2013 Clean Label Conference

A Conference Report
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2013 Clean Label Conference

The "clean label" trend has been on-going for decades. It is driven by consumer interests, operational efficiencies and the development of sophisticated food technologies enabling simple-appearing products. At the Clean Label Conference's core was the delivery of practical information on the development of consumer-friendly packaged foods and beverages.

On October 29-30, 2013, Global Food Forums assembled 13 expert speakers at the Hyatt Lodge in Oak Brook, Ill., USA. Presentation topics included natural colors, flavorings, sweeteners, antioxidants and texturizers, etc., as well as consumer and retail trends, regulatory, culinary approaches and packaging. This report summarizes the information presented.

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- ***When Natural Isn't Good for You: Managing Food Safety, Litigation & Regulatory Risk***
  Anthony "Tony" Pavel, JD, Partner, Morgan Lewis & Bockius, LLP
- ***From Wal-Mart to Whole Foods: What are Shoppers Looking For?***
  Linda Gilbert, Founder/CEO, EcoFocus Worldwide, LLC
- ***Bringing Culinology to Clean Label Development - How and Why it Matters***
  Mark Crowell, CRC, MBA, Principal Culinologist, CuliNex, LLC
- ***Going Au Naturel: Coloring Considerations***
  Ronald Wrolstad, Ph.D., Distinguished Professor of Food Science Emeritus, Oregon State University
  Taste Physiology and Considerations in Sweetener Choices
  Alex Woo, Ph.D., Managing Director and Founder, W2O Food Innovation
- ***A Food Scientist's Approach to Working with Organics***
  Sharon Herzog, MS, Director of R&D, Country Choice Organic

All presentations and adapted versions are available online at http://GlobalFoodForums.com/2013-cleanlabel/downloads.

When it comes to new trends in the clean label movement, Leonardo da Vinci put it best: "Simplicity is the ultimate sophistication." Purity and simplicity have taken clean label by storm, leading to simpler inputs, focused messaging, cleaner labeling, streamlined design and easy delivery. So explained Steve French, MBA, Managing Partner at Natural Marketing Institute (NMI), in his presentation "Consumer & Market Trends: Opportunities for Simple, Clean, & Pure Abound."

Over the past 10 years, opinion has shifted from the elimination of negatives to the notion of clean label between those two concepts, French said.

French's presentation was an overview of the several trends within the clean label movement today, many of which he supported by citing NMI's data on American adult consumers. French said providers today are living by the "less is more" maxim and have removed complexity and nuance to make it easier for consumers to determine what products best fit their personal values.

A key finding on this claim is that 47% of consumers look for foods/beverages with a short list of recognizable ingredients, compared to 37% in 2007. An even more obvious piece of evidence is the sheer number of beverage products that have emerged with "pure," "real" or "simple" in their name: 178 in 1999 compared to more than 400 in 2012.

Clean label has picked up momentum for a myriad of reasons, the most obvious being consumers' desire to be more healthy. But, French explained, it also has ties to gaining more control over their lives. "And, think of this sense of control as being brought to them by food and beverages."

In NMI's research, consumers responded strongly to the following when it comes to maintaining a healthy and balanced life: nutritious foods (68%), a balanced diet (66%), natural foods (35%), fortified/functional foods (27%) and organic foods (22%). For all those looking to proactively become healthier in their diet, there are essentially two options they can pursue: Add certain foods or avoid certain foods. Interestingly, each method is employed by roughly the same number of people. French noted that 69% have added foods, while 71% have avoided them.

Illustration courtesy of the Natural Marketing Institute

Many terms and buzzwords are used to try to define the consumer trend toward the desire for purity and simplicity in products.

"These numbers are very high and remarkably stable, but it's that combination of the two together that formulate the basis for critical mass, especially among clean label," he said.

Labels are a crucial element to this trend. French said that 51% of respondents purchase foods based on the ingredient list, and over half are based on the nutritional facts. These are compared to 42% and 45%, respectively, when NMI asked the same questions in 2006. Similarly, 74% of American adults say package labels influence their purchase of healthy and natural products.

As the number of people looking to labels grows, what they are looking for is likewise changing. That said, consumers are still checking for negatives first. Items like calories (52%), total fat (46%), sodium and sugar (both 44%), saturated fat (38%) and trans fat (33%) come

before positives, such as vitamins (17%), natural ingredients (13%), organic ingredients (7%), minerals (6%) and glycemic index (3%).

While food scientists have successfully cut down negative categories, like sugar and sodium, with novel ingredients, French reported that 54% of consumers don't want to see those artificial replacement ingredients on the label, either. That's why, from 2007-2011, one sees growth in natural sweetener products, such as stevia (30%), evaporated can juice (17%), raw sugar (6%) and honey (5%)—while "artificials" slowly decline. Similarly, minimal processing remains an important concept to consumers, with 56% saying they prefer minimally processed foods (compared to 48% in 2007 and 52% in 2011).

Another buzzword French advised to keep in mind is "local," as 66% of consumers say they've used locally sourced foods/beverages in the past year, and 67% say it's important that their store carry locally grown produce. Similarly, 52% of consumers care about "sustainable agriculture" compared to 44% in 2005.

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Clean Labels: Implications, Strategies and Insights

Clean labels may be "tipping to the mainstream;" so predicted Leslie Skarra, CEO, at Merlin Development, Inc. The trend in the U.S. is small, but growing and "snowballing" in the UK and Europe. Baby Boomers have been driving the expansion with increased disposable income and quests for health and longevity. More importantly, Millenials are also driving a shift to clean labels. Many Millenials have grown up with skepticism of the food industry. The "food psychology" of clean label foods is also important.

Cooking only with clean label foods may be akin to the sentimentality formerly associated with baking. Unlike prior generations that economized on food when money was tight, Millenials are investing in clean label foods—despite the long recession and continued economic difficulties within their demographic group.

The implications of clean label food processing are numerous and complex. For traditional processors, these include the difficulties of matching current product attributes with new clean label formulations. Also, current branding may reduce "clean label believability" in some instances.

In addition, alternate formulation, process or distribution strategies may be necessary, due to shelflife and micro issues resulting from clean label formulation changes. Ingredients are key, according to Skarra, but one must also consider altering line speed, operation and distribution strategies. In fact, it "may be easier for a new brand or company to deliver clean label foods, due to current business expectations for traditional processed food manufacturers." Skarra stressed it is best to commit to only use ingredients that are familiar and acceptable to consumers. A company could eliminate the need for antimicrobials via enhanced sanitation, and/or alternate processes, packaging or distribution technologies. Another option is to replace current ingredients with new fermentation-based antimicrobials (i.e., cultured wheat flour).

For processors currently focused on clean labels, their challenges include expanding their market via expanded distribution, which may stress sensory quality and microbiological stability. Price reductions may also be necessary, to capture a larger market share.

Merlin's unique approach to clean labels starts with clearly identifying all issues. It is important to thoroughly

All presentations or/and adapted versions are available online at
http://GlobalFoodForums.com/2013-cleanlabel/downloads.

search for direct solutions. "Understand what is done and why. Question all assumptions. Finding alternatives (i.e., ingredients, processes, packaging, distribution) to achieve the structures/functions/mechanisms needed is also important."

There were several concrete marketplace examples of clean label products given in the session. The first was a hamburger bun where replacements for HFCS could be sugar, dextrose, fructose, corn syrup and/or enzymes. Calcium propionate can be replaced with cultured wheat flour or whey. Diacetyl tartaric acid ester of mono- and diglycerides (DATEM) could be eliminated, and enzymes/other ingredients used in its stead.

Another example was a clean label salad dressing. Cultured antimycotics and the addition of a label saying "refrigerate after opening" can replace potassium sorbate. Rosemary extract, tocopherols and/or a different oil source can be used rather than EDTA.

Source: Merlin Development, Inc.

For a clean label yogurt, Skarra suggested eliminating potassium sorbate, which she noted is used by many major national brands. Some of the issues with its elimination include process differences (to prevent mold inoculation); process reliability to assure every package is mold-free; and the impact on the brand if the system should fail.

Skarra referenced the recent Chobani yogurt recall, stressing that after the recall, the company partnered with Cornell University; hired a new VP of quality, food safety and regulatory affairs; and launched a major ad campaign, stressing that "every cup is a commitment to delicious, preservative-free food."

Suppliers should continue with innovations to support clean label foods. Also, Skarra suggested looking outside the U.S. for approaches or solutions; and to "be patient with slow implementation…the barriers to change are formidable."

For traditional food processors, Skarra challenged them to "design products with a 'clean sheet of paper' approach and a long view to the future, as emerging competitors are doing." She also emphasized: "Use straightforward, unqualified communications with consumers via brands, packaging, claims, ingredient declarations and media."

Clean label processors should adapt traditional processor-development techniques to expand the market beyond their current consumers, she said, and to "improve quality as seen by consumers and reduce costs via line speeds and efficiencies, rather than formula cost-cutting."

In conclusion, Skarra said food manufacturers are best served by "regaining the gatekeeper role from retailers." Education also plays a role, via the Web and package labels. "Committing to the simplest, long term messages will be most powerful and defensible."

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Packaging Does Much More than "Contain"–It Defines Your 1st Sale

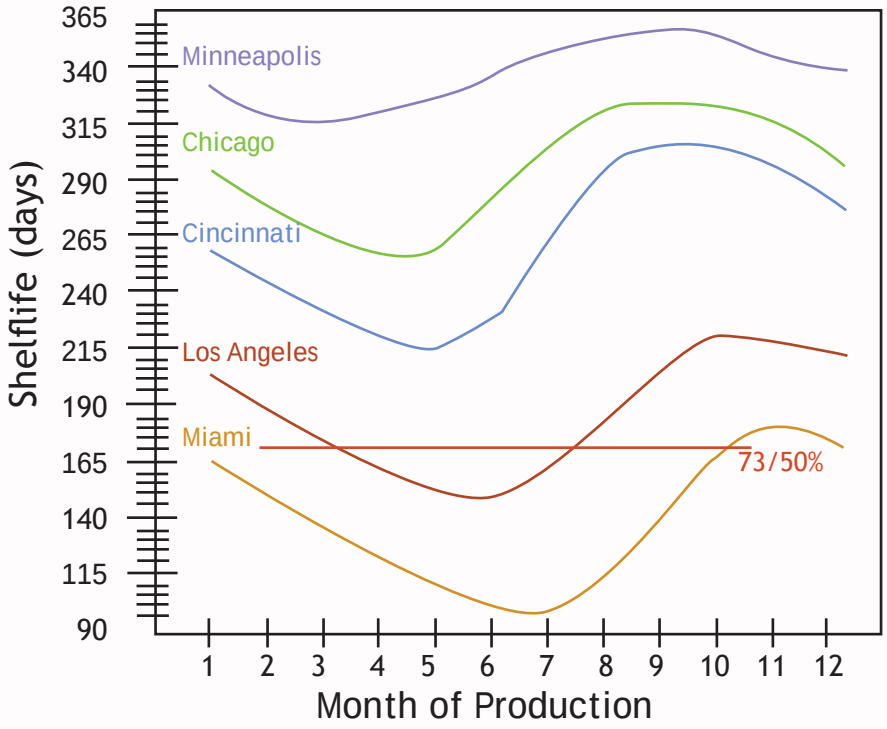
Consumers buy products on the basis of relative perceived quality. Packaging gives the first impression of a product to consumers, so it can greatly impact sales, noted Kenneth Marsh, Ph.D., Kenneth S. Marsh & Associates, Ltd., as he began his presentation.

Packaging contains and protects products, but it also promotes distribution, presents the product and offers information through the label. For a new product, the package determines the initial sale of the product. Product quality influences subsequent sales.

Distribution of grocery products can occur through two basic systems. Traditional grocery product manufacture has limited manufacturing and distribution facilities, and products travel long distances to reach consumers. This requires longer shelflife, achieved through a combination of ingredient choice, processing and packaging. Alternatively, distribution can take place through many regional manufacturing and distribution facilities. This is exemplified by Frito Lay, in which products travel shorter distances; experience a more rapid turnover; and require shorter shelflife and less protection.

"Packaging for a food depends on how it is processed, formulated and distributed," stated Marsh. "Packaging should be considered as the product is developed, not as an afterthought. During product development, shelflife and distribution options need consideration, along with formulation and processing options, in order to increase choices for a viable product with increased profitability and chance of success."

Look at a snack product that goes rancid in a glass container in a dark room. Options to save it include antioxidants, a barrier package with nitrogen purge, and refrigerated distribution with many manufacturing and distribution sites. Preservatives, antioxidants, humectants or encapsulation can make the product less sensitive. Barrier packaging can protect the product during transport, and refrigeration can slow down the degradation. These steps, combined with more rapid distribution, can make



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Shelflife can be calculated for a moisture-sensitive cereal product produced in different cities using each city's' monthly average temperature and humidity. The straight line represents 73˚F/50% R.H., commonly used as a standard room temperature and humidty. Products distributed in Northern states can be considered over-packaged. Products warehoused in non-temperature-controlled warehouses in Southern environments may become unacceptable before their designated shelflife.

an otherwise not-viable product acceptable.

Packaging also represents the company image. It gives impressions from the aisle and shelf; thus, material, shape, texture, label and graphics are important. Brand identification is promoted by package graphics that tie the product line together, such as the spoon on Betty Crocker cake mixes, or the red and white label for Campbell's soups. Individual varieties and flavors can then be differentiated as the consumer looks directly at the products.

"Fresh" can be suggested through open-air markets and often simple packaging, such as plain plastic bags often used for bulk spices, nuts, etc. Matt bags, such as those used for many potato chips, give a fresh, deli look and yet compete with grocery items with laminated structures that offer better barriers than paper bags.

Packaging is often based on expected conditions, but one is not always certain. Climate in the U.S. varies in time and locale. Environment affects shelflife. If distribution is not temperature- and humidity-controlled, then shelflife is influenced by where and when it is produced and warehoused, and any abuses inflicted along the way. Depending on timing and abuses, shipments may need adjustment from normal FIFO (First In-First Out) order. If conditions are recorded, then shelflife calculations can be made for quality attributes and shipments made based on basis of available shelflife (i.e., product quality).

Marsh suggested, "Computer-aided distribution is a tool that utilizes temperature probes, recording devices and a database consisting of all shipments with dates and distributions. Computer calculation of quality impacts of high temperature experienced in a truck delayed on a hot day, for example, can modify pull dates to allow mildly temperature-abused products to be shipped first."

New options for efficiency include matching distribution to turnover rates; varying packaging for cost efficiency; packaging for the total market, not just the worst; and determining needs for new markets. For example, products regionally produced in the Northern states could require less barrier protection than the same product produced and distributed in Southern states. Profitability results from the least costly system to deliver quality products which sell.

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Natural Antioxidants: Maximizing Effectiveness for Shelflife Extension

Antioxidants, when present in food or in the body at low levels, can delay, control or prevent oxidative processes leading to food quality deterioration or initiation and propagation of degenerative diseases. Antioxidants are generally phenolic and polyphenolic in nature and can be either synthetic or natural.

Effective at low concentrations, antioxidants are non-toxic; have good carry-through properties; and often are of reasonable cost, said Fereidoon Shahidi, University Research Professor in the Department of Biochemistry at Memorial University of Newfoundland in St. John's, Canada.

Primary antioxidants act as free radical scavengers and reducing agents. Synthetic antioxidants in foods include BHA, BHT, TBHQ and PG. Ascorbic acid and tocopherol can either be synthetic or naturally sourced, while mixed tocopherols, rosemary, sage and green tea are natural. Secondary antioxidants include EDTA and citric acid, which deactivate pro-oxidants.

Consumers now demand clean labels with no artificial ingredients, while longer shelflives and stability in foods are also expected. "Food processors can meet the needs of both groups by using plant-derived natural extracts," offered Shahidi.

Over 5,000 polyphenolics have been identified in different plants. These compounds are present to protect plants against herbivores; attack by microorganisms; and from stress due to sunlight. Antioxidants also participate in wound-healing in plants, and they attract pollinators.

Important components of functional foods, antioxidants occur as phenolic acids (hydroxybenzoic acid derivatives), phenylpropanoids (cinnamic acid derivatives), tocols (tocopherols and tocotrienols), flavonoids, isoflavones, coumarins, tannins, carotenoids, phospholipids, amino acids, protein hydrolysates, ascorbic acid (vitamin C) and many more.

Lipid oxidation, causing flavor, odor and shortened shelflives in food, happens with time, light, heat or enzymes. Metals, like iron and copper, which all foods have, are initiators. With iron, Fe2+ is more soluble than Fe3+ and is more than 100 times more reactive than ferric.

"Photooxidation requires singlet oxygen, produced by interaction of light and a sensitizer like chlorophyll. This reaction is unaffected by most antioxidants but is inhibited by quenchers of singlet oxygen, such as beta-carotene," Shahidi stated.

Natural antioxidants are available commercially. Rosemary extract, green tea extract and mixed tocopherols are commonly used in clean label products. Rosemary has FDA GRAS status (21CFR 182.10); it contains carnosic acid and carnosol, extending shelflife in meats, poultry, seafood, edible oils, snacks, sauces and dairy products. Green tea contains catechins and can be used in the same products as rosemary. Natural tocopherols are usually a mixture from deodorizer distillate. The most abundant and commonly used is from soybean oil processing, containing mainly gamma, delta and alpha tocopherol. Applications for rosemary and green tea extracts include meat, poultry and seafood, which are highly susceptible to oxidation, resulting in a warmed-over flavor, discoloration and protein degeneration.

Baked products are susceptible to oxidation because of long shelflife requirements. Mayonnaise, dressings, soups and sauces have a large oil-water interface and complex food matrix that increases their susceptibility to lipid oxidation. Oxidation risk also is high in margarines, which have a biphasic food matrix. Meanwhile, shortenings are more saturated, but one needs to be aware of their trans fatty acid content and governing regulations.

Nutrient content claims can also be made for antioxidants, if they have an established RDI according to 21CFR 101.54(g) and are present in amounts qualifying for the claims. Vitamins A, C and E, riboflavin and selenium are examples. Antioxidants without RDIs do not qualify, and many warning letters have been issued by FDA for misuse of the term, advised Shahidi. Many plant extracts provide naturally derived antioxidants that offer both

Sources of Natural Antioxidants

Source	Active Compounds
Spices	Flavonoids, phenolic acids, coumarins
Teas	Catechins and condensed tannins
Fruits and vegetables	Ascorbic acid, flavonoids, carotenoids, hydroxylated carboxylic acids
Cereals and grains	Phenolic acids, flavonoids, lignans, sterols
Oils and oilseeds	Tocopherols, lignans, flavonoids, phenolic acids, phospholipids
Soybean and other legumes	Isoflavones, phenolic acids
Proteins and protein hydrolyzates	Acids, peptides, carnosine, Maillard reaction products

Source: Derived from "Natural Antioxidants: Maximizing Effectiveness for Shelflife Extension," a presentation by Fereidoon Shahidi, Ph.D., Department of Biochemistry, Memorial University of Newfoundland.

Consumers are now demanding clean labels on food products with no artificial preservatives, yet they want extended shelflives. Plant-derived antioxidants can help promote both.

clean labels and health benefits in foods, he concluded.

Fereidoon Shahidi, Ph.D., Department of Biochemistry, Memorial University of Newfoundland, St. John's, NL, Canada A1B 3X9

Flavorings: Clean and Friendly

The first step in clean labeling with flavors is to understand the regulations. A lengthy list of compounds that may be termed "natural flavor" is provided in Title 21 Code of Federal Regulations (CFR) 101.22. They include the "essential oil, oleoresin, essence or extractive, protein hydrolysate, distillate, or any product of roasting, heating or enzymolysis, which contains the flavoring constituents derived from a spice, fruit or fruit juice, vegetable or vegetable juice, edible yeast, herb, bark, bud, root, leaf or similar plant material, meat, seafood, poultry, eggs, dairy products, or fermentation products thereof, whose significant function in food are flavoring rather than nutritional."

Artificial flavor includes the substances listed in 172.515(b) and 182.60 of Chapter 21, except where these are derived from natural sources. "Basically," explained Gary Reineccius, Department Head of Food Science and Nutrition at the University of Minnesota, "if it is not natural, it is artificial."

Labeling and naming of flavored finished products can become complicated and a bit subjective. For example, natural flavor added to a cherry pie filling, with sufficient characterizing ingredients (cherries), is labeled "cherry pie," but natural flavor added to food with not enough cherries to sufficiently flavor the pie by themselves is labeled "natural cherry-flavored pie." The added flavor now must be natural and cherry-like.

Foods containing artificial flavoring materials that simulate, resemble or reinforce a named or characterizing flavor must be labeled as containing artificial flavoring on the principle display panel. In determining whether added flavor does or does not simulate, resemble or reinforce the characterizing flavor, the principal test is to separate such added flavor from the product. Thus, vanillin added to chocolate would clearly not be a characterizing flavor, because it does not taste like chocolate.

"Benzaldehyde added to cherry juice would be considered artificially flavored, because benzaldehyde reinforces and extends the cherry taste. The test is not solely whether an artificial flavor simulates or is chemically identical to the characterizing natural flavor, but also—more broadly—whether it resembles, reinforces or simulates it," said Reineccius. In lemon pudding with citral and no lemon added for flavoring, the product would be labeled "lemon pudding, artificially flavored." If a flavor is natural and is derived totally from sources other than

Photo courtesy of the Cherry Marketing Institute

Labeling and naming of flavored finished products can become complicated. Natural flavor added to a cherry pie filling, with sufficient characterizing ingredients (cherries), is labeled "cherry pie," but natural flavor added to food with not enough cherries to sufficiently flavor the pie by themselves is labeled "natural cherry-flavored pie."

the product whose flavor is simulated, it is either labeled "artificially flavored" or as "with other natural flavors" (WONF). If other natural flavors are added and the flavor contributed by the ingredient does not separately characterize the named flavor, then the regulations state that the front panel must say "lemon pudding with other natural flavors," for example, and the ingredient statement must list WONF.

In order to label a product with a blend of three or more distinguishable characterizing flavors, such as natural cherry, orange and grape flavors, or a blend with no primary recognizable flavor, the flavor may be declared by an appropriately descriptive generic term, such as "fruit punch" flavor. Such a product entirely flavored with artificial materials could be labeled in the same manner, but the ingredient statement must declare artificial flavors.

When labeling flavors contained in food products, their encapsulation matrices, flavor solvents and preservatives are typically considered incidental additives, added to a food as a component of an ingredient with no technical or functional effect, therefore exempt from labeling according to 21 CFR 101.100.

Reineccius points out that the claim "all-natural" for a product is not the same as natural flavor. "Another claim often seen, 'no additives,' does not apply to GRAS substances, listed in CFR 1182.105 to 182.8997 and 184.1. GRAS substances are not considered additives," he strived to clarify.

In conclusion, an opportunity for a clean label often means natural flavor over artificial flavor, which typically adds substantial cost. Internal practices and corporate image come into play. Flexibility in labeling and interpretation of flavor characterization or simulation varies, industry-wide. WONF is frequently ignored.

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Emerging and Applied Clean Label Starch Technologies

Starch is a natural carbohydrate polymer packed into a granule. Its shape, size and morphology depend on the plant species. Starch granules contain both linear and branched starch polymers that swell with heat and water during gelatinization, and retrograde or recrystallize upon cooling.

Chemically modified starches provide benefits, such as improved food processing and shelflife stability under acidic conditions; and extreme temperature and shear and during storage. Functional characteristics of chemically modified starch include altered viscosity development, improved film forming properties, selected aestheic properties, and retrogradation control of amylose and amylopectin.

"However," explained Sakharam Patil, President, S.K. Patil and Associates, "consumer desire for foods with simple, non-chemical-sounding ingredients has created excellent opportunities for non-chemically modified starches." Clean label modified starches can be produced without chemicals, by physical or enzyme modification, yet possess properties similar to chemically modified starches.

Clean label starch modifications include heat moisture treatment (HMT), annealing (ANN), dry roasting, spray drying and enzyme modifications. HMT and ANN are physical modifications that change the physicochemical properties of starch without destroying its granular structure. In HMT, starch is heated to temperatures above gelatinization temperature but with insufficient moisture to gelatinize.

Regardless of the starch origin, HMT promotes an increase in the gelatinization transition temperature; a widening of the gelatinization temperature range; decreases in granular swelling and amylose leaching; and increases in thermal stability. HMT induced changes in starch structure and properties vary with starch source and amylose content.

During ANN, starch is exposed to excess water for

an extended period of time at temperatures above the glass transition but below gelatinization temperature, explained Patil. ANN specifically changes the physicochemical properties of starch by improving its crystalline perfection and facilitating interactions between the starch chains, resulting in controlled swelling, gelatinization and enhanced stability.

Enzyme modified starches are another clean label solution. Modern biotechnology has provided several commercial enzymes for clean label starch modification. "Enzyme modification of starches eliminates undesirable by-products and improves starch purity, producing consistently high-quality products at potentially low cost," stated Patil.

Major starch modifying enzymes include endoamylases, which attack starch randomly and reduce viscosity rapidly. Exoamylases attack the glucose polymer chain from the reducing end group and successively remove glucose or maltose units from the starch polymer. Debranching enzymes, like isoamylase, exclusively hydrolyze α-1,6 glycosidic bonds that specifically degrade amylopectin, leaving long linear polysaccharides. Transferases, such as amylomaltase and cyclodextrin glycosyltransferase, cleave α-1,4 glycosidic bonds and transfer part of the donor molecule to a glycosidic acceptor forming a new glycosidic bond. Slowly digestible starches (SDS) and resistant starches (RS) result from these new bonds and are in demand because of their fiber-like behavior, both functionally and nutritionally. Corn, pea and lentil starches are sources of SDS and RS when heat and enzyme treated. SDS also provides sustained or slow energy release, modulating the glucose release in the blood stream, thereby providing the low or slow glycemic effects to manage diabetes.

Amylomaltases have a similar type of reaction but result in linear starches, while cyclodextrin glycosyltransferase gives a cyclic product. Starch treated with amylomaltases have thermoreversible gelling characteristics and can be dissolved numerous times upon heating, a behavior very similar to gelatin.

The choice of which clean label modified starch to use depends on formulation, processing conditions and shelf stability. Sources can include waxy, regular maize, potato, tapioca, rice, pea and wheat starches.

Applications for clean label modified starches include a wide variety of foods. Examples include a pregelatinized native pea starch that provides pulpiness in tomato sauce and a gelatin-replacing, enzyme-modified potato starch, as a vegan alternative in jelly-type confectioneries.

Enzyme-modified starches can replace fat in cakes and dairy products, to reduce fat up to 30%, while amylomaltase-treated starches enhance creaminess in yogurts.

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Starches Made by α-glucanotransferase Enzymes

Starch Product	Application
Cycloamylose	Protein folding
Cyclic cluster dextrin (CCD)	Sports drink
Cyclodextrins	Cholesterol removal
Thermoreversible starch gel	Gelatin/fat replacer
Slowly digestible starch (SDS)	Slow glucose release
Resistant starch	Food fiber
Highly branched starch	Paper coating
Highly branched amylopectin cluster	Slow glucose release

Source: Carbohydrate Polymers, 2012

The variety of clean label modified starches and their applications are shown here. Of particular note is the thermoreversible starch gel, which can be used as a gelatin or fat replacer.

Opportunities and Limitations of Natural Antimicrobials

The primary function of food antimicrobials is food safety; the secondary function is shelflife extension. "In order to be effective as an antimicrobial," explained Kathleen Glass, Ph.D., Associate Director of the Food Research Institute at University of Wisconsin—Madison, "several factors need consideration."

"Concentration of active compounds, antimicrobial solubility, dissociation constant, food composition (e.g., fat, moisture, hydrophobic proteins, free iron, pH, salt, water activity), synergistic effects between antimicrobials, processing, cooling, and storage temperature and times all affect antimicrobial effectiveness," Glass continued.

A key characteristic of antimicrobials is amphiphilcity. An amphiphilic antimicrobial is partially lipophilic, with ability to pass through cell membranes; and it is also partially hydrophilic and, thus, is soluble in the aqueous phase. Sodium chloride is a conventional antimicrobial that reduces available water. Others include organic acids and their salts, such as lactate, acetate, diacetate and antimycotics (both acid and salt forms), like sorbate, benzoate and propionate. Nitrite, phosphates and some antioxidants are also included.

To be considered a "natural antimicrobial," it is generally understood that the compound must be naturally occurring or directly extracted using simple methods, chemical reactions or naturally occurring biological process. No petrochemicals or genetic engineering can be used, explained Glass. No processing could be used that would not be done in a home kitchen. Antimicrobials from natural sources include microbial, plant or animal sourced compounds.

Microbial sources include fermentation byproducts like organic acids and other primary metabolites, such as bacteriocins like nisin; competitive cultures, bacteriophages and natamycin (pimaricin); and minerals and gases, like sodium chloride and 100% CO2 or CO. Plant sources include spices, extracts, essential oils, oleoresins, natural wood-smoke components, natural nitrate or nitrite and fatty acids. Animal sources include lysozyme, chitosan, lactoferrin and milk lactoperoxidase.

Fermentates are commercially available, proprietary ingredients that are derived from culturing sugar or milk and spray-dried. Often, they are blends of organic acids like lactic, propionic and acetic. These may or may not contain bacteriocin activity, and their byproducts depend on what starter cultures are used (for example, *Propionibacterium*, *Lactococcus*, *Pediococcus*, etc.). The substrate and controls, such as temperature, oxygen and nutrient availability, also help determine the fermentation byproducts.

Organic acids in their undissociated form enter the cell, lowering its internal pH, denature proteins, disrupt proton motive force, inhibit membrane transport and starve cells.

Clean Label Antimicrobial Alternatives

E Number	Common Name	Clean Label Version
E260	Acetic acid	Vinegar
E280	Propionic acid	Culture sugar/dairy solids
E270	Lactic acid	Culture sugar/dairy solids
E234	Nisin (bacteriocins)	Culture sugar/dairy solids
E300	Ascorbic acid	Cherry powder
E392	Extracts of rosemary	Rosemary
E1105	Lysozyme	Egg white
E250	Sodium nitrite	Cultured vegetable juice
E251	Sodium nitrite	Celery, spinach

Source: Food Research Institute

Natural antimicrobials can often be labeled with common household names, meeting consumer demand for clean labels, yet enhancing the safety of foods.

Chelating metal ions can cause sub-lethal injury to pathogens and enhance efficacy of other antimicrobials.

Organic acids and salts have optimized efficacy with lower pH values (<5.5, near pKa) and lower temperatures (4 vs. 7 or 10°C)—except when the pH is <4.6; then, combined stress with higher temperatures increases inactivation rate. Combining with other antimicrobials also optimizes efficacy.

Bacteriocins are polypeptides that inhibit other closely related species. They are the byproducts of lactic acid bacteria fermentation such as nisin, pediocin and reuterin. Active against Gram-positive bacteria, they bind to receptors, which affects pore formation, causing leakage of molecules and cell death of pathogens. Bacteriocins are bacteriocidal but have some disadvantages. Bacteriocins may be inactivated by proteolytic enzymes in raw foods, and some microbes have developed resistance. Additionally, they are less effective in high-fat foods, and they also may inhibit beneficial competitive microflora. Bacteriocins work best in low-fat foods, with pH <6, and in combination with other antimicrobials.

Plant extracts, spices and glycerides used as antimicrobials are native compounds that protect the plant. They can be extracted with water or ethanol and concentrated. Common plant extracts used in foods that provide flavor and antimicrobial activity include cinnamon, thyme, mustard, cloves and oregano. Antioxidants commonly used in foods that also provide antimicrobial activity include dried plum, rosemary, tocopherol, (vitamin E) and ascorbate (vitamin C). Disadvantages of plant extracts include variability due to variety, extraction methods and agricultural practices. They can also partition into the fat phase, which tends to make them less effective and also may impart strong odor, flavor or color. There may be unknown toxicological effects at higher concentrations. Activity may also decrease after heating some extracts.

Clean label antimicrobials can be applied to a wide variety of foods. Typically, they are ingredients familiar to consumers yet can enhance the safety of foods. Optimization of ingredients can reduce usage levels, improve sensory attributes and be cost-effective.

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When Natural Isn't Good for You: Managing Food Safety, Litigation & Regulatory Risk

What is clean labeling? There is no uniform definition, but in part, clean labeling is a response to consumers' lack of knowledge regarding food science and safety. "Clean labels" tend to involve: 1) reducing the number of ingredients generally; 2) eliminating "chemical-sounding"

Xanthan gum was used as an example of the subjective nature of the term "natural."

ingredients; and 3) implying "natural" without necessarily using that term.

Clearly, there is pressure on industry from consumers and advocacy groups for labels with pronounceable words. "The exception is if the ingredient is 'hip' and sounds natural; for example, 'açai' where the pronunciation gets a pass," explained Anthony Pavel of Morgan, Lewis & Bockius LLP.

Clean label is a subjective term influenced by consumers' lack of knowledge or misunderstanding of ingredients, said Pavel. Take, for example, xanthan gum. Xanthan gum is the product of fermentation of sugars and, depending on the production technique, can be considered a "natural" ingredient. Nonetheless, there has been some level of reformulation to remove xanthan gum, because it sounds artificial. However, xanthan gum ironically assists in the formulation of gluten-free baked goods, another consumer trend based at least somewhat upon misunderstanding.

Consumers are also interested in good prices; however, many are willing to pay a premium for organic and "natural" products. Taste, texture, healthfulness, good shelflife—yet minimal processing and safety—are all desirable properties.

Labels also must comply with FDA and FSIS requirements. For example, ingredients are still required to be listed by the common and usual name, unless a regulation provides for a different term. Sugar is still sugar; high-fructose corn syrup is not simply "corn syrup." Exemptions to listing are limited in number and include incidental additives and processing aids that are present at insignificant levels with no function in the finished product. An insignificant level is not clearly defined, except with sulfites; they are considered to be incidental only if present at less than 10ppm.

Ingredients many consider to be "natural" and organic have some overlap, but not always. For example, the USDA's National List of organic ingredients currently allows ammonium bicarbonate, calcium hydroxide, potassium carbonate, tetrasodium pyrophosphate and xanthan gum in certain organic products, even though they likely wouldn't be considered "clean label" ingredients.

Pavel stressed that when reformulating to create a clean label product, safety should be the number one concern. Formulation changes that affect shelflife and stability need to be validated and reviewed in the context of final labeling. For preservatives, there are not always effective clean label alternatives.

"Labels must be truthful and accurate, not misleading or false in any way. Omission of material facts can be misleading. FDA places a big emphasis on front-of-package claims, and FTC has increased scrutiny of foods. Health-related claims are becoming more prevalent in food advertising, and so are being given increased scrutiny," advised Pavel. Statements that claim to treat or prevent disease are a big target, he added.

Specific food additives are also under attack by consumer pressure groups. For example, CSPI has a Food Additives mobile app which warns consumers about ingredients. The app warns that caramel coloring may sound innocent, but may made with ammonia, sulfites or both.

All issues discussed here are potential targets. FDA is picking its labeling battles as a result of strained resources. At this point, natural claims are a lower priority than safety issues. A gap has been created by FDA's inaction on developing a definition of "natural," but lawyers in the plaintiffs' bar are filling that gap and suing companies directly over their labeling and marketing claims.

In conclusion, there is a need to respond to consumer demand for clean labels, but reformulation requires a holistic review of safety, shelflife, product attributes and related label claims. Regulatory requirements must still be met, and consumers need to be educated.

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From Walmart to Whole Foods: What Are Shoppers Looking For?

Gone are the days when products like Cool Whip, Tang and Velveeta reign supreme. This is an era where the consumer is king, and food providers must understand what their shoppers desire—and respond accordingly.

"Consumers have been pulling us back from the 'Better Food through Chemistry' path over and over and over again," explained Linda Gilbert, CEO and founder of EcoFocus Worldwide. "Now, consumer perception is the reality of the marketplace that we need to deal with....The consumer has become the voice, not the audience."

Gilbert's presentation focused on how stores use private label brands to enter the clean food category in response to their shoppers' interests and concerns. "It's important to look at consumers through the lens of where they shop, or through the lens of what they're expecting through your particular brand."

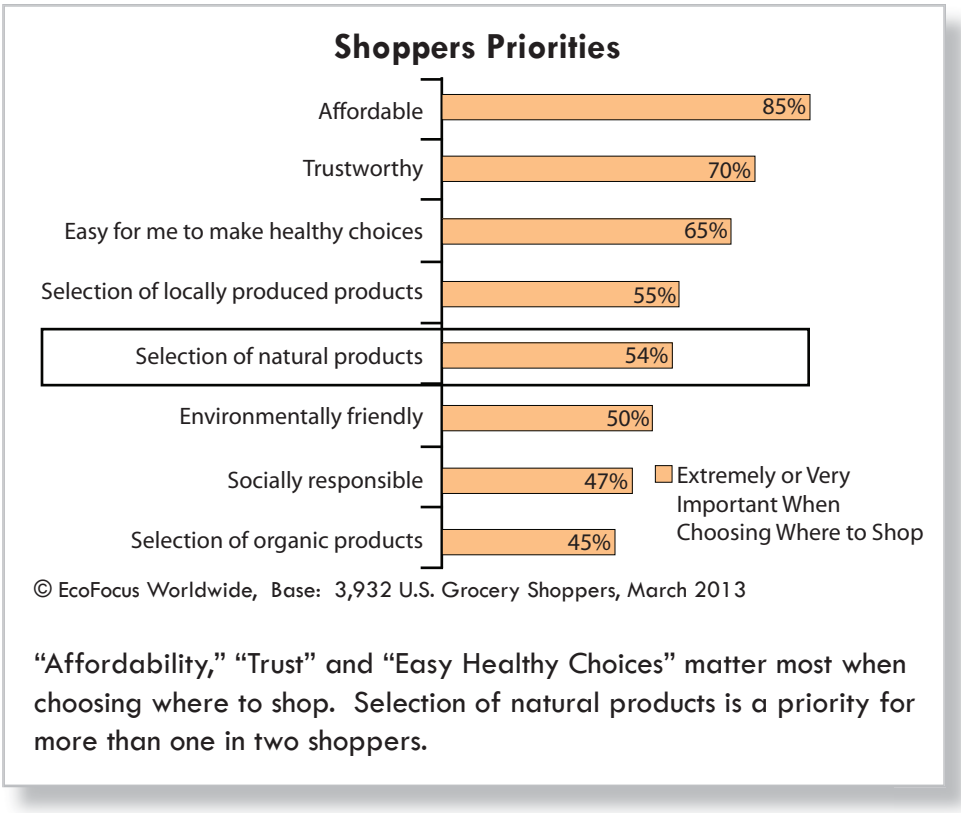
Growth in private label brands is outpacing national brands, Gilbert said, and store brands are no longer mimicking national ones, but instead are focusing on innovative, clean label products and packaging lines of their own. In turn, this is differentiating retailers in the marketplace, as well as increasing shopper loyalty and profitability.

When EcoFocus asked consumers what goes into their decision about where they're going to shop, Gilbert said, "It's no surprise, given the economics today that affordability is at the top of the list." But, what may come as a surprise is the fact that more than half of respondents (54%) said that the selection of natural products is either extremely important or very important to them. That's right up there with healthy options (65%), local product selection (55%), organic product selection (45%), and if the store is environmentally friendly (50%) and socially responsible (47%).

Digging deeper, EcoFocus separated the results by retailer and also asked those shoppers if they felt the retailer had a wide selection of natural products. At the top of the list, 80% of Whole Foods shoppers think a wide selection of natural products is important to them, and 82% said the store offered a wide selection. Trader Joe's had similar results at 74 and 77%, respectively.

But, other retailers on the list didn't have the same luck, as large gaps appeared between the numbers. Natural products are important to Costco, Sam's Club and Target shoppers, for instance (at 66, 62 and 67%), but only 35, 35 and 33% of their shoppers think the stores have the wide selection they want.

"A lot of consumers are looking for that wide selection of products," Gilbert said, "but there's often a gap



"Affordability," "Trust" and "Easy Healthy Choices" matter most when choosing where to shop. Selection of natural products is a priority for more than one in two shoppers.

between what the store is doing for them and where consumers see the importance being."

EcoFocus' research also delved into retail customers' priorities within the clean label category. The highest priority among Target shoppers, for instance, is "no artificial ingredients," and another high concern is GMOs. That's why Target has their Simply Balanced brand, which excludes 105 common, artificial ingredients and many products with GMOs.

As opposed to the Target example, Walmart shoppers place higher priority on healthy choices (65%) than natural choices (55%). "So, it makes a lot of sense that the Great Value products emphasize lower sodium, fat and sugar…more than talking about avoiding preservatives, artificial flavors or things of that sort," Gilbert said.

Both Target and Walmart have made pledges to their shoppers to increase loyalty and deliver the products they want. In Target's case, the promise is to eliminate GMOs from the Simply Balanced line by 2014. In Walmart's case, it is to reduce sodium and sugars in Great Value products by 2015, plus decrease fruit and vegetable prices.

Gilbert went on to describe very similar efforts from Costco, Kroger's, Wegmans, Publix, Whole Foods, Trader Joe's, A&P and Safeway with their private label products. "These brands are accounting for almost 25% of store revenues at some of these retailers today."

These private labels have become so successful that Gilbert said they may start becoming retail brands themselves. Publix has done this very thing with its Greenwise line and subsequent Greenwise Markets. "So, if you're a CPG manufacturer, you better wake up and look at what's going on," Gilbert urged.

The amount of variables within the clean label trend continues to grow, as customers' desires evolve, and Gilbert said that has led to an evolution among providers. They are marrying the concepts of clean, natural and organic with others, such as sustainable, local, environmentally conscious and socially responsible. This is affecting everything, from the ingredients in the food and where it comes from to its packaging materials and easy-to-understand labels.

"There is no single clean label consumer out there," Gilbert began. "It can even vary from category to category. What they expect from a cereal may be different from a snack. So, you need to understand those nuances in order to provide products that are going to have a long life of success with consumers."

Linda Gilbert, CEO and founder of EcoFocus Worlwide, Linda@ecofocusworldwide.com or +1.727.906.3319

Bringing Culinology to Clean Label Development – How and Why it Matters

In his presentation, Mark Crowell, Principal Culinologist at CuliNex, said, "We are Culinologists, blending the art and science of industrial food production." He further stated that the products CuliNex creates "must be safe, taste great and meet all specifications and regulatory requirements."

When discussing clean label products, Crowell maintained that clean label raises the bar, because it requires reliance on fewer ingredients; fewer processing aids; and ancillary category requirements.

Products fail, said Crowell, for a few reasons, including poor planning, poor management, poor conception and poor execution.

In the planning stage, it is important to have a good company strategy; built-in competencies; well-planned distribution strategies; and good market and investment analysis. Good management includes having clear goals and what Crowell terms "product champions" on staff.

The concept stage of developing a clean label product must take consumer benefit into consideration; timing and positioning are also crucial. Execution involves having a sales plan, good retailer support, advertising, price, timing and a product promise.

Having a "product promise" consists of the product's taste, texture and appearance—but it also must take packaging and shelflife issues into account.

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Efforts to give bread a plum-purple shade by using colors derived from natural anthocyanins proved a challenge; they have poor heat stability.

The issues of digestion, energy and satiety are important. This requires culinary creativity, as well as knowledge of natural ingredient functionality and careful commercialization, so one is sure to attract the right audience/consumer.

For his first case study, Crowell used "creative concepting," which he called the "first step to successful product manufacturing," to showcase Koochikoo Cookies. These sugar-free cookies were designed to appeal to kids and moms wanting healthier choices. The concept was for a "cheerful chocolatey chip" cookie that was made with "monk fruit and rich, bittersweet chocolate chips that stud a crispy, brown sugar-flavored, whole-wheat cookie."

By having a defined process for generating ideas, Culinex was able to consider a broad array of creative approaches to the cookie's flavor, texture, appearance, positioning and formulation.

The second case study showcased how to understand and use clean label ingredients; the item used to demonstrate this was Sunsweet Plum Amazins Bread. With 60% of the U.S. prune market, Sunsweet's bread is the "first branded bakery initiative for them," said Crowell.

As part of the product's brand identity, Sunsweet asked Culinex to make the bread a pleasing shade of plum-purple. Said Crowell: "We determined we could do this using purple wheat and purple corn. However, what we could not seem to do was make it a pleasing purple color. We had purple-gray. This turned out to be a considerable challenge, since all natural purple colors are derived from anthocyanins that have poor heat stability. We were not able to solve this problem until we had a thorough understanding of ingredient functionality and had tested every one of our natural color options through more than 150 experiments. If we knew how hard it was going to be, we would have engaged outside experts sooner and studied the chemistry more closely."

In the third case study, Whole Foods' Salmon Burger, the goal was to "Keep the Gold Standard Gold." Whole Foods' management wanted to outsource production of their Salmon burger to simplify in-store operations. The existing product, made fresh in each store, was the Gold Standard. It had to be matched by a frozen, manufactured item.

"Our goal was to figure out how to do this while achieving an 8-month frozen shelflife with commercially available ingredients. It took a combination of careful product specifications for the raw materials (including the salmon); a custom seasoning blend; natural colors; carrageenan to improve mouthfeel and bind-free water and rosemary extract to aid oxidative stability. The product was very successful and eventually was rolled out to other regions of the country.

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Going *Au Naturel*: Coloring Considerations

Neither FDA nor the EU has a legal definition of "natural" colorants; however, consumers and marketing departments seem to have a clear concept, wryly noted Ronald Wrolstad, Ph.D., Distinguished Professor of Food Science Emeritus, Oregon State University. FDA classifies colors as either certified, synthetic FD&C food dyes or as color additives for food use that are exempt from certification. Most of those exempt from certification are naturally derived.

"The Southampton Study several years ago that assessed the effects of synthetic food colorant consumption on 3-year-old and 8-to-9-year-old children's hyperactivity levels concluded that the Global Hyperactivity Aggregate (GHA) score was higher due to synthetic color consumption. However, the FDA took no action, and the EFSA concluded that the Acceptable Daily Intake should not be changed. Yet, partially due to that study, global sales of 'natural' colorants have overtaken artificial," said Wrolstad.

While providing cleaner labels and health benefits, there are obstacles to using "natural" colorants. Typically less stable to heat, light and oxygen, they may also react with other components in formulations producing undesirable flavors and colors. All desired hues may not be possible, and natural colors are more costly.

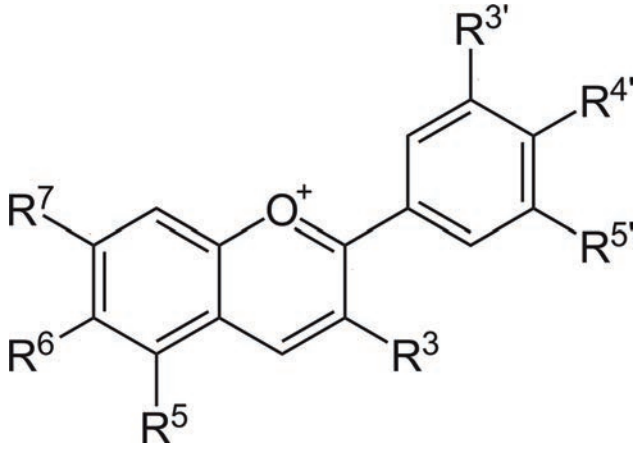
"The ideal natural colorant," explained Wrolstad, would be permitted for use in all markets and have no negative impact on product appearance or flavor. Also desired are no changes to nutritional profile, shelflife or stability; or to the manufacturing process, packaging or ingredient cost. In the real world, there is no global consensus on regulations. When replacing synthetic colors with natural ones, matching appearance is challenging, he added. Flavor profiles often change, and color is usually less stable—often causing processing and packaging changes and cost increases.

Alternatives to artificial dyes include anthocyanin-based colorants. In the U.S., these include fruit and vegetable juices and have an E163 designation in Europe. Structure variation of a compound impacts hue and stability. They are reddish in acidic solutions and more purple nearer a neutral pH. Betalain pigments are prominent in beet powder and beet juice. They have been found suitable for frozen desserts, for example.

Cochineal and carmine, which are extracts of insects (*Dactylopius coccus*), are extremely stable to light, heat and oxidation, but they are more expensive and are non-kosher. Tomato lycopene extract is water-insoluble, available in oleoresins, powders and water-dispersible preparations. Tomato lycopene extracts range from yellow to orange to red hues and are stable through a broad pH range, but are also susceptible to oxidation.

Carotenoids provide natural yellow and orange hues. They are lipid-soluble and susceptible to oxidation. Annatto is available in water- and lipid-dispersible preparations and provides yellow to orange colorings. Turmeric is a spice-giving characteristic color and flavor to mustard, pickles and curry powder. It is unstable to light and susceptible to oxidation. Clinical research has looked at tumeric's potential health benefits in kidney and car-

Basic Chemical Structure of Anthyocyanins



Source: Wikipedia

The color of anthocyanins change with pH. They are reddish in acidic solutions, purple in neutral solutions and greenish-yellow at pHs above 7.

diovascular diseases, certain cancers and arthritis, among other health conditions. (See http://ow.ly/stpFa.)

Saffron provides an intense yellow pigment. It is derived from the stigma of *Crocus sativus* flowers and is relatively stable to light and heat, but it is very expensive, warned Wrolstad.

For green hues, chlorophyll [sodium copper chlorophyllin] is approved in the U.S. for citrus-based, dry-mix beverages but is used widely in the EU.

When it comes to blues, there are limited options. Spirulina extract is the blue water extract of cyanobacteria of the *Arthrospira* genus and has been approved for confections and chewing gum. Caramel colorants are generally manufactured via the Maillard reaction. They are water-soluble and range from amber to reddish-brown to dark brown. Preparations are available for soft drinks and alcoholic beverages. Carbon black has been delisted in the U.S., but is permitted in the EU. Titanium dioxide is a permitted whitening agent in confectionary, baked goods and dairy products.

Differences may occur between suppliers. A colorant can vary in price, purity, tinctorial strength, shade, the presence of unwanted flavors, stability to heat and light, tendency to precipitate and suitability for individual applications. On the horizon are new sources of edible plants with high pigment content, desirable hues and good stability.

Ronald Wrolstad, Ph.D., Distinguished Professor of Food Science Emeritus, Oregon State University, http://oregonstate.edu/foodsci/

Taste Physiology and Considerations in Sweetener Choices

When it comes to making foods sweeter in a "clean label way," there are ways to do it naturally and simply, besides using sugar. Some approaches take advantage of the connection between taste and smell. The trigeminal nerve is found in the face (rather than the nose). It responds to irritants, like tingling and numbing, as well as temperature differences.

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Cross-modal correspondence can enhance sweetness. The brain processes information from different senses to form multisensory experiences. For example, smells, other tastes, trigeminal sensations, sights (like colors) and sound all influence taste.

"The trigeminal sensation can also be used for sweetness enhancement, as can all of the other senses," said Alex Woo, Managing Director of W2O Food Innovation, as he discussed recent technologies in clean labeling sweetness enhancement.

Natural high-potency sweeteners, such as stevia and monk fruit extract, offer solutions in reduced-sugar or sugar-free applications. When using these sweeteners, a bulk sweetener is also sometimes needed, such as natural non-/low-caloric erythritol, which helps achieve maximum sweetness, yet with minimal off-flavors and low cost, suggested Woo.

Stevia extract, which is labeled as such, is commonly used and has multiple suppliers. It is "natural," non-caloric, has GRAS status with no FDA objection letter, is 200-400 times sweeter than sugar, stable to heat and a pH over 3, is non-GMO; and certifications for kosher and halal are available. Monk Fruit extract is also non-caloric and is GRAS with no FDA objection letter. It is not yet approved in the EU. Monk fruit extract, not quite as common yet, is 150-200 times sweeter than sugar, heat-stable, non-GMO, kosher-certified and is labeled as "monk fruit extract."

"Monatin" is a unique, natural amino acid that has recently emerged, but, as yet, is not approved anywhere. It is extracted from a South African plant, *Sclerochiton ilicifolius* root. It is 3,000 times sweeter than sugar with a unique temporal profile. Monatin has a quick sweetness on-set and no lingering, bitter, metallic or astringent aftertaste.

Woo went on to explain that erythritol has multiple suppliers, is found in fruits and vegetables, and is the only natural polyol made by fermentation. It also has the highest digestive tolerance among all polyols. Non-caloric, it is non-GMO-possible, 65% as sweet as sugar and has a 3.5% limit in beverages in the U.S. However, not all consider erythritol a clean label solution.

"When 'natural' is not enough," Woo gave examples for sweetener enhancement that could result in shorter label declarations. He explained how to use "cross-modal correspondences" to enhance sweetness. The brain processes information from different senses to form multisensory experiences in people's daily lives; therefore, smell, tastes other than sweetness, sights, sounds and trigeminal sensations can all influence the perception of sweetness. Although sweetness is detected in the mouth, there is also interaction between olfaction and gustation. Retronasal "sweet" aromas sensed in the nose increase the sweet perception in the mouth. Many sweet taste modulators are legally labeled as "natural flavors," thus result in more consumer-friendly labels.

Woo referenced work by Professor Tepper at Rutgers University, who is investigating molecular biology as a way to "trick" the taste buds. "This approach is novel in the food industry," stated Woo, "but it is the way of the future." For example, fresh tomato aroma makes tomato sauce taste sweeter. Sugar distillates enhance beverage sweetness. Vanilla, below and above threshold, enhances sweetness, according to various reports.

Some FDA GRAS, natural, high-potency sweeteners are approved under FEMA GRAS as "natural flavor," when they are used at very low levels, as sweetness and/or flavor enhancers. Examples include thaumatin and monk fruit extract. Woo explained trigeminal-on-taste "intramodal" sweetness enhancement using the examples of carbonation, a trigeminal pain agent, which can make artificial high-potency sweeteners taste more like sugar. It is labeled as "carbonated water." Beverages formulated with high-potency sweeteners have also shown in panels to taste sweeter at higher temperatures.

Some studies have shown that the shape of a food, specifically a more rounded shape—as in oranges or apples—tends to be associated with sweeter stimuli. For example, round chocolates were found to taste sweeter than other shapes. Research has found that color influences sweetness as well. Strawberry mousse was sweeter and more liked on a white plate than on a black plate. Hot chocolate tasted sweeter and had more aroma in a dark cream cup than in a white or red cup–"Why? I don't know," smiled Woo.

Clean label, reduced-sugar foods and beverages with high-potency and bulk sweeteners can be made even sweeter with cross-modal correspondences. Woo concluded: "As Ernest Starling, 1866–1927, Nobel Prize winner and discoverer of the first hormone put it: 'The physiology of today is the medicine of tomorrow.'"

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A Food Scientist's Approach to Working with Organics

Organic consumers show a wide spectrum of behaviors, said Sharon Herzog, Director of R&D, Country Choice Organics. One category, which comprises less than 10% of American organic buyers, is the "true natural:" those with a "faith-based belief system" and who are "committed to organic and prioritizes health and environment over price, convenience or taste." A second type, composed of the "health seeker," encompasses approximately 20-25% of households. These consumers are "faith-based decision makers" who are "committed to personal/family well-being, but are not willing to sacrifice taste or convenience for a health benefit."

Some of the most prominent drivers of the organic movement include consumer awareness of the link between nutrition and health, and the desire to avoid pesticides, herbicides, GMOs and trans fats. Further drivers include concerns for the environment and an interest in sustainability.

Her unique Product Development Toolbox for organic products addressed regulatory compliance, knowledge of ingredients, and their functionality processing and packaging. The process of developing organic products is heavily influenced by the percent of organic components in the final product; additional certifications required; any retail requirements; and/or internal company requirements.

For example, which ingredients can be used and what claims can be made depends on whether the finished product contains 100%, 95% or more, at least 70%, or less than 70% organic material in the final product (not counting its water and salt content). Please see http://ow.ly/sC1OI.

Permitted ingredients are also determined by the National List of Allowed and Prohibited Substances (which can change rapidly and for which there is a Sunset Process—all ingredients are reviewed at least every five years); the availability of a non-organic ingredient declaration; an ingredient's commercial availability; and certain other certification requirements.

Some non-organic, agricultural substances are allowed, because they are not commercially available.

Herzog discussed the challenges surrounding ingredient functionality by using emulsifiers as one example. For the conventional emulsifiers mono- and di-glycerides, organic substitutions could be lecithin, rice bran or oat fiber. When it comes to lecithin, the form is also important. The liquid form must be organic, since it is commercially available. However, non-organic, de-oiled, powdered lecithin is allowed for use in certain organic products—since this form is not considered commercial availability.

When a humectant or moisture control is needed, HFCS is a conventional choice, said Herzog. Organic replacements might be brown rice, cane, tapioca or oat syrups. There are considerations in product scale-up with organic ingredients. For example, organic sugar generally has not had all molasses removed, and clumping can be an issue.

In regards to antioxidants, conventional choices include TBHQ/BHA, whereas alternatives for organic products could be tocopherols and/or use of ascorbic acid, nitrogen, high-oleic oils and cinnamon.

Turning to flavors, Herzog noted that natural flavorings can be used, but one must dig deeper than that for their use in organic products. For example, carriers in a flavoring cannot be synthetics (e.g., propylene glycol, polyglycerol esters of fatty acids, mono- and di-glycerides or polysorbate 80); and no synthetic preservatives are allowed (benzoic acid, BHT/BHA). During its processing, certain solvents are allowed (e.g., water, natural ethanol, super-critical CO2, essential oils, natural vegetable oils), but not hydrocarbon solvents.

Herzog ended her presentation by noting that at her first natural products show, an organic product retailer said "Sharon, we'll never have to apologize for what we do" and noted that she does feel really good about the industry.

Sharon Herzog, Director of R&D, Country Choice Organics, www.countrychoiceorganic.com

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