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Manufacturing & **DISTRIBUTION**

BY HAL GOOD

Physical Property Testing

Having the safest food in the world won't guarantee customers. Color and texture add to the enjoyment of eating. Here's how these factors can enhance the palatable properties in the food.

Methods of Measuring Food Color

GOLDEN POTATO CHIPS OR YELlowish orange juice? Color is an important attribute to the food industry. Consumers make purchasing decisions based on overall appearance. And often, color and flavor are directly related. Manufacturing processes, such as extrusion and baking, and ingredient color can affect final color. To obtain and maintain the desired color, monitoring and controlling ingredient color through the manufacturing process is essential.

Color is assessed for several reasons:

- To determine and document ingredient effect on product color;
- To determine color change as a result of storage or processing;
- To ensure consistency of ingredient color for QC purposes; and
- To determine conformance to final product quality specification.

Visual color assessment has several shortcomings. Reliable visual evaluations require control of multiple variables: spectral quality, intensity and angular size of the light source; direction from which the light strikes the sample; the direction in which the sample is viewed; the distance between specimen and color standard; and the observer's spectral response. Colors that fall between visual color standards, within the visual color system in use, are often difficult to communicate to other individuals. Finally, visual color assessment is subjective, tiring and tedious. Using color measurement instruments is obviously a better, more objective method to check ingredient color and to evaluate the process efficiency in obtaining or maintaining the desired product color.

Methods and instruments for color measurement are selected based on the optical characteristics of the food product:

- **Opaque Food** Seen wholly by reflected light, this group includes fruit, crackers, corn flakes, cheese puffs, flour, tomato juice, cheese and meat.
- **Translucent Food** Seen partially by reflected and partially by transmitted light; many fruit juices, jams and custards fall into this category.
- **Transparent Food** Seen wholly by transmitted light; clear juices, wines, jellies, gelatins, vegetable oil and soft drinks are in this category.

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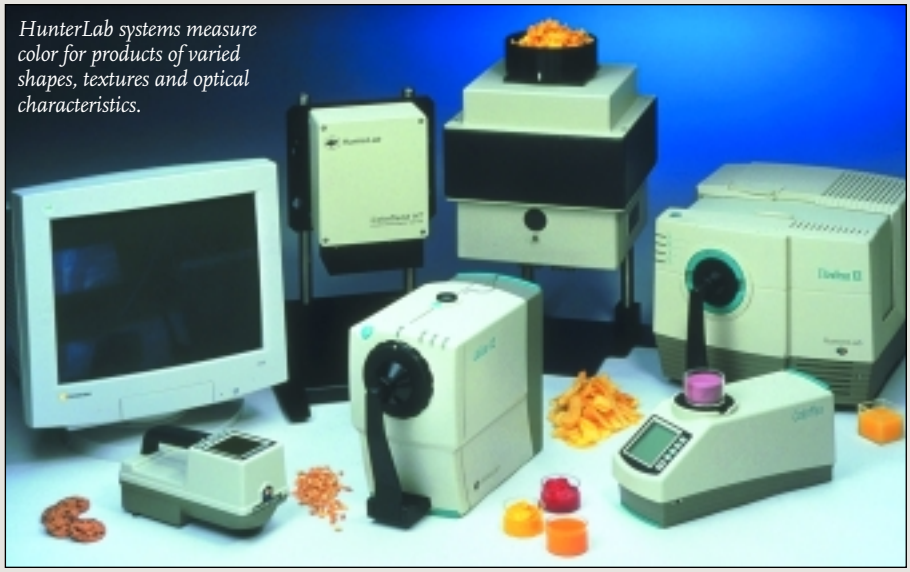

HunterLab systems measure color for products of varied shapes, textures and optical characteristics.

The best way to measure color of opaque liquids, opaque solids, pastes, powders and small granules is using a 45°/0° geometry instrument with a horizontal sample port.

sample port. This instrument geometry illuminates the sample at a 45° angle and is measured at a perpendicular angle (0°). This is similar to how we view samples with our eyes. Liquid sample is poured into a sample cup and placed over the instrument port for measurement; flat slab samples—blocks of cheese or slices of meat—are placed directly on the sample port. A sample port aperture with glass insert prevents juices from dripping into the instrument. To measure coarse granules, flakes, chips and disks—cookies and crackers—the best system is a 45°/0° geometry instrument with circumferential illumination and a large measurement port. This geometry compensates for the directional effect of the sample and the large measurement area provides a good optical average of non-uniform samples. For continuous measurement of crackers and cookies, an on-line color monitoring system can be mounted over a moving web to provide real-time color data.

Translucent samples require special handling. The color of a translucent sample changes when the light path length going through changes. The path length must be fixed. A "ring and disk" assembly is used to measure this type of sample. A cup with ring, disk and sample is placed on the 45°/0° geometry instrument port for measurement.

Transparent food is measured by transmission instead of reflection. Brewed tea, for example, is poured into a transmission cell, which is then placed in the transmission compartment of an instrument having sphere geometry. Typically, this type of instrument can also measure transmission haze and color. The haze value is related to turbidity for products such as clear juices and brewed tea.

Consistent product color, reduced waste and improved customer satisfaction are some of the benefits of instrumental food color measurement. Use of proper instrumentation and measurement protocol ensures high precision and correlation to visual perception.

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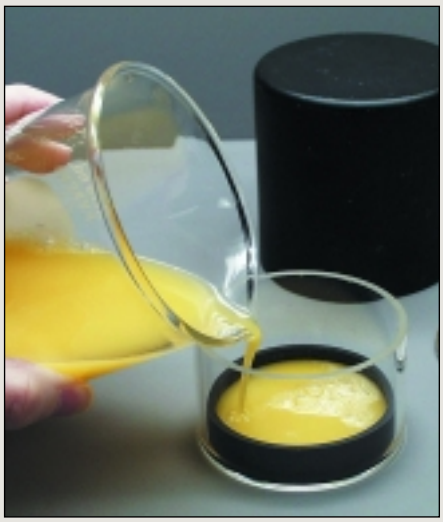

Orange juice sample being prepared for measurement using a "Ring and Disk" assembly.