04, b*=27.95 | L*=52.07, a*=30.06, b*=34.82 |

ΔL*=5.78, Δa*=0.02, Δb*=6.87, ΔE*=8.98
Mix-2 sample is Brighter and Yellower
Alarm limit (adjustable) = 95%, **MATCH:** 91%
Alarm triggered as Match % is below user set threshold of 95%

Sensegood Spectrophotometer for color measurement and consistency control in food dyes

Photo: Right color implies right proportion of ingredients. To illustrate, Mix1 and Mix2 are the mixtures of natural and artificial tomato colors in different proportions. Sensegood spectrophotometer helps in finding a match percentage and alarms if matching is poor. Here Mix1 can be standard saved reference in the instrument and Mix2 can be all production batch samples.

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.

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. Sensegood spectrophotometer has provision for averaging option in normal mode as well as in auto repeat measurement mode.

Sensegood spectrophotometer provides wide varieties of indices. 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 a 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.
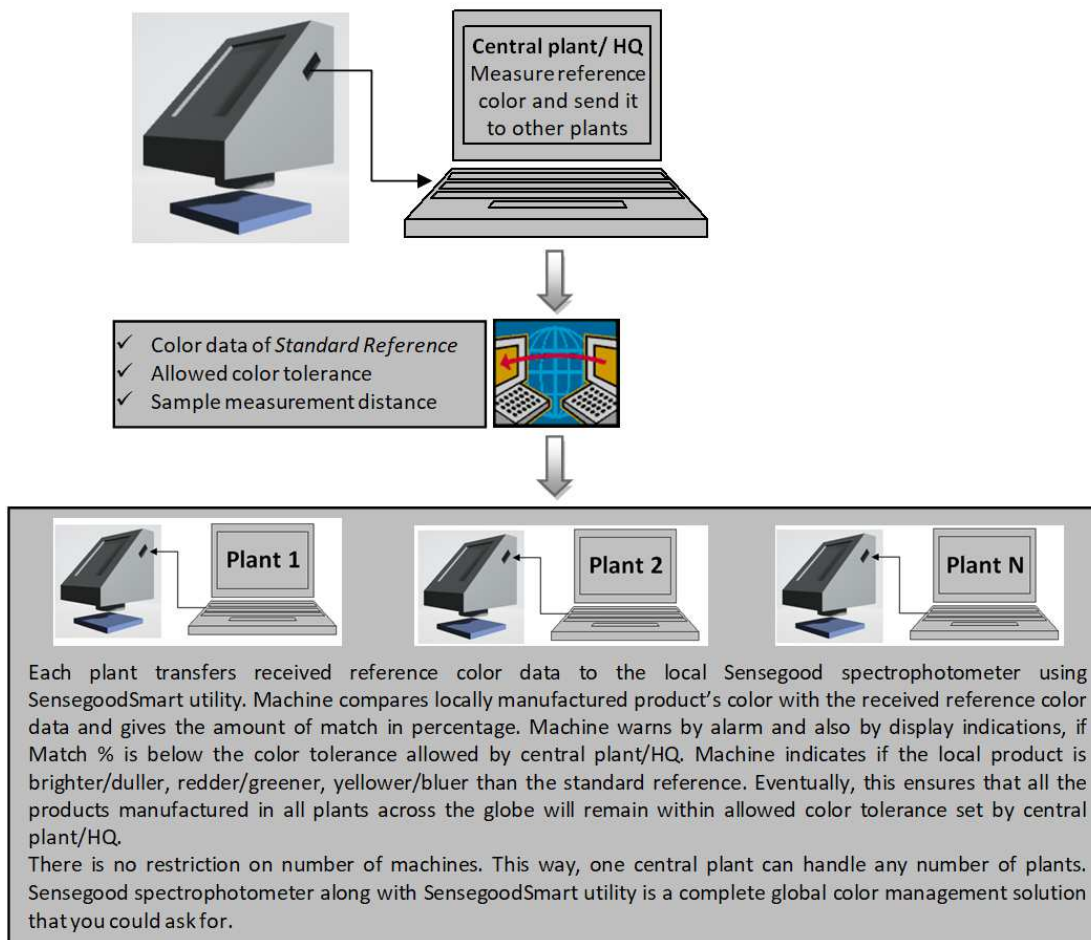
SensegoodSmart utility:

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 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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[3] Does the Color of Foods and Drinks Affect The Sense of Taste?: Compilation available at University of Washington website: http://www.faculty.washington.edu/chudler/coltaste.html
[4] Potera C. (2010). Diet and Nutrition: The Artificial Food Dye Blues. Environmental health perspectives, 118(10), A428. https://doi.org/10.1289/ehp.118-a428

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