

2018 CLEAN LABEL CONFERENCE

“SOPHISTICATED SOLUTIONS FOR SIMPLIFIED PRODUCTS”



What's Inside on Clean Labels...

- Consumer Views: What Should be in Foods
- Ingredient Labeling, Consumers & Regulatory Risk
- Controlling Lipid Oxidation
- Properties of Label-friendly Dairy Ingredients
- Ancient Grains: Cultural Use, Properties
- Microbial Control: Pathogens are the Easy Part
- Top Ingredient Trends & Health Consciousness
- The Cost of Clean Label: Supply Chain
- Natural Colorants: Challenges, Opportunities
- Sugar Replacement, Reduction, Reformulation

Note: This digital magazine, initially posted at <https://globalFoodForums.com>, is now at <https://foodtrendsnotech.com/global-food-forums-magazines/>



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2018 CLEAN LABEL CONFERENCE MAGAZINE

Sophisticated Solutions for Simplified Products

Global Food Forums is pleased to announce a successful Clean Label Conference (held March 26-28 in Itasca, Ill., USA). This annual conference's tagline, "Sophisticated Solutions for Simplified Products," articulates our belief that it is the food technologists that use sophisticated science who will provide most answers to the challenge of simplifying product labels.

Some 31 presentations, a cadre of ingredient exhibitors and the addition of a Pre-conference Texture Workshop by Ingredion provided useful and insightful information for well over 200 attendees.

Presentations and a digital copy of this magazine are available for download at www.GlobalFoodForums.com/store/clean-label-conference. We'd love to see you at the 2019 Clean Label Conference on March 26-27, at the Westin hotel, Itasca, Ill., USA.



SOURCE: GLOBAL FOOD FORUMS INC., 2018 CLEAN LABEL CONFERENCE

👤 **Clean Label Conference attendees listen and learn while Elizabeth Sloan, Ph.D., president of Sloan Trends, Inc., discusses the value of transparency in the marketplace.**

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The Global Food Forums Story

Welcome to the 5th post-conference magazine from our annual Clean Label Conference. When we incorporated Global Food Forums in 2012, our vision was to develop a family of in-person, niche product development conferences for the food, beverage and nutritional products industries

Each of our events, which also includes the Protein Trends & Technologies Seminars (<https://bit.ly/2xYcJgX>) and Sweetener Systems Conferences (<https://bit.ly/2LFjN3Q>), is tied to a significant, long-term consumer and industry trend in which applied food science plays a crucial role. The technology-based programs are designed to provide R&D and other food scientists with practical and impartial formulation

advice, along with consumer trend insights, emerging ingredients, nutritional and regulatory updates, and other factors impacting product formulations.

Food technologists are our core customers. All our company decisions are guided by how they impact this community's event experience. To date, our conferences have drawn more than 2,900 attendees. They range from bench-level food scientists to VP/Directors of R&D, and also include those who interact with this technical community to better understand their needs, challenges and the changing business environment.

We hope you'll attend some of our future events. We'll work hard to make them your best conference experiences ever!



Warm regards,
**Peter Havens &
Claudia O'Donnell**
Co-owners, Global Food Forums, Inc.

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For an inside look at the team, visit: www.globalfoodforums.com/about-us/gff-team/

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Consumers' Focus on Health and Wellness Drives Clean Label Demand

Consumers are very passionate about clean label issues, and clean label category segments are growing much faster than their traditional counterparts. Untapped clean label opportunities exist in various fresh and packaged-foods categories, such as frozen pizza, luncheon meats, salad dressing, sweet goods and more.

“According to the latest Nielsen data, at least half of consumers (53%) feel that keeping the bad stuff out of food is more important than adding the good stuff,” explained A. Elizabeth Sloan, Ph.D., President, Sloan Trends, Inc. After bacteria, the top food safety consumer issues are carcinogens and chemicals in their food. These fears outpaced concerns over antibiotics, biotech/GMOs and allergens. In 2017, 52% of consumers said they preferred foods and beverages with no artificial additives—an all-time high—and 43% of consumers stopped buying a food because of a negative story on food chemicals.

At the end of 2017, one-third of all foods and beverages were clean label, and half of all shopping trips included a clean label item. In the “Diet and Nutrition” category, only 40% of products are clean label, indicating significant opportunity for category growth.

Sloan offered other insights. For example, clean label is now the second-most desired attribute in the beverage category for 2018. New Age beverages posted the highest absolute dollar growth for the year ending 12/09/2017, followed by healthy snacks, deli dip, health care nutritionals, crackers and frozen novelties.

Frozen products have the highest incidence of “free from” claims. Millennials are driving the growth in the frozen category, with 43% of this age demographic purchasing more frozen foods in 2017. Pizza is a \$24 billion business, but only 5% of this category is clean label, Sloan noted. However, last year almost one-third of all dinners were prepared outside the home. The fastest growing segment of the foodservice market is prepared fresh foods in supermarkets.

After hormone-/antibiotic-free, consumers would like to see MSG-, sulfite- and phosphate-free claims more often on their label, per Mintel.

According to the latest Euromonitor data, the global packaged food clean label market is estimated at \$193 billion vs. \$76 billion in the U.S. “Growth of health and wellness foods is actually stronger in developing countries than in developed countries,” said Sloan.

Shifts in health and wellness behaviors are driving new opportunities given the mega-trends outlined below, according to IRI:



■ Consumers are increasingly focused on health and nutrition because they have children; are getting older and/or have a health condition; or are feeling tired/run-down.

- Consumers are purchasing for benefit as opposed to form or brand. For example, one-third of households are living a high-protein lifestyle (note, the percentage outlook for more protein is actually 60%) and seeking more dietary protein, which can come from a variety of products including bars, cereal or snacks.

- Instant Nutritionals were the seventh-fastest growing category in the U.S. In 2016, bars, beverages, meal replacements and adult nutritional products offered clean label opportunity.

- Customers are now worried that they are not getting enough “specialty food ingredients,” such as probiotics, botanicals or

Consumers Shift to More Healthful Ingredients

- 53% are excluding unwanted ingredients, but more important is the increase in adding beneficial ingredients (2018)
- 52% prefer foods and beverages with no artificial additives (all-time high)
- 43% stopped buying a food because of a negative story on food chemicals
- 53% are buying more organic foods and beverages than ever (\$43b market 2017) +10%
- \$ growth of the following claims:
 - o Free of additives/artificial ingredients +8%
 - o All-natural +8%
 - o No artificial colors +6%
 - o Nothing artificial +4%
- 60% bought at least some natural food or beverage every month (2017)

Source: Packaged Facts, Organic & Clean Label, 2018; IFIC, Food & Health Survey, 2017; FMI, US Grocery Shopper Trends, 2017; Nielsen, Y/E 5/20/17, 2018 CLEAN LABEL CONFERENCE



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superfoods vs. one in five who are concerned about not getting enough basic nutrients.

- There has been a reorientation of top health concerns in the U.S. by age. The top concern used to be “heart disease,” but now “retaining mental sharpness as I age” tops the list.

- There is a new demographic of “fit” consumers who exercise at least three days a week. These consumers are seeking products that deliver stronger muscles, as well as brain health, and are forcing the \$42 billion sports nutrition market to move mainstream.

- In addition to foods, there’s also demand for more natural ingredients in over-the-counter drugs, which are also mimicking many food properties (e.g., flavor and foods forms as liquids or candy).

- There is an opportunity to provide a healthier halo for many food products by embracing processing techniques that improve the nutritional quality of their foods or position them as less processed (e.g., cold milled, fermented or use of high-pressure pasteurization). Fairlife Ultra filtered Milk is one example, which is now the fastest growing among the top 10 milk brands in the U.S.

- Kid-specific products are a \$41 billion business. Parents are starting to prefer clean label, kid-specific foods, including toaster pastries, snack cakes and frozen pizza.

- There is growth in alternative plant-based snacks and beverages. Eight in 10 would purchase more plant-based snacks if they were fortified.

The primary reasons that people more actively embrace health and nutrition are because they have kids at home; they’re getting older; have a new condition; or are feeling tired/rundown, Sloan continued. And, while trends in more healthful, clean label products are on the rise, many untapped opportunities for new product development exist in a wide range of food and beverage categories.

“You are What You Eat: New and Emerging Consumer Views of What Should be in Food,” A. Elizabeth Sloan, Ph.D., President, Sloan Trends, Inc.

NOTE: For data attribution, see Sloan’s presentation at: <https://bit.ly/2tzVn16>

Ingredient Labeling, Regulatory Risk & Consumer Confidence

In dealing with clean food and beverage package labels, “we are really dealing with consumer perceptions,” said Lauren Swann, MS, RD, LDN, President of Concept Nutrition, Inc. This, she proposes, spells opportunity.



❗ **When fruit and vegetable juice is used as a color additive in food, it may be declared as “Artificial Color,” “Artificial Color Added” or “Color Added;” or by an equally informative term that makes clear that a color additive has been used in the food, such as “Colored with Fruit Juice” or “Vegetable Juice Color.”**

There is no (U.S.) government designation for what constitutes a “clean” ingredient-labeled food or beverage, but there are regulations that determine how ingredients can be listed on a package. According to the FDA, ingredient listings must use: only official or acceptable names; no trademark or brand names; no “fanciful” names; no descriptors, such as “pure,” “non-GMO,” “real,” etc.; and no geographic names, unless they are part of the common name. However, botanical origin names (e.g., cane sugar) are acceptable. And, some approved designations allow a modicum of variability (e.g., skim milk, nonfat milk). The USDA guidelines for meat and poultry products under its purview differ from those of the FDA, for example, allowing spices to be listed as “flavor,” “flavorings” or “natural flavorings.”

Consumers want ingredient label transparency and equate “healthy” with natural and minimally processed foods. However, although some ingredient label regulations apply to typically clean label products (e.g., organic), progress on other initiatives, such as requests for FDA to define “all-natural” claims, have [so far been] dead in the water, says Swann. “Organic, non-GMO, gluten-free, lactose-free, allergen-free products, and even kosher and halal certification can also be associated with clean labels,” she adds.

Whereas the Federal Trade Commission’s authority over advertising tends to be more reactionary, complying with established

government labeling regulations can be complex and challenging. For example, although the term “fresh” is defined by Federal regulation, pasteurized milk can be optionally claimed as “fresh,” but pasteurized fruit juices cannot. Conversely, although non-governmentally defined terms, such as “authentic, real and simple,” can be found on product packages, caution is warranted. Vague, ill-defined terms shroud clean labels in legal ambiguities that can invite lawsuits, warned Swann.

Larger companies may sometimes have different individuals or departments responsible for developing and reviewing specific parts of food package labels. However, “I advise companies to assign one individual or department to be responsible for label review as a whole rather than in parts, to catch potential inconsistencies,” emphasized Swann, “because mandated ingredient lists must support any relevant claims.”

“I research terms very carefully to identify issues that may be risky for clients,” said Swann, beginning with the Standards of Identity (SOI) in the U.S. Code of Federal Regulations (CFR). These, too, can appear inconsistent or confusing. But, even if there aren’t SOIs specific to a product’s formula, there are still commonly established names from long-standing industry marketplace practices that should be followed, because they represent the type of product composition that the consumer has come to reasonably expect for items bearing that name.

One can get creative to a point, such as listing a preservative’s role “to protect color,” but colors themselves can be highly problematic for “clean” labeling. The FDA views any attempt to use ingredients to affect a product’s final color as artificial.

“Let’s say that you make lemonade and add a tiny drop of cherry juice to turn it pink, yet a cherry taste is not identifiable in the finished product,” explains Swann. The cherry juice may be natural, but the FDA would consider the lemonade to have been artificially colored, because its sole function is color, and the cherry juice must be identified as “color” in the ingredient list, added Swann.

According to the FDA, incidental additives, ingredients introduced by another ingredient or non-functional processing aids can be omitted, unless they are allergenic or contribute significant nutrient value. The USDA, however, is “very fussy about ‘incidental additives’ in meat products,” considering amount and nutrient contributions along with end-product functionality for compliant label approval.

Ultimately, however, it is the consumers that decide what is legitimate. Thanks to the Internet, consumers now have ways of uncovering details about ingredients and share their findings with peers, noted Swann.

“Different consumer demographic segments look for different ingredients,” said Swann. Whereas Baby Boomers try to avoid ingredients viewed as detrimental to aging-related health issues, Millennials have other concerns. This suggests opportunities for more demographic-specific ingredient listings, Swann added.

“We know that ingredient names definitely influence purchase decisions. [One study] found that 73% of consumers polled were willing to pay a high price for products made with ingredients they recognize and trust,” said Swann. They also like to know what those ingredients do in the product. “The bottom line is, whenever you put an ingredient into a food or beverage product, consumers today expect each ingredient to provide some specific value to them,” concluded Swann.

“Ingredient Labeling Considers Regulatory Risk in Capturing Consumer Confidence,” Lauren Swann, MS, RD, LDN, President of Concept Nutrition, Inc.

Clean Label Solutions for Lipid Oxidation Control

The chemistry of lipid oxidation is as complex as the means of defense. “You can get literally hundreds of products that are formed from oxidative reactions,” explained Eric Decker, Ph.D., Professor and Head of the Department of Food Science, University of Massachusetts, Amhurst. Rancidity, off-flavors and loss of nutrients are consequences. Formation of toxic products, such as acrolein, is driving food safety concerns. Oxidation may be controlled by removing oxygen, using metal chelators, adding antioxidants or utilizing physical properties.

One of the most important questions to ask is where do reactions occur in the food? In a bottle of oil, instinct might suggest the addition of a lipid-soluble antioxidant would be most effective.



A_w influences lipid oxidation. A sweet spot exists between limiting molecule mobility and exposing peroxides.



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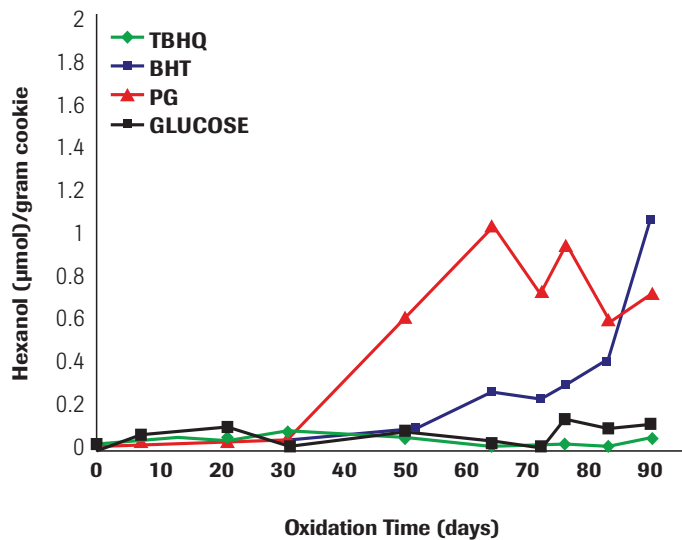


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Glucose Compared to Synthetic Antioxidants



SOURCE: ERIC A. DECKER, UNIVERSITY OF MASSACHUSETTS-AMHERST/2018 CLEAN LABEL CONFERENCE

🧪 **Reducing sugars, such as glucose, can inhibit lipid oxidation by both reducing water activity and inactivating free radicals, thereby extending shelflife. When comparing glucose to synthetic antioxidants in a cookie example, glucose had a similar result to that of TBHQ—the optimum antioxidant for many foods. Maltose and maltodextrin also work, while contributing less sweetness.**

“It [is] the opposite. A polar water-soluble form [is] most effective,” said Decker. This “Antioxidant Paradox” occurs because even refined bulk oils have nano-droplets of water (e.g., 200-250ppm), as well as surfactants that associate into colloids. Oxidation reactions occur at the surface of the water droplets, like water-in-oil emulsions. Polar antioxidants are concentrated inside the water phase, where they are most effective.

“In an oil/water emulsion, the opposite is true. You want a nonpolar antioxidant. The reason for this is where the antioxidant ends up in the food product.” If a water-soluble antioxidant is put in emulsified oil, a large amount of antioxidant will go to the water portion—where it won’t be in a place that it can react with the lipid. Thus, its antioxidant activity is lost.

Tocopherols are nonpolar antioxidants that will degrade as they scavenge free radicals. Mixed tocopherols, a combination of different tocopherol homologs, “[place] antioxidants in a lot of different places in the food matrix, so they can be where the free radicals are produced,” Decker said. The downside is that there isn’t consensus as to whether tocopherols are part of a clean label solution, because of their chemical name.

Rosemary extracts are popular free-radical fighters. Different extraction technologies minimize strongly flavored terpenes and

increase the amount of carnosic acid and carnosol, the main antioxidants. These extracts are versatile, because there are many molecules that have antioxidant activity and different polarity

Green tea antioxidants are in the catechin family. They are extremely water-soluble. These work in bulk oils and frying oils, but the challenge is getting them into the oil through dispersion. Some green tea extracts contain chlorophyll, a pro-oxidant. If they are used in a food that is exposed to light, it can promote oxidation. Decker recommends choosing a green tea extract in which the chlorophyll has been removed or protecting the product from light. Lipid-soluble derivatives are also available, he added.

Because they seek out different physical locations, combinations of antioxidants may be most efficacious. In some cases, an antioxidant that works very well can be regenerated by another antioxidant. Unfortunately, blends complicate the ingredient deck with multiple ingredients.

Manipulating physical properties of the food is a potent deterrent. Lipid oxidation is strongly influenced by water activity, although it’s important to find the sweet spot between limiting molecule mobility and exposing peroxides. “While there are many cases where you want to be at low water activity, this can promote oxidation,” Decker explained.

Adding sugar drops the water activity. In a cookie example, two formulations were compared, one with 1.6% glucose and one with an equal percentage of sucrose. The glucose increased the shelflife compared to the sucrose. “Because glucose is a reducing sugar, it can potentially donate a proton to the free radical and inactivate it,” said Decker. “Compared to synthetic antioxidants, such as TBHQ, BHT and propyl gallate, glucose performs close to TBHQ—the optimum antioxidant for many food products.”

Glucose is also effective in a cracker system, but increased sweetness may not be desired. Maltose and maltodextrin also work, while contributing less sweetness. In going from a monosaccharide to a disaccharide, twice as much of the disaccharide is needed to have the same reducing equivalent. The big takeaway? “Glucose is an overlooked potential means of controlling oxidation,” added Decker. “I think glucose is an interesting antioxidant that I don’t think anyone considers.”

“Clean Label Solutions to Controlling Lipid Oxidation,” Eric Decker, Ph.D., Professor and Head of the Department of Food Science, University of Massachusetts, Amhurst



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Dairy Proteins: Key Functional Properties

Dairy proteins can deliver the following key functional properties in foods:

- **Water binding** is an important function in beverages, bakery, confectionary, soups, meat products, batters, ice creams and custards. Milk protein concentrate (MPC), whey protein concentrate (WPC) and whey protein isolate (WPI) bind water to replace less desirable ingredients in these applications.

- **Gelation and viscosity** are critical to structure in cheese, yogurt and reduced-fat foods. Dairy proteins can form rigid, heat-induced irreversible gels that hold water and fat and provide structural support in these food systems.

- **Heat stability** is critical in extended shelflife beverages. Whey proteins provide superior functionality in beverages with pH below 6, while caseins provide superior heat stability in neutral pH beverages and UHT or retort-processed drinks.

- **Emulsification** is a crucial functionality in ice cream and coffee creamers. Milk proteins and the proteose-peptone fractions of milk can be a good replacement for commercial emulsifiers, such as mono- and diglycerides.

SOURCE: SONIA PATEL, MSC, MIDWEST DAIRY FOODS RESEARCH CENTER, DEPT. OF FOOD SCIENCE AND NUTRITION, UNIVERSITY OF MINNESOTA/2018 CLEAN LABEL CONFERENCE

Dairy Protein Ingredients Offer Functionality and Consumer-Friendly Labels

As part of the clean label trend, consumers are demanding removal of ingredients from food that they perceive as not “clean,” or unhealthy. “Dairy ingredients offer a clean label alternative to ingredients that have landed on a ‘no no’ list. These ingredients can be modified to achieve desired functionality,” said Sonia Patel, Dairy Food Application Scientist, Midwest Dairy Foods Research Center in her presentation, “Label-friendly Dairy Ingredients: Physio-chemical Properties and Uses in Foods & Beverages.”

There is no simple one-for-one replacement of ingredients to achieve a cleaner label. Replacement of food ingredients affect taste, texture, functionality, consumer acceptance and shelflife of food. Before food scientists start reformulating, they need to understand how replacing specific ingredients will affect consumer appeal. Desired functionalities include meltability, water binding, solubility, viscosity, emulsification, heat stability, gelation, whipping, foaming, color development and flavor. Dairy proteins can provide all these functionalities, but whey protein ingredients will exhibit different functional properties than casein or milk protein ingredients.

Whey protein concentrates function as efficient fat mimetics, imparting creaminess and superior texture to soups, sauces and salad dressings. The surface-active properties of WPC, WPI, beta-lactoglobulin and skim milk powders make them excellent foaming and whipping agents in ice cream, frozen desserts and whipped toppings. Through Maillard browning, dairy ingredients provide color development in bakery applications. Dairy ingredients also boost the protein content of gluten-free formulas, noted Patel.

Permeates are a co-product of the production of whey protein concentrate, whey protein isolate, ultra-filtered milk, milk protein concentrate or milk protein isolate processing. Replacing salt in processed foods with permeates can reduce sodium, as well as improve texture, color and flavor. In addition, milk minerals provide a source of readily bioavailable calcium in nutritional supplements, beverages and bars.

As of June 2015, partially hydrogenated oils (PHOs) are no longer GRAS. Patel went on to say that many companies are replacing PHOs with butter, which has unique melting and crystallization properties. Emerging research suggests that consumption of dairy fats and dairy products is linked to reduced risk for heart disease and type 2 diabetes.

The functional properties of dairy ingredients can be modified in many ways. Physical modification can be achieved through heat treatment, acidification, and the addition of mineral salts, homogenization or shear. Enzymatic modification can be affected through hydrolysis, renneting or transglutamination.

A patented process of carbon dioxide treatment and high-pressure processing will cause casein micelles to disassociate, improving Greek yogurt texture without the addition of stabilizers or emulsifiers. This low-cost technology can be easily integrated into existing production lines.

Cavitation is the sudden formation and collapse of low-pressure bubbles in flowing liquids by means of mechanical forces. As liquid passes through the APV Cavitorator, it is subjected to controlled cavitation. Microscopic cavitation bubbles are produced and, as they collapse, shockwaves are given off into the liquid, which can emulsify and prevent scaling. During heating, temperature is created uniformly throughout the entire liquid without any heat transfer surfaces. This technology could potentially smooth Greek yogurt texture and manage viscosity in beverages. Plain yogurt made through cavitation might have a clean label that reads simply “Contains: skim milk, milk protein and cultures,” Patel advised.

Membrane filtration technology allows for production of a wide variety of dairy ingredients using a simple filtration process that concentrates the protein. Since the ingredients are produced without any chemical treatment, this manufacturing process



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■ **Current consumer trends related to “clean label” are driving food companies to proactively move away from ingredients such as hydrogenated oils in their foods to “cleaner” ingredients, such as butter and cream.**

could be categorized as clean label processing, as it involves only physical separations.

Dairy has a “clean image” and can easily be modified to provide superior functionality in a wide range of clean label products.

“Label-friendly Dairy Ingredients: Physio-chemical Properties and Uses in Foods & Beverages,” Sonia Patel, MSc, Dairy Food Scientist, Midwest Dairy Foods Research Center, Dept. of Food Science and Nutrition, University of Minnesota

Cultural Use and Functional Properties of Ancient Grains

“What is old is new again,” said Melanie Goulson, MS, Principle Scientist, Merlin Development, Inc.—a food and beverage R&D and commercialization firm, and Adjunct Professor, St. Catherine University, as she referenced the surging interest in ancient grains. “Ancient grains have made quite the comeback, so we are trying to learn quickly what our earliest ancestors already knew,” Goulson added.

Chia is a pseudo-cereal native to Mexico and Guatemala and is rich in omega-3 oils. Among its current-day applications, Goulson highlighted a traditional chia beverage from north-west-Mexico’s indigenous people called *iskiata*. The tribe, famous for its long-distance runners, consumed *iskiata* as an energy drink. Today, it is a popular Mexican energy drink known as *chia fresca*, which is made with citrus, water and sometimes a sweetener.

The very small chia seeds have a gelatinous coating that hydrates in water, creating a soft suspension of “pearls,” said Goulson. It is

also used in other beverages, puddings, yogurts, tortillas and nutrition bars. “But, if you put on your food science hat, chia’s gel is of particular interest,” said Goulson. She described it as “a high-molecular weight, non-starch polysaccharide dispersion” with very stable viscosity between pH 2-12; high stability to temperature and ionic strength; and rapid viscosity recovery upon the removal of shear. “It is different from either xanthan, microcrystalline cellulose or guar, so it could offer unique, clean label-friendly applications, such as a suspension agent in beverages,” proposed Goulson. Also, it could be potentially used as an emulsion stabilizer, gluten-free pasta component or shelflife extender in breads.

Quinoa, another New World ancient grain cultivated by the Andean Incas, is rich in protein and contains all essential amino acids. It is also rich in B vitamins and essential minerals, noted Goulson. One shortcoming, however, is the presence of bitter saponins in the seed coat, which probably function as natural pesticides. These should be removed from the seed by either alkaline pretreatment or grain pearling. Traditionally, quinoa is “popped”—similar to corn, milled into flour or used as a thickener in Peruvian stews.

The starch composition of quinoa varies greatly (35-70% dry matter basis), depending upon variety, according to Goulson. It consists mostly of amylopectin, which exhibits good puffing properties in popping or extrusion, and is not prone to retrogradation (a major cause of staling). In heated solutions, the starch thickens more slowly than potato or tapioca starch and generates a more stable viscosity than native corn, wheat or rice starches. This suggests many potential clean label product applications for quinoa.

A third ancient grain is teff, a gluten-free, nutty flavored cereal grain of Ethiopian origin with seeds the size of poppy seeds. Traditionally, teff seeds are fermented using yeast and lactic acid bacteria to produce a sourdough batter. The batter is steam-baked to form a spongy, porous flatbread called *injera*. The fermentation renders minerals more nutritionally available, while converting insoluble fiber to soluble fiber, explained Goulson.

At present, due to political considerations and cultivation challenges, teff has only limited availability in North America and Europe. Goulson proposed that considerably more work needs to be done to uncover the product development potential of this “early stage” ancient grain. Teff is about 70% starch and, while “there still isn’t much known about this grain,” said Goulson, its gluten-free nature offers product-development possibilities. For example, *injera* has been made into snack chips that are said to be quite delicious, noted Goulson.

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■ Despite a boom in international demand for quinoa (an Andean pseudo-cereal) cultivation, supply-chain and quality-control challenges remain.

However, she also cautioned against overstating its opportunities. “We don’t want to try to fit a square peg into a round hole. It’s important to consider the impact of physicochemical properties on product performance and apply teff and other ancient grains where they make the most sense.”

Goulson proposed that the popularity of ancient grains should endure for some time. She pointed out that many top consumer food trends begin in the culinary world. In the National Restaurant Association’s recent 2018 Top 100 Trends list, Ancient Grains ranked #20, African Cuisine ranked #15, Peruvian Cuisine ranked #11 and Authentic Ethnic Cuisine ranked #9. “It certainly seems like there are many opportunities for ancient grains to establish themselves on many different levels as clean label ingredients,” concluded Goulson.

“*Cultural Use and Ancient Properties of Ancient Grains*,” Melanie Goulson, MS, Principle Scientist, Merlin Development, Inc. and Adjunct Professor, St. Catherine University

Microbial Control in Clean Label Products

Although our industry and government remain mostly focused on pathogen control, “spoilage control is a more difficult challenge to address,” said Peter Taormina, Ph.D., President, Etna Consulting Group. “Pathogens are the primary culprits in food safety; they are the organisms identified by companies in their hazard analyses and critical control points (HACCP), and are addressed through

formulation and process controls.” However, added Taormina, spoilage organisms also pose significant hazards to manufacturers in the form of product viability and corporate brand image.

New, clean label ingredients can be problematic, because not much is known about them yet. “For example, the non-proteolytic, psychrotolerant *Clostridium botulinum* is one pathogen that keeps me up at night, because it lacks a proteolytic effect that makes growth in the product evident,” said Taormina. The group II, non-proteolytic *C. botulinum* are mostly associated with aquatic environment sources and, given that some clean label ingredients are derived from aquatic environments, food safety scientists must ask whether they come bearing spores of these organisms.

Formulating to control pathogenic and spoilage microorganisms requires a “big picture” approach that anticipates establishing multiple hurdles to microorganism outgrowth, including formulation, packaging and post-lethality treatments. “Antimicrobial hurdles used in product development and processing include processing temperature, water activity (a_w), pH, reduction-oxidation potential (REDOX) and preservative application,” said Taormina. “Preservatives should pose the last hurdle. However, we would rather that pH and a_w hurdles are great enough so that REDOX and preservative hurdles aren’t challenged, as some microbes can grow at very low pH and a_w .” And, whereas salt is the “best preservative we have, public resistance to salt consumption limits its use in clean label products,” he added.

For clean label preservatives, we want to avoid -ics, -ates and -ites, or anything with an “x” or a “y,” noted Taormina. Unfortunately, that describes many of the most effective preservatives available, but some of these also exist in natural sources, such as acetic acid in vinegar; benzoic acid in cranberries; and propionic acid from Swiss cheese.

Plant-derived antimicrobials that could qualify as clean label ingredients include glucosinolates (cruciferous vegetables), lignans (flax seed), saponins (yucca, asparagus), catechins (green tea) and spices...whether as essential oils or as extracts. Microbial preservatives provide another option, such as microbially derived antimicrobials including bacteriocins (e.g., nisin), competitive bacteria (e.g. *Lactobacilli*) and phages (viruses that infect bacteria). Celery, Swiss chard or acerola cherry powders represent clean label-friendly sources of nitrites for cured meats.

Processing can boost or supplement preservative ingredients in formulations. One relatively new method, high-pressure processing (HPP), is well along in commercialization. Each process poses its own spoilage challenges, however: HPP may allow for the survival of spore-forming bacteria concomitant with the destruction of otherwise competitive microbial strains. A number of spore-forming bacteria

**INGREDIENTS: ORGANIC BROWN RICE PROTEIN,
ORGANIC PEA PROTEIN, ORGANIC HEMP PROTEIN**
ALLERGENS: NONE

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Water Activity Growth Limits for Many Common Microorganisms

a_w	Microorganism	Typical Food Products
0.97	<i>Clostridium botulinum</i> E (1) <i>Pseudomonas fluorescens</i> (1)	Fresh meat, fruits, vegetables, canned fruit, canned vegetables
0.95	<i>Escherichia coli</i> (1) <i>Clostridium perfringens</i> (1) <i>Salmonella</i> spp. (1) <i>Vibrio cholerae</i> (1)	Low-salt bacon, cooked sausages
0.93	<i>Bacillus cereus</i> (1), <i>Rhizopus nigricans</i> (2)	Some cheeses, cured meat, bakery goods, evaporated milk
0.92	<i>Listeria monocytogenes</i> (1)	
0.85	<i>Aspergillus clavatus</i> (2)	Sweetened condensed milk, aged cheeses (Cheddar), fermented sausage (salami), dried meats (jerky), bacon, most fruit juice concentrates, chocolate syrup, fruit cake, fondants
0.78	<i>Aspergillus clavatus</i> (2)	Jam, marmalade, marzipan, glace fruits, molasses, dried figs, heavily salted fish
0.62	<i>Saccharomyces rouxii</i> (3)	Dried fruits, corn syrup, licorice, marshmallows, chewing gums, dried pet foods
0.50	No microbial proliferation	Caramels, toffees, honey, noodles
0.40	No microbial proliferation	Whole egg powder, cocoa
0.30	No microbial proliferation	Crackers, starch-based snack foods, cake mixes
0.20	No microbial proliferation	Boiled sweets, milk powder, infant formula

SOURCE: ©2017-2018 METER GROUP, INC. USA, [HTTPS://WWW.METERGROUP.COM/FOOD/ARTICLES/MICROBIAL-GROWTH/2018-CLEAN-LABEL-CONFERENCE](https://www.metergroup.com/food/articles/microbial-growth/2018-clean-label-conference)
1 = BACTERIAL; 2 = MOLD; 3 = YEAST

Water activity (a_w) is just one of the parameters to consider in controlling microbial growth.

can survive heating processes and grow-out under refrigeration temperatures, even at relatively low pH. This is especially problematic for low-acid products, such as nut milks, noted Taormina.

“When considering extended shelflife, there is always risk. Pathogen control is well-researched, and one can always find a lot of good data in peer-reviewed research,” said Taormina. That is not the case with spoilage microorganisms. “Their risk continuum looks very different than that for pathogens,” he added.

For example, traditional spoilage inhibitors for ready-to-eat packaged meats include sodium or potassium lactates, plus sodium diacetate or acetate. Alternative clean label inhibitors include vinegar, fruit-extract vinegar blends and cultured sugar. “A problem arises, however, when, for clean label reasons, dextrose is replaced with sucrose. (The result is that common *Leuconostoc* sp. bacteria will cleave the sucrose disaccharide, producing a slimy film on the meat.) I see this over and over again,” emphasized Taormina.

Spoilage is the result of an accumulation of factors and, unfortunately, much less information is publicly available about spoilage microorganisms than about pathogens, Taormina noted.

Therefore, companies should do their research and seek outside help well in advance of new product launches—before real damage is done to the product and the company’s reputation.

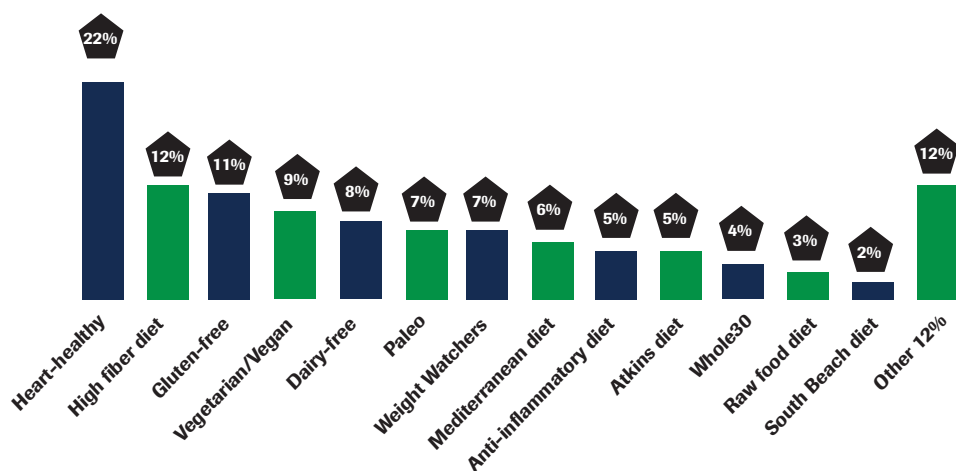
“*Microbial Control in Clean Label Products*,” Peter Taormina, Ph.D., President, Etna Consulting Group

Consumers Lean Toward Simplified, Comprehensible Labels

Consumers are craving transparency now more than ever. Clean label is the industry’s response to that need for label transparency. “Today, 94% of consumers feel that it is important for brands to be transparent; 83% would value having more in-depth product information, and 37% would be willing to switch to a brand that shares more detailed information,” said Thea Bourianne, Senior Food and Beverage Data Analyst, Label Insight.

Transparency impacts shopper behavior. Consumers now link health, wellness and transparency with their definition of safety and include factors such as free from harmful ingredients (62%);

Consumers and Diets



SOURCE: 2017 LABEL INSIGHT SHOPPER TRENDS SURVEY/2018 CLEAN LABEL CONFERENCE

Nearly half of all consumers follow some type of diet or health-related program.

clear and accurate labeling (51%); and fewer ingredients, less processing and nothing artificial (42%).

Label Insight was born out of the personal struggle of the founders to find products they could trust after their father was diagnosed with a health condition. There's a lot of information [on the label of] physical packaging; much of it is hard for the average consumer to understand. It's also difficult to compare one product to another. Label Insight takes all of the information from the package label and translates it into a "data prism." The result is a diverse set of over 22,000 attributes. The company has 440,000 products in their database, covering more than 80% of the top selling products in U.S., said Bourianne.

Consumers are shopping with more diverse needs than ever before. Nearly 50% of consumers follow some sort of diet or health-related program. There are lifestyle diets, allergen intolerance diets, weight management diets and many more that influence the way consumers shop and select products. More than three-fourths of consumers are looking at ingredient statements to avoid certain ingredients—artificial ingredients being one of the most common. Currently, 81% of our food products in the U.S. are free from artificial sweeteners; 76% are free from artificial flavors; 74% of foods are free from artificial colors; and 59% of food products are free from artificial preservatives.

Sugar tops the list of ingredients that consumers are trying to avoid, with 44% of consumers avoiding artificial sweeteners, and 56% avoiding high-fructose corn syrup. Also, 47% of consumers say they will decrease the amount of sugar they consume in 2018. One of the factors fueling the shift away from sugars is the updated Nutrition Facts Panel that calls out added sugars. Currently,

40% of food products contain added sugars on their ingredient statements, regardless if they declare it on the nutrition label yet.

Trendy diets dictate which ingredients many consumers avoid. "Individuals on a Paleo diet eliminate dairy, refined sugar and certain cooking oils. Those on the Whole 30 Diet avoid dairy, sugar, legumes and grains. Those on a Ketogenic diet avoid refined carbs, sugar and juice," explained Bourianne.

Customers are looking for cues on packaging to let them know if a specific product meets their diet expectations. Currently, only 630 products make a

"paleo suitable" claim, while 66,000 products could make that claim based on the Label Insight ingredient analysis, Bourianne noted.

Just as consumers are avoiding certain ingredients, they are also seeking out other ingredients. Although there is no regulated definition for "superfoods," it is generally accepted that they are foods that contain high levels of desirable nutrients. Blueberries and avocados are the most desired superfoods. Popular superfood ingredients also include green tea, kale, cinnamon, coconut oil and ginger.

The probiotics trend is also big. Over 6,400 foods, mostly yogurt, contain probiotics. There is recent growth in claims around fermented beverages and foods including kombucha and sauerkraut.

There are clear winners and losers in the clean label quest, stated Bourianne. Salty snacks and candy categories are seeing the most dollar growth in clean label products, while coffee and ice cream categories are seeing high percentage growth.

Retailers are expressing what it means for them to be clean and transparent. Whole Foods' list paved the way for everyone with their list of unacceptable food ingredients. Raley's, Wegmans and Hy-Vee, among others, have created their own "no no" lists. Raley's has created various symbols to indicate foods with specific attributes, such as "vegan" or "no added sugar." Consumers can also use these categories to filter foods when shopping online.

Transparency is not going away, and industry is responding at the brand and retail level, concluded Bourianne.

"Exploring Today's Top Ingredient Trends and How They Fit into our Health-Conscious World," *Thea Bourianne, Senior Food and Beverage Data Analyst, Label Insight*

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Challenges and Solutions: Managing a Clean Label Supply Chain

“As you have all probably come to realize by now, we are dealing with a clean label market that is still quite immature,” said Will Lennon, MBA, Chief Operating Officer, Imbibe, a beverage development company. “This means that pricing hasn’t yet equilibrated; information isn’t yet transparent; and raw material supply is still inconsistent.”

Lennon outlined some of the specific challenges confronting the clean label category. On the ingredient side, for example, there is cost: clean label colors may cost five times more than the artificial colors they replace and require higher concentrations of use and shorten product shelflives. Clean label products may also require expensive packaging upgrades: A conventional cold-filled beverage, thanks to conventional preservatives, may now require hot-filling, along with much higher packaging material costs.

Lennon illustrated with a case study, “...a large consumer products company wanted us to develop a clean label powdered beverage. (Although the customer desired a freeze-dried berry powder, the cost was prohibitive.) So, we found a drum-dried berry powder, at half the cost, that we could blend with the freeze-dried powder to bring ingredient costs into line.”

Product developers really need to press upon ingredient suppliers to provide acceptable clean label options. But, they should also

establish a hierarchy of expectations. “Clean label can mean many things, and often, not all those needs can be met,” added Lennon. Does clean label mean minimally processed or preservative-free? Choices must be prioritized.

Clean label product development must also deal with capacity constraints. Normally, companies use contract manufacturers to launch new product lines to hedge their overhead risks. Today, limited capacity exists for clean label manufacturing and “large, billion-dollar companies are sequestering big parts of that capacity,” said Lennon. This results in larger up-front commitments for minimum-order production quantities and ingredient and packaging material inventories. “We also now demand that our suppliers stock three-to-four months of key-ingredient inventory, and many aren’t ready for this,” said Lennon. In some cases, key ingredients come in from overseas, further lengthening and complicating supply chains. Thus, both suppliers and manufacturers need to think about how much up-front risk they are willing to assume in case of product failure. And, warned Lennon, these supply chain challenges will only increase as large companies, such as Mondeléz, Weight Watchers, Kellogg’s and others enter the category.

An additional complication is that many new clean label ingredients originate from single suppliers and, overlooking the risks inherent to working with single-source suppliers (e.g., fires, bankruptcy), very little price competition or transparency exists when negotiating prices. Companies must thus make major commit-

Cost Implications of Ingredient Replacement

Ingredient Category	Artificial Ingredients	Clean Label Alternative	Cost Implications ¹
Sweeteners	Sucralose, Ace-K	Stevia, Monk fruit	\$18-\$85/kg vs. \$132/kg
Preservatives	Sodium benzoate, potassium sorbate	Hot-fill or aseptic processing and/or packaging or refrigerated supply chain	<ul style="list-style-type: none"> • Higher MOQs² • Increased packaging costs • Cold-fill PET - \$0.15 • Hot-fill PET - \$0.20 • Aseptic HDPE - \$0.25
Colors	Red 40, Yellow 5, Blue 2	Carotenoids (annatto, beta carotene), anthocyanins (beet juice, berry extracts), paprika, turmeric, spirulina	<ul style="list-style-type: none"> • \$5.02/gal per \$26.40/gal (Beet Juice) • Need to use more "natural" color

NOTE: 1 PRICES NOTED ARE APPROXIMATIONS AND WILL VARY FROM SUPPLIER TO SUPPLIER.
2 MOQ - MINIMUM ORDER QUANTITY

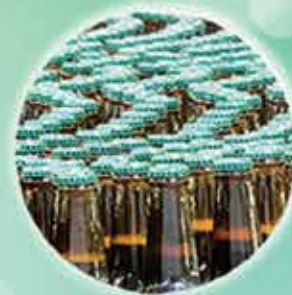
SOURCE: WILL LENNON, COO, IMBIBE/2018 CLEAN LABEL CONFERENCE

📌 The cost of replacing various ingredients with clean label alternatives can pose challenges for product developers.



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ments that can make or break their new product introductions, based on very little information.

Lennon cited the case of a single-source brown rice protein supplier that was building a plant in China due to be completed in four months' time. Its ingredient may be key, but should the customer assume the risk of contracting with that supplier? "Reputational risk is another soft cost to consider and, often, you have little control over a suppliers' ability to deliver crucial ingredients," he added.

The only solution, in Lennon's view, is to insist on complete transparency when discussing supply chain risks with both suppliers and customers. Also, spend face time with each party to help avoid misunderstandings or mistranslations. "We had a Chinese supplier that claimed that their stevia leaf extract was organic, but upon discussion, it turned out that it was only the leaf that was organic, not the alcohol solvent used for extraction," said Lennon.

Finally, there are the unforeseeable "hash-tag" costs imposed by fickle consumer trends and regulatory agencies (e.g., California Prop 65). These can place immediate reformulation demands on companies' product development and procurement resources at a moment's notice.

It is all heading in the right direction, affirmed Lennon. Clean label definitions continue to evolve, and supply will eventually catch up to demand, "but we are not there yet," he added. In the meantime, get your operations team involved early in the product development process, and "be fully aware of and transparent about attendant risks," advocated Lennon.

"Challenges and Solutions for Managing a Clean Label Supply Chain," Will Lennon, MBA, Chief Operating Officer, Imbibe

Research on New Methods to Enhance and Stabilize Natural Colorants

Food colorants have joined consumers' growing demand for clean label and natural ingredients, particularly considering mainstream and social media's outpouring of information, whether accurate or not, regarding adverse health effects from the consumption of synthetic colors. Colorants made from natural sources may have an added-value ability to provide health benefits, such as antioxidant potential, and can increase consumers' perception of a product's all-natural, clean label, simplified ingredient statement, noted M. Monica Giusti, Ph.D., Professor, Department of Food Science and Technology, The Ohio State University. Plus, some pigments from plant sources may even be classified as superfoods, added Giusti.



■ Research on the use of pyranoanthocyanin pigments, typically found in red wine, is ongoing as a way to improve color stability of fruit and vegetable juices.

Although there is a wide variety of colorants exempt from certification by the FDA, as listed in 21CFR73, ensuring consistency, quality and stability are not necessarily easy tasks. Pigments can interact with the product's matrix and change color; may not be stable under processing or storage conditions; may be affected by texture; and certain colorants are allowed for use in a limited number of applications.

Yet, abundant research of colorants from natural sources is in process. Opportunities exist for improved stability, as well as added health benefits, including potential use as antibacterials, antivirals and anti-inflammatories. Research is also being conducted in analytical, horticultural, bioavailability and processing areas.

Giusti's research focuses mainly on the color enhancement and stability of anthocyanins. Currently, grape color extract and grape skin extract (enocianina) are the only anthocyanin-based colorant extracts approved for use in the U.S. However, the approved category of "fruit juice concentrates" and "vegetable juice concentrates" open an opportunity to utilize a wide variety of plants rich in anthocyanins or other pigments as sources of colors, as long as the processing conditions of the plants have followed typical processes for juice. This approval status leaves opportunity for expanding the applications of anthocyanins as food colors, as there are numerous sources in nature with this pigment, and fruit and vegetable juices are label-friendly to consumers.

"Anthocyanins are water soluble," said Giusti. "The color is due to the main structure, a flavonoid, but you can have several [types of] sugars and acids attached [to this molecule]. In general, the



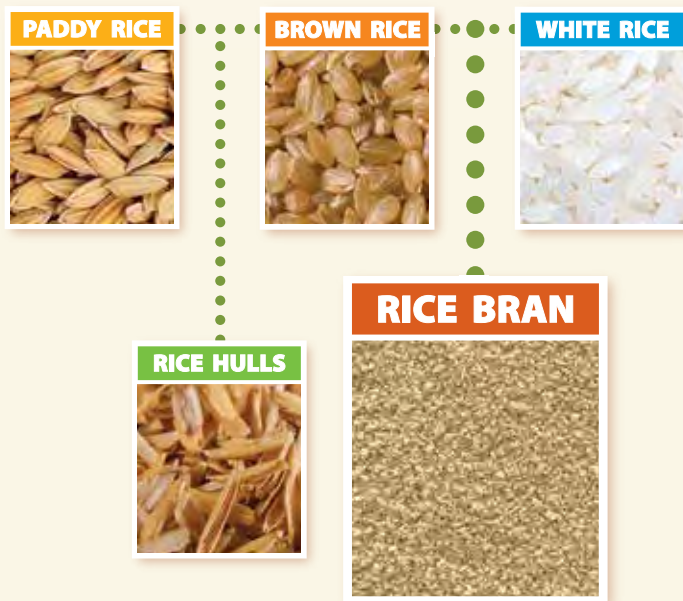
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bigger the molecule, the more stable it becomes and the more resistant it becomes to processing, storage and stresses. Pigments from vegetables usually have the larger pigment structures that last longer, while most fruit pigments degrade faster. However, there are some exceptions, such as grape, which is a fruit source but has the more complex chemical structure that is a little more stable. That's why grape extracts are popular for applications."

One approach Giusti has used to extend the life of the color is co-pigmentation, where a component with little or no coloration can be added to enhance and stabilize the pigments. For instance, her research team is investigating the use of soy products, as an innovative way to incorporate isoflavones—a functional, healthful component to the diet—while stabilizing the color. Additionally, Giusti is looking into the formation of pyranoanthocyanin pigments, pigments derived from anthocyanins and commonly found in wine, to explore their formation or addition to vegetable juices to enhance color stability.

Some of the blue color in plants is due to the presence of metals together with anthocyanins. So, the presence of certain metals in the matrices' environment can allow for formation of those blue hues by anthocyanin-metal complexation, suggested Giusti. Natural sources of blue and green pigments allowed for use in foods are currently limited, and many desired colors are currently achieved through use of synthetic compounds. Increased understanding of the pigment-metal complexation would allow us to provide natural alternatives for those synthetic colors.

Microencapsulation is another approach to achieving stability of anthocyanin-based pigments and could improve the distribution of pigments in a wider variety of matrices, such as those high in protein, which are susceptible to color loss or more hydrophobic matrices that could have poor dispersion. Work is being done on bioavailability and bioactivity, as well.

Consumer perception has increased demand for use of colorants from natural sources. Suppliers that commercialize pigments know a lot about those behaviors in different types of matrices, as well as stability in processing, noted Giusti. Further research can only expand the availability of pigments from natural sources and improve their stability.

"Natural Colorants: Challenges and Opportunities," M. Mónica Giusti, Ph.D., Professor, Dept. Food Science and Technology, The Ohio State University, Columbus, Ohio, giusti.6@osu.edu

Clean Label Challenges

In addition to its role in modulating taste, aroma and color, sugar serves as both bulking agent and texture modulator. It affects flow properties, crystallization, as well as interfacial and network



In addition to its role in modulating taste, aroma and color, sugar serves as both a bulking agent and texture modulator.

formation in complex food systems. A presentation by Jerome Diaz, Ph.D., Food and Biobased Research, Wageningen University and Research, discussed the interaction of sugar along with other ingredients in complex food systems.

Sugar functionalities in specific food applications were compared with clean label alternatives. Specifically, challenges in confectionery and beverage applications were highlighted, and the utility of thermodynamic models in sugar reformulation were described. The presentation was valuable for product developers intending to successfully reduce, replace and reformulate sugar under a clean label framework with the goal of hastening time-to-market of high-quality, clean label, sugar reformulated consumer products.

A PDF of Jerome's PowerPoint presentation in its entirety can be accessed at <https://goo.gl/6BRn9x>.

"Overcoming Clean Label Challenges in Sugar Replacement, Reduction and Reformulation," Jerome Diaz, Ph.D., Food and Biobased Research, Wageningen University and Research

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WTI produces functional ingredients that help processors improve their products by inhibiting pathogen growth, extending shelf-life, enhancing product flavor, increasing yield and improving product quality. We offer many options for different applications; liquid, dry, low sodium, sodium-free, all natural, conventional and organic. www.wtiinc.com



RiceBran Technologies (NASDAQ: RIBT and RIBTW), is a global leader in the production and marketing of value-added ingredients derived from stabilized rice bran. RIBT

has proprietary and patented intellectual property that enables the conversion of rice bran, one of the world's most underutilized food sources, into a number of highly nutritious human-food ingredients, which are vegan, non-GMO verified and gluten-free, and make "Whole Grain Rice" and "Brown Rice Flour" packaging claims possible. www.ricebrantech.com



Wenda Ingredients offers all-natural, clean label meat and poultry ingredients with a focus on replacing chemicals and providing solutions to processors and brands. WENDA's all-natural fruit and

spice extracts are used globally in meat and poultry. They increase yield (eliminate phosphate) and pathogen protection, extend shelf life and color, and offer the world's best "uncured" labeled meat-ingredient solution for replacing celery powder, cherry powder, HPP and chemical nitrite, erythorbate, lactate, diacetate, and so on. Going clean label has never been easier. www.wendaingredients.com



Flavor Producers specializes in producing delicious flavors for the food and beverage

industries. Flavor Producers offers premium-quality conventional and certified-organic flavors along with the new line of essences, extracts and natural emulsions. Visit the following website to see what's new at Flavor Producers, your partner in flavor development. www.flavorproducers.com



Biospringer, the yeast ingredient specialist, is a global producer

of natural flavor bases derived from baker's yeast. Biospringer's fermentation derived yeast ingredients are ideal for sodium reduction, sweetness enhancement and flavor improvement in a broad range of applications. Biospringer's collaborative team will help you develop formulations that demonstrate the benefits of gluten-free, organic, GMO-free and clean-label ingredients, produced in the U.S. at Biospringer's GFSI-BRC-certified facility. <http://www.biospringer-na.com>



Nexira's portfolio of ingredients includes a wide range of natural ingredients and organic botanical

extracts that meet current clean label demands and requirements. www.nexira.com



EXBERRY®, by **GNT**, makes the beauty of nature accessible to all categories of food and beverages. A simple process of chopping,

crushing, filtering, and blending transforms fruits and vegetables into vibrant and reliable color solutions that are pure enough to eat by the

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spoonful. Sold in more than 65 markets worldwide and available in 400 different shades, EXBERRY® is the premier color solution for food and beverage manufacturers of all sizes. Interested? Inquire about receiving a sample color kit at: www.gnt-group.com



Magrabar is a leading manufacturer of a range of antifoams and defoamers, emulsifiers and surfactants, additives, release agents and viscosity modifiers for both food grade and industrial uses. With products derived from materials including vegetable oil, mineral oil and silicones, we have innovative solutions for a wide range of industries and applications, including organic and non-organic food processing. www.magrabar.com



Firmenich is the world's largest privately-owned company in the flavor and fragrance business. Founded in Geneva, Switzerland, in 1895, it has created many of the world's best-known flavors and perfumes that billions of consumers enjoy each day. Its passion for taste and smell is at the heart of its success. It is renowned for its world-class research and creativity, as well as its thought leadership in sustainability and exceptional understanding of consumer trends. www.Firmenich.com



Gum Acacia is a crucial ingredient in the production of a stable beverage emulsion. **ISC Gums Premium Spray Dried Gum Acacia** is trusted by beverage houses worldwide, unlike starches and other physically, enzymatically or chemically altered ingredients, says the company. Gum Acacia is over 90% soluble dietary fiber and completely soluble, making it easy to incorporate into numerous applications to support their health benefits, such as: beverages, cereal bars, baked goods and dairy products. ISC Gums produces Organic, Non-GMO, Kosher, Halal certified Gum Acacia. <http://www.iscgums.com/>



Innovating allergen-friendly plant protein manufacturing since 2005 & receiving New Economy's Clean Tech Food & Beverage Award, **Axiom** features organic hemp protein, the first of many virtually-neutral

plant proteins. Signature products include the patented, clinically tested Brown Rice Protein, the truly organic, guaranteed gluten and soy-free Pea Protein. With more plant-based proteins, dairy alternatives, sweeteners, and starches in the pipeline, California-based Axiom is known for its large commercial supplies, FDA GRAS status, Quality and Heavy Metals Management Program. www.axiomfoods.com



DuPont Nutrition & Health combines in-depth knowledge of food and nutrition with current research and expert science to deliver unmatched value to the food, beverage and dietary supplement industries. It is an innovative problem-solver, drawing on deep consumer insights and a broad product portfolio to help our customers turn challenges into high-value business opportunities. www.foodsciencematters.com and www.danisco.com



The expanding portfolio of natural, specialty ingredients from **Briess** offers almost unlimited options to help you put a better label on the table. Briess ingredients are minimally, specially processed to maintain the natural integrity of the raw grain or starch, while developing flavor, color and function. Briess specialty malts, malt extracts, gluten-free sweeteners, and sprouted, roasted and pregelatinized grains offer multiple solutions to help solve difficult formulating challenges. Non-GMO. RTE and organic options. <http://www.briess.com/food/>



Tate & Lyle is a global provider of ingredients and solutions to the food, beverage and other industries. Texturants, Sweeteners and Health and Wellness make up our Food & Beverage Solutions division, while our Primary Products division houses bulk sweeteners, industrial starches and fermentation products. Food Systems provides a wide variety of blended ingredient solutions. Our clean label and non-GMO sweetener, oat and starch solutions help food and beverage manufacturers meet consumer demand for simpler, easier-to-understand ingredient lists. www.tateandlyle.com

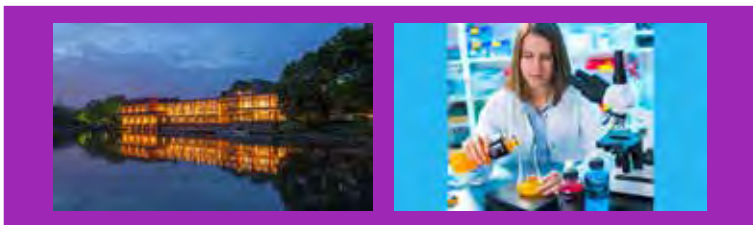
3rd Annual



October 23, 2018

Hyatt Lodge, McDonald Campus
Oak Brook, Ill., USA

A technical, product development summit providing practical, impartial, “how-to” advice to R&D and applied food scientists working with sweeteners & sugar reduction.



Confirmed Speakers

- Replication of Sugar Taste Enabled by Taste Modulators & Enhancers
 - Grant E DuBois, Ph.D., Consultant, Sweetness Technologies, LLC
- 3rd Generation Stevia Extracts: Neuroscience, Ingredient Technologies & Food Applications
 - Alex Woo, Ph.D., CEO and Founder, W2O Food Innovation
- Update on Added Sugar Labeling
 - Lauren Swann, MS, RD, LDN, CEO and President, Concept Nutrition, Inc.

Additional topics include:

- Nutritional Updates
- Caloric Sweeteners & Important Physiochemical Properties
- Consumers & Products Trends
- Sweetener Product Sampling Station

globalfoodforums.com/2018-sweetener-systems

Additional Resources & Insights



The Antioxidant Paradox: Easy to Verify, Hard to Understand

Research shows that use of a polar antioxidant in an oil-in-water emulsion, such as salad dressing, almost totally neutralizes the antioxidant effect. This occurs because the polar antioxidant is drawn to the water-soluble portion of the emulsion and away from the oil. The antioxidant cannot prevent rancidity in the oil phase. Conversely, using bulk oil as an example of a nonpolar substance, polar antioxidants are better at preventing rancidity than nonpolar antioxidants, which have similar chemical properties to that of the oil. For a more in-depth explanation, see <https://bit.ly/2JuayD4>

Consumer Research Reveals Food Trust Issues



Consumers' desire for “transparency” has often been said to be an important aspect of the clean label trend. Research conducted by The Center for Food Integrity (CFI) shows that consumers don't necessarily trust those they hold responsible for food health and safety, including food manufacturers, farmers and regulatory agencies. “If you're held responsible and trusted for ensuring safe and healthy food, you are seen as a credible source,” says Charlie Arnot, CEO of CFI. “However, if you're held responsible—but not trusted—that's a dangerous disconnect that can't be ignored.” (Originally posted January 9, 2018) For more information, see <https://bit.ly/2Mh16Yf>

Technology Snapshot Presentations



Global Food Forums will once again have a series of Technology Snapshot Presentations at our 2019 Clean Label Conference. To obtain more information, such as the purpose of Technology Snapshots; how they are chosen; the criteria used; and how to submit a proposal, go to: <https://bit.ly/2JH3VgO> or scan the QR code.

For future events, including the coming year, please find the dates and locations at <https://www.globalfoodforums.com/events/>



Our Clean Label Library

Global Food Forums has updated its Store/Library. Complimentary copies of presentations and post-conference summaries from past Clean Label Conferences can be accessed at: <https://globalfoodforums.com/store/clean-label-conferences>



2018 Sweetener Systems Conference

October 23, 2018

Hyatt Lodge, Oak Brook, IL. USA

MAIL OR FAX REGISTRATION TO:

Global Food Forums, Inc.

P.O. Box 1421, Saint Charles, IL., 60174

FAX: 1-208-246-2242

NOTE: Online registrations can be made at:
www.GlobalFoodForums.com/2018-Sweetener-Systems

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REGISTRATION & FEES: Super Early Bird Registration Discount expires on August 31, 2018)

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Ingredient/Services Supplier-\$795.00

Attendees will receive a registration receipt confirmation email. Please contact Jenny for registration questions at Jenny@globalfoodforums.com or 1-800-799-9671 ****A \$25.00 processing fee will be added to all credit card transactions.**

Registration includes Receptions on Monday, October 22nd (6:00-7:30 p.m.) and Tuesday, October 23rd (5:00-6:30 p.m.), all general sessions, meals, networking events and attendee bag and binder.

I plan on attending: **Monday Night Reception** **Tuesday Night Reception**

Host Hotel-Hyatt Lodge, 2815 Jorie Blvd, Oak Brook, IL, 60523 USA <https://thelodge.hyatt.com/en/hotel/home.html>

A limited number of group rate rooms have been reserved at \$155.00, plus tax, for Monday & Tuesday evenings, October 22-23, 2018. The cut-off date for discounted room reservations is October 1, 2018.

For hotel reservations call 1-888-627-9031 and mention the **2018 Sweetener Systems Conference** or visit www.GlobalFoodForums.com/2018-Sweetener-Systems (Registration & Fees tab).

Cancellation & Substitution Policy-Cancellations must be received in writing. For refund details or to update your reservation details visit www.GlobalFoodForums.com/2018-Sweetener-Systems. Alternative parties may be substituted at any time, without penalty.

6th Annual



Sophisticated Solutions for Simplified Products

March 26 - 27, 2019

Westin Hotel, Itasca, Ill. USA

Efforts to formulate packaged foods, beverages and nutritional products with consumer-friendly ingredients continue to grow. The 2019 Clean Label Conference focuses on providing practical advice to R&D and application scientists working to simplify ingredient statements.

10 General Session
Speakers

18 Technology
Snapshot
Presentations

3 Application Briefs



globalfoodforums.com/2019-clean-label



Additional Resources & Insights

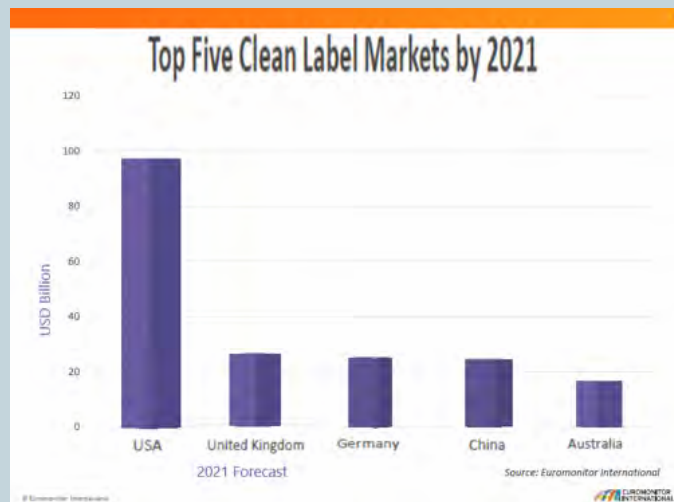
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Where the Clean Label Markets Are



According to Euromonitor International, the U.S. is projected to dominate the clean label market during the next several years. However, it is by no means alone, as consumers search for cleaner, all-natural, more healthful products. (<http://www.euromonitor.com>)

Clean Label Movement & Packaging

Consumers' desire for packaged products with fewer and more familiar-sounding ingredients impacts packaging as well as the food itself. For example, a June 13, 2018, news item from FoodIngredientsFirst.com reports that a recent survey shows consumers want more information on ingredients than is provided on traditional labels. One answer may be the SmartLabel, which uses a QR code that consumers can use to link to more information on the Internet. Packaging and distribution channels can also mitigate the need for certain ingredients. For example, better oxygen barriers can reduce the need for antioxidants, and refrigerated distribution might reduce the need for emulsifiers and certain other ingredients.

The presentation "Packaging Does Much More than 'Contain'—It Defines Your 1st Sale," given by Kenneth S. Marsh, Ph.D., packaging consultant, at the 2013 Clean Label Conference, provides an overview of the role that packaging can play in the successful launch of safe, cost-effective clean label food products.

- FoodIngredientsFirst.com & SmartLabel—<https://bit.ly/2JEZ1B6>
- Kenneth Marsh presentation—<https://bit.ly/2l8Y752>

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EMULSIONS FLAVOR ACACIA GUM
ORGANIC HIGH OIL LOAD COST SAVINGS
STABILIZATION
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Manufactured in France, our emulsifiers are sourced from carefully selected acacia trees. Our range provides high-quality and proven technical properties. Nexira offers solutions for a wide spectrum of emulsions, from standard to challenging emulsions (with alcohol, heat treatment, preservative-free) or low-cost-in-use emulsifiers.

* Damar-EZ™ is a purified damar gum designed for flavor stabilization, FEMA-GRAS approved, distributed in the US.

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