The measurement of food colour to ensure brand consistency and quality

Visible light is found between 380 and 780nm in the electromagnetic spectrum. It is bordered by ultraviolet light on the low end and infrared light on the upper end. When light strikes an object, it is reflected, absorbed, or transmitted.

Because reflected light determines the colour of a material, the appearance can change depending on the amount of light, the light source, the observer's angle of view, and the size, shape, structure, and surround of the material.

Colour and quality

In the food industry visual colour is an important quality attribute of food products because it signals freshness and flavour, and therefore influences the consumer's purchase decisions before the food is tasted. Food scientists, food processors and marketers want food to look both appealing and consistent.

The colour of raw ingredients will affect the finished product, and the appearance of food will change during processing and over the course of its shelf-life. Colour can help to guarantee consistent quality from suppliers and to determine whether the final product meets internal quality standards.

Agricultural commodities may have batch to batch variation. With cinnamon, for example, the colour varies based on the region and country of origin in which the cinnamon is harvested, the age of the bark, and any contamination. This colour variation may not affect the taste, but may affect the perception of the end-product.

Similarly, some colours may degrade, adding complexity to the consumer's expectations of consistency. Artificial colours are added to food to offset colour loss due to light, air, extreme temperatures, storage, and moisture, to mask natural variations in colour, or to enhance naturally occurring colour.

Colour perception

There are disadvantages associated with a subjective examination of a product's colour, since visual colour judgments can be affected by a wide variety of factors, from lighting conditions and angle of observation, to visual deficiencies of the eye which leads to individual differences in colour perception. Instrumentation is available in the market to provide a subjective and consistent method of colour quality control. Many instrument manufacturers can assist in the choice of which instrument to use, which will depend on the food material and the specific application.

Colour measurement

Colorimetry quantifies colour by measuring the three primary colour components of light which are seen by the human eye, namely red, green and blue. Colorimeters employ photocells as receptors, and they measure colour in much the same way and with the same sensitivity as the human eye. A microprocessor converts the colour sensor reading to internationally accepted numeric values. They always take measurements using the same light source and illumination method, and as a result, the measurement conditions will be the same, regardless of whether it is day or night, indoors or outdoors.

Using this principle, secondary and tertiary colours such as yellow and orange are not individually quantified, but derived from their primary components. Instruments using this colorimetry principle are called chromameters or colorimeters, and are used to measure the colour of a wide range of foodstuffs, including fresh and processed fruits and vegetables, formulated foods, dairy products, meat products, spices and flavours, cereals and grains.

In spectrophotometry the ratio of the light reflected or transmitted from a food product to that from a known reference standard, is measured across the full spectrum of visible light to provide a precise and accurate measurement. Instruments using this principle are called spectrophotometers. They are more accurate and more expensive than colorimeters and tend to work best for transparent and translucent foodstuffs such as liquids, syrups and gels, oils, and beverages.

The International Commission on Illumination (CIE) defines the colour of an object as the specification of colour stimuli in terms of, for example, amounts of three reference colour stimuli: red, green, and blue. This system is the most influential for the description of colour and is based on using a standard source of illumination and a standard observer.

NMISA and measurement standards

The National Metrology Institute of South Africa (NMISA) is a government entity reporting to the Department of Trade and Industry and enables the reliability of measurement results in South Africa. NMISA's mandate is to develop and maintain primary and secondary standards (chemical and physical quantities) for South Africa, to compare these standards to international standards and establish global comparability; and to see to the correct use of the International System of Units (SI).

Measurement standards are disseminated to South Africa and the region via a range of services and products such as calibration, reference materials, proficiency testing schemes and measurement services. NMISA has a Photometry and Radiometry laboratory with scientific links to the CIE, and advanced expertise in colour measurement and calibration. NMISA is equipped to calibrate both colorimeters and spectrophotometers.

For more information about NMISA and its services, call 012 841 4152, send an email to info@nmisa.org. or visit *www.nmisa.org*.

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