

Natural Colors Go for the Green

By Cindy Hazen, Contributing Editor

Color the food industry green. Consumers are not only looking for descriptors like natural and organic, they are looking for sustainable ingredients and compostable packaging, and they are talking about carbon offsets and neutrality. While we cannot help the food developer meet the locovore's expectations, we can offer direction in creating a label-friendly hue.

Natural defined

The definition for natural foods has shades of gray. For non-meat foods and beverages, a natural declaration is left to the discretion of the manufacturer. The FDA does not define natural, and therefore does not recognize any color as natural.

In most instances, the agency considers colors that are "exempt from certification" to be labeled added color. These colors are typically what the industry refers to as a "natural color" and are listed in Title 21 of the *Code of Federal Regulations (CFR)*, Part 73.

There are exceptions. "Spices which are also colors shall be declared as 'spice and coloring' unless declared by their common or usual name," states *CFR* Part 101.22.

Carmine, because it has been implicated as an allergen, must be labeled "carmine" or "cochineal extract." It is considered natural, but some consumers take offense that the source need not be labeled. Carmine and cochineal products are extracted from the cochineal insect, which lives on the prickly pear cactus in South America.

For meat products, USDA provides black-and-white guidance. Minimally processed products that do not contain an artificial ingredient or added color may be labeled "natural."

Consumers often assume organic and natural mean the same, but there is a difference. USDA oversees the certification program for organic foods. "Many colors are permitted for use in the four organic categories," explains Carol Locey, product director, colors, Kalsec Inc., Kalamazoo, MI. "To be labeled '100% certified organic,' a food containing color is required to use 100% organic coloring. Foods labeled 'organic' must contain at least 95% to 99% organic ingredients. The National Organic Program maintains the list of allowed and prohibited substances for use in the 95% to 99% organic category. Non-synthetic colors, such as paprika and annatto, are permitted in section 205.605 (National Organic Standards) for use in products labeled as 'organic' or 'made with organic' food groups. However, if a certified-organic color is available, it must be used. If an organic color is not available, the non-organic version is permitted as long as it is extracted without the use of solvents such as hexane and acetone."

Because the majority of natural food dyes are derived from fruits and vegetables, some of these are also certified organic by the USDA. They may also contain healthful phytonutrients. To some extent, colorants such as anthocyanins and carotenoids can be leveraged as ingredients for functional foods.

How green is your color?

A general rule of thumb to follow in determining if a color is "green" is to look at how it's processed. Grinding is the epitome of natural. Water extraction is accepted worldwide. However, a number of countries do not consider certain colors natural "if they have been processed or chemically altered, or made by fermentation," says Jeff Greaves, president, Food Ingredient Solutions, LLC, Teterboro, NJ. Carotenoids, for example, are sometimes produced by fermentation.

"Paprika can be produced by a simple expeller method of separating the oils and pigment by pressing the ground paprika in the presence of oil," says George Kean, Ph.D., color applications manager, Kalsec. "Significant volumes of annatto extracts are produced by water extraction. Similarly, fruit and vegetable concentrate colors are prepared either by expressing the juice from mature varieties of fresh, edible fruits, or by the water infusion of the dried fruit."

Each natural color, "whether it is annatto or purple carrot, has its own specific, ideal method of extraction," says Byron D. Madkins, senior director, product development and applications—colors, Chr. Hansen, Inc., Milwaukee.

Natural color primer

Sometimes, flavor components tag along when natural colors are extracted from their respective sources. Most natural colors, though, when used at typical dosage levels, will not impart or contribute to the flavor of the final food application. "However, as more companies are replacing products currently colored with synthetic colors with natural color options, we have found that we will need to be more aware of the potential flavor impact of some of the natural color options," says Madkins. "This is true in snacks and confectionery, where the foods can be highly colored. For example, some of the colors that are carotenoid-based may also have a characteristic flavor note. Red radish and red cabbage have characteristic sulfur flavor and odor notes."

Spices such as paprika and turmeric are known for their flavor, as well as the color they impart. Sometimes this is an added benefit, but for products in which the flavor is not complementary, de-flavored products are available.

Extractives of paprika derived from sweet capsicum peppers provide reddish-orange hues to a wide variety of food products. "These colorings are generally heat stable through processing, including retort and pasteurization," says Locey. "Certain applications, such as batters, breadings and snack-

Natural Color Market Growing Rapidly

At the recent HiE conference, Steve Rice of [RTS Resources](#) said there is a marked shift toward using natural colors. According to Rice, the colors market is estimated at \$1.7billion, and natural colors make up some \$.65 billion of that total.

"Total colour usage has been growing by about 4 per cent year on year, but naturals are growing by 6.5 per cent year on year, so inevitably we can see that it's [synthetic colours](#) that are being squeezed out," said Rice. "Our forecasts now show very little growth for synthetics, with all of the growth coming from naturals."

The market for natural colors will likely become intense as manufacturers begin using natural colors in more products and begin to see highly stable natural colors and explore new natural extracts.

food coatings, expose the pigments to oxidative stresses which can lead to loss of color during storage on the retail shelf. High-stability formulations are available for these types of applications."

Oleoresin turmeric is bright yellow and is often used to replace FD&C Yellow No. 5. "Turmeric is very heat-stable and easily used in retort, extrusion and pasteurization processes," says Locey. "Depending on the composition of the food product, turmeric may fade in light. In beverages, significant color loss can occur if exposed to light. However, in a candy, the pigment is light-stable as long as the water activity is low."

Annatto and beta-carotene provide yellow to orange shades in applications. "Many of the carotenoids, because they are naturally oil-based, require additional formulation, such as emulsification or encapsulation, in order to be used in water-based applications," says Madkins.

Oil-soluble annatto is used in meat and fish breading, bakery mixes, processed cheese, and margarine, while water-soluble annatto is used in cheeses, bakery mixes, cereals, yogurt and fruit preparations, notes Locey. "While annatto typically does not contribute any flavor, care should be taken that color degradation doesn't occur when overheating," she says.

The anthocyanins, such as those found in elderberry, purple carrot, purple sweet potato, red radish and grape, work well in low-pH applications. However, the resultant color is dependent on pH. It will change from a raspberry color at pH 3 to a deeper, blueberry-red at pH 5. Beverages, confections, jams and jellies are typical applications.

Carmine and cochineal provide a range of hues from orange to red to purple. These colors are usually stable in most food applications, including beverages and dairy products.

Natural Flavors, Colors Drive 2011 Beverages

Consumers' desire for natural, healthy and convenient products will continue to drive beverage development in 2011, according to results of the [Beverage Industry's New Product Development survey](#).

According to the survey results, 45 percent of respondents plan to launch more new products into the marketplace in 2011, while 44 percent plan to launch the same number. Consumer demands, changing tastes and the need to create excitement in a product line are driving new product introductions with particular emphasis on health and wellness, profitability, all natural flavors/products and gaining market share.

In terms of flavors, chocolate will be the anticipated best-selling flavor for 2011 with lemon taking the No. 2 spot followed by other popular citrus flavors like orange and lime.

Thirty-eight percent of respondents indicated that both natural and healthy are attributes that consumers must have. On average, a majority of survey-takers are keeping in line with this trend by planning to use natural flavors and colors in 2011.

Constructing with color

Natural colors generally function differently than synthetic colors--and from each other. "The main synthetic colors—Red 40, Yellow 5, Yellow 6 and Blue 1—all have very similar functionalities and chemistry, generally speaking," says Madkins. "However, annatto is very different from turmeric, which is very different from an anthocyanin (fruit or vegetable juice). Each has its own chemistry and stability and, thus, they each have applications for which they are most suitable. Anthocyanins are

most suitable in applications less than pH 4. Annatto, as norbixin, will precipitate at pH less than 5. Beta-carotene is stabilized by the presence of ascorbic acid, while ascorbic acid will cause anthocyanins to degrade and fade. The developer needs to be aware that within the natural color range, there are these different classifications or groupings of pigments."

While there is not a full spectrum of natural colors to replace synthetic dyes, new advances are broadening the range. "A full range of natural hues are available, and color manufacturers have developed products with acceptable stability in many applications," says Kean. "In certain applications, natural colors may have limitations due to packaging or ingredient interaction, and most likely require higher usage levels. For example, carotenoids, when used in select clear beverages, may not express similar clarity when compared to their synthetic counterparts. However, as the demand for natural colors increases and consumers' interest in health and wellness continues to grow, these limitations are not as big of hurdles when the goal is a natural label that appeals to the consumer."

Matching artificial neon shades with natural counterparts is especially challenging. Greaves finds natural colors offer a broader range of reds than artificial colors, but notes "there is a general lack of blue and green options among natural colors."

Greening up

Yet, while it may be more difficult to naturally color a food green, color manufacturers are stepping up to meet the needs of the "green" consumer. Chr. Hansen has ongoing programs in place globally "to be as green as possible with regard to overall production—for example, minimizing and optimizing energy and water usage—and pigment extraction at our respective plants," says Madkins.

The method of packaging natural-color ingredients can also add benefits. "Aseptic packaging capabilities offer customers preservative-free colors that deliver maximum shelf life and, as an additional benefit, enhance sustainability," says Mark Goldschmidt, technical director, Sensient Colors, (a unit of Sensient Technologies Corp.), St. Louis. The company recently made a capital investment in such technology.

Sustainability of natural resources is key. "Our natural colors use raw materials extracted from botanical sources. We continue to improve the vibrancy and stability of natural colors by developing more stable botanical sources, identifying new sources or even developing new plant hybrids," says Goldschmidt. "Selective-plant-breeding programs and new hybrid creation are important factors in producing more stable botanical sources."

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