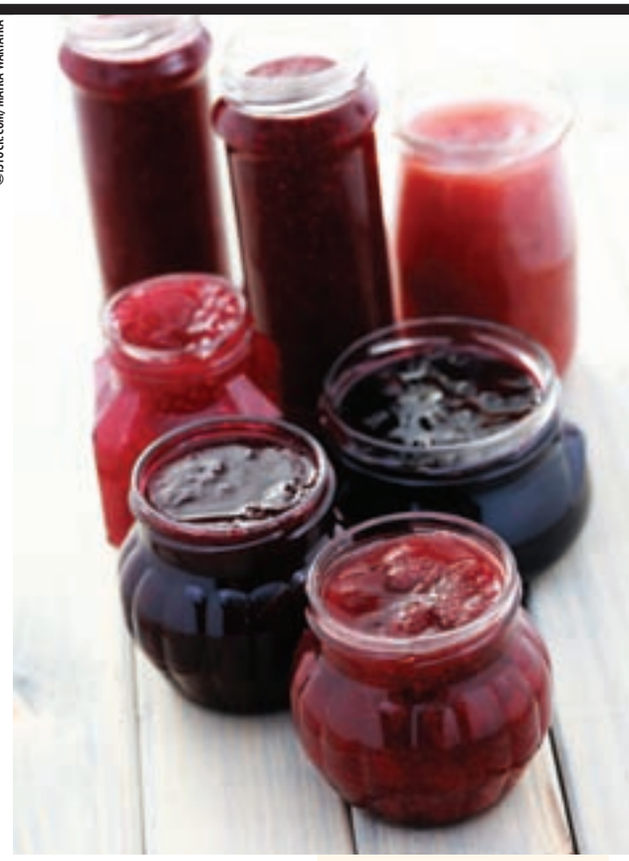

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# Trends in Global Colorings

**An overview of the coloring market, definitions of coloring substances and technical considerations in their use are provided.**

*Claudia D. O'Donnell, Chief Editor*

*Editior's Note: This article was first published in the October 4, 2010, issue of* E-dition, Prepared Foods*' e-newsletter, sans the chart, "Stability of Natural Colors," added here.*

Colorings have been much in the news of late. Topics range from child hyperactivity studies to interest in carmine, a natural red coloring derived from cochineal insects. Carmine, for example, is generally not able to qualify as kosher but is still experiencing great demand and increased costs.

Coloring materials can enhance a product's natural color, replace what was lost during processing, or add a novel sensory aspect that attracts customers. The coloring category of ingredients also is undergoing great change around the world.

The global food colors market was worth an estimated $1.45 billion in 2009, relays an August 2010 market report, "The Global Market for Good Colours," by Leatherhead Food Research. World usage of food colors is currently about 40,000-50,000 tons. Although current economic conditions mean "annual growth levels have started to fall off sharply," says the report, by the middle of the next decade, the global market value is expected to reach $1.6 billion, up 10% from its present levels. From 2005-2009, the global market for natural colors increased almost 35% in value, with much future growth expected to come from natural colors and coloring foodstuffs. Foods account for some 67% of the food coloring global market, followed by soft drinks (28%) and alcoholic beverages (5%).

**Colors will impact how people perceive the flavor and sweetness of a food or beverage.**

Europe accounts for 36% of the global coloring market, followed by the U.S. (28%), Japan (10%) and China (8%), with the remaining 18% from developed economies, such as Canada and Australia, and emerging food markets, such as India and Brazil.

Leatherhead Food Research's report segments the global color market into synthetic, natural and nature-identical colors. "Synthetic colors" tend to be pure chemicals of standardized strengths. They usually are of lower cost and more stable across a range of conditions compared to natural colorings. Examples include Sunset Yellow FCF, iron oxides/hydroxides and brilliant Blue FCF. "Natural colors" are generally extracted from agricultural, biological or mineral sources. Examples include anthocyanins (e.g., from red, blue and purple fruits), betalains (mainly from beet root), caramel (sourced from sugar), carotenoids, chlorophylls and riboflavin. "Natural-identical" colors are identical to pigments found in nature, but are produced by chemical synthesis.

Lastly, and of increasing interest, are ingredients that fall under the term "coloring foodstuffs." The Leatherhead report contrasts them from natural colorings, in that they are processed from foods such that the food's essential charac-

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teristics have been maintained, whereas natural colorings have been selectively extracted and concentrated. Coloring foodstuffs are standardized for color and maintain the initial balance of sensory and coloring properties. "All typical components, such as flavonoids, carotenoids, carbohydrates, vitamins, minerals, amino acids and trace elements are maintained in representative amounts," states the report. Such ingredients are not assigned E numbers.

The "Global Market for Food Colours" report notes that colorings are highly important to certain categories, notably confectionery, desserts and beverages. Colorings are also important to savory snacks, breakfast cereals and sweet spreads, such as jam. "Tartrazine, for example, is used to provide the distinctive yellow color of the Inca Kola brand in Latin America," it states.

The vast majority of colors are widely used across the globe, but the report provides examples of how regions differ. Allura Red AC (16035) is widely used in the U.S, but is banned in many European countries. The U.S. has a partial ban on erythosine (45430), but this coloring is widely used in the rest of the world. Beyond governmental regulations, individual companies also may have policies. The retailers Tesco and Asda removed all artificial colors from their own private label products in 2008.

## Color Functional Properties

The "Global Market for Food Colours" offers an overview on technical aspects of colorings. It notes that colors may have additional functions. For example, the caramel color in cola may add a slight viscosity, an aspect that was missed when clear colas were launched years ago. Caramel colors may also help emulsify oil-based flavorings. Additionally, studies show the colors predetermine flavor expectations and also the apparent level of sweetness. A strongly colored, red strawberry drink is usually perceived to be sweeter than a less strongly colored drink, even though sweetener levels are identical.

Stability of natural colorings is generally less than synthetic colors. Color degradation is impacted by pH, light, temperature and oxidation reactions with other ingredients.

Anthocyanins, for example, fade rapidly at a neutral pH and also appear increasingly red, rather than blue or purple at lower pHs. Annatto precipitates at pHs under 4, and a modified form of annatto may be required. Heat processing may lead to browning of anthocyanins and other coloring degradations. Charged ions also create issues. Free calcium cations can interact with annatto, changing it from orange to pink. Iron and magnesium reduce the color of carotenoids.

### Stability of Natural Colors*

| Color | Color Shade | pH Stability | Heat Stability | Light Stability | Oxygen Stability |
|---|---|---|---|---|---|
| Anthocyanin | Red to blue (depends on pH) | > pH 3.8 color changes | Good | Fair to good | Sensitive |
| Annatto | Yellow to orange | Precipitates at < pH4; degrades in acids | Fair | Fair to good | Sensitive |
| Beta-carotene | Yellow-orange to orange-red | Good at pH 2-8 | Good | Fair to good | Sensitive |
| Caramel | Brown | Good (stable at pH 3-10) | Good | Good | Good |
| Cochineal | Orange to red | Good (stable at pH<5) | Good | Good | Good |
| Chlorophyll | Olive green | Loses color in diluted acid | Poor to fair | Poor to fair | Sensitive |
| Lutein | Yellow | Excellent | Good | Good | Fair |
| Lycopene | Yellow to red | Good | Good | Fair | Fair |
| Paprika | Orange-red | Fair | Fair to good | Poor to fair | Sensitive |

* Note: American spelling used.
Source: Leatherhead Food Research Regulatory and Technical Consultancy Services (2008). *Legislation in Ingredients Handbook: Food Colours.* Ed. Emerton V. Blackwell Publishing Ltd, 161-74.

The report also touches on new product innovations used to overcome some of the technical challenges posed by natural colors. They include antioxidant use; blending (for example, one supplier found it could offer an orange hue by combining purple sweet potato and natural beta carotene); emulsion technologies; microencapsulation; nanoentrapment; and, finally, co-pigmentation, in which colorless organic compounds or metallic ions form molecular or complex associations with pigments that generate a change in color intensity.

Research also continues on new sources of natural coloring from fruit, vegetables, edible plants and marine life. For example, cactus pear and purple pitaya juice are rich sources of betalains, and the microalgae *Haslea ostrearia*, responsible for the greening of oyster gills, may offer a new source of blue pigments.

As long as the color of foods and beverages remains important to consumers, efforts by the industry to provide safe, suitable, stable and economical colorings will continue.

*This article is based on Leatherhead Food Research's August 2010, "The Global Market for Food Colours," market report. The 54-page report provides greater depth of the topics discussed here and also covers markets by world region, regulatory developments, a review of patents and profiles of the major global suppliers, including brand information. For more information, contact Leatherhead Food Research's Publications Department at +44 (0)1372 822241 or publications@leatherheadfood.com. See also www.leatherheadfood.com/food-colours.*



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### Website Resources:

**www.PreparedFoods.com** — Use the search term "Coloring Options" to find a July 2010 article by the Burdock Groups' Laurie C. Dolan and Ray A. Matulka. This cover story discusses in-depth current and upcoming

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regulations covering the use of colorants and functional ingredients that may color food as a secondary property. Food developers are faced with a complex body of regulations in the U.S. and Europe regarding the usage of natural coloring agents.

**www.PreparedFoods.com** — Use the search term "How Long Will I Be Blue?" for an October 2008 article by Claudia D. O'Donnell that reviews consumers' changing attitudes in regards to what various colors mean to them, and the benefits and challenges to using synthetic and natural colorings in formulated products.

**www.PreparedFoods.com** — Use the term "Keeping Up Appearances" for an October 2007 article by Steven Young, Ph.D., that provides an overview of some technical considerations in the use of colorings and inclusions in frozen desserts.

**www.PreparedFoods.com** — Use the search term "Looking at Sensory Coloring" for an October 2006 article that discusses how consumer panels, trained sensory panels and instrumental analysis can be used to help guarantee a product's color is consistent from batch to batch, comparable to gold standard colors and acceptable to consumers.

***Prepared Foods'* website** also carries a broad selection of presentations on the use of colorings in foods and beverages, offered in a Powerpoint format and accompanied by audio narratives. Presentation names and years are as follows. To locate, search for the presentation's name:

- Research on Heat and Light Stability of Naturally Derived Coloring for Beverages (2009)
- Use of Carotenoid Colors in Foods and Beverages (2009)
- Natural and Nature Identical Colors (2009)
- Colors and Perception (2009)
- Coloring Foods with Beta-carotene and Using Vitamin A to Make Products Healthier (2008)
- Natural Colors: Health Benefits and Application Guidelines (2008)
- Color and Applications in Confectionery Technology (2008)
- Coloring Food with Food (2008)
- Incorporating Colorful Fruits and Vegetables in Your Product (2008)
- Natural Colors in Beverages and Confections (2007)
- Innovative Food and Beverage Fortification with Natural Tomato Lycopene (2007)
- Natural Solution to Coloring Foods (2007)
- Caramel Color 101 (2005)
- Designing Color Systems For Application (2005)
- Natural Red as a Mainstream Color Solution (2005)



**See Food Master-*INGREDIENTS*, p. 64**