

IFEAT 2013 Photos & Highlights

Sustainability, green chemistry, biotech, mint, citrus, China's F&F industry and more.

Jeb Gleason-Allured, Editor in Chief

The annual conference of the International Federation of Essential Oils and Aroma Trades (IFEAT) took place at The Fairmont Hotel in San Francisco September 29 to October 3. The event, which grows with every iteration, is a notoriously busy venue for industry networking. While many delegates may not have had an opportunity to sit in on every discussion, the conference program offered a range of compelling topics and speakers. While the full proceedings can be purchased via www.ifeat.org, what follows is a small selection of the program's many highlights.

Keeping Citrus Sustainable

The demand for natural flavors is growing, now accounting for about 1/3 of all food ingredients worldwide, said Jennifer Haggard of Givaudan. Flavors overall may have aggregate growth of 2–4% per year, but natural flavors are growing at almost double digits. Products are being formulated and reformulated with naturals, said Haggard, and not only in mature markets.

"That's certainly changing the business model," she explained. "It's changing the portfolio and how we manage [it]."

Citrus, for instance, represents more than 60% of Givaudan's natural material portfolio. Citrus represents a healthy growth area, but it also happens to be one of its biggest risk areas for the supply chain. There are weather factors, said Haggard, such as with the infamous 2004 Florida hurricane that ravaged grapefruit crops. There are risks from a socioeconomic standpoint as well, as farmers choose more lucrative crops, including alternatives to citrus and other key aromatic naturals. Meanwhile, greening, chancre and other citrus diseases affect supply, quality and cost. In all, about 5–10% of citrus' cost can come from crop issues. And, as consumers migrate away from frozen concentrated juice, it becomes critical for flavor ingredient procurers and producers to work closely with processors to ensure a stream of byproducts for the flavor industry. Finally, said Haggard, competition from the fresh fruit market will also create competition for aromatic material feedstock.

Read more about Gennadiy Kolomeyer's insights into green chemistry in "IFEAT Preview: More Than a Slogan—Sustainability in F&F" on Page 66 of the October 2013 issue of *Perfumer & Flavorist* Magazine; Read Reshma Shetty's "Cultured Ingredients Arrive" on Page 34 of the November 2013 issue of *Perfumer & Flavorist* Magazine; www.perfumerflavorist.com/magazine/pastissues.



The annual conference of the International Federation of Essential Oils and Aroma Trades (IFEAT) took place in San Francisco September 29 to October 3; all photos courtesy of Laure Moutet.

Haggard outlined Givaudan's approach to "thoughtful" management of natural ingredients. The program is intended to employ ingredients, including citrus products, in a way that maximizes their impact on the flavor profile of applications. The company has coupled its flavor creation capabilities with knowledge of commercial and non-commercial citrus. Via research conducted at the citrus groves of UC Riverside in California, Givaudan has studied the chemical components and sensory qualities of fruit, linking sensory and chemical information throughout the growing and ripening process. As a result, the company has developed citrus WONF (with other natural flavors) solutions that comprise the key sensory qualities of desired citrus types using aromatic components of less vulnerable and more widely available fruit sources. These are one-to-one replacers for folded oils, single-fold oils and enriched oils. This allows for greater control of availability and cost. As natural flavors are poised to overtake artificial flavors in the coming years, the need to control volatility will continue to grow.

Mark Your Calendar: Rome and China 2014

IFEAT's 2014 conference will take place September 21–25 at the Cavalieri Hotel in Rome. The organization's China Study Tour, meanwhile, will take place August 31 to September 8. For more information, visit www.ifeat.org.

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U.S. Citrus Management

Melanie Cooksey of Treatt USA presented an overview of U.S. citrus production.

California, she noted, produces orange, lemon, tangerine and grapefruit. Ninety percent of the state's oranges are bound for the fresh fruit market. Approximately 8–9 tons of lemon oil is produced from California lemon, which features a unique citral quality.

Arizona produces oranges and lemons, but very little essential oil.

Texas produces grapefruit and orange, Cooksey explained. The state's concentrated growing area—fewer than 25,000 acres of commercial production—makes it highly susceptible to freezes. Texas produces about 20 tons of grapefruit oil, which is coveted for its high nootkatone levels.

Florida, which produces orange and grapefruit, grows a significant portion of the oranges applied to orange juice. Florida has had five “impact freezes” in recent decades, Cooksey explained, which forced growers to move ever farther south. Today, citrus is grown from central Florida to the Everglades. The crops have become so important to the state economy, that they are second only to tourism.

In 2003, Florida had a record production of 242 million boxes of oranges; each box equals 90 lb of fruit. Since then, citrus acreage and orange juice consumption have fallen precipitously due to competition from other beverage categories, weather damage and the loss of groves to housing development. As citrus oil production has fallen, so too has oil yield. Florida, Cooksey said, is facing diseases, including citrus chancre and huanglongbing. Recently, she noted, the U.S. Department of Agriculture lowered its orange production forecast from 154 million boxes to less than 134 million boxes.

The result is that the orange oil, d-limonene and terpene segments have been negatively affected, primarily with market volatility. Supply consolidation has also reshaped the market, as have product reformulations and reduced inventory. In addition, the decline of orange production deemphasizes processors, who will find little financial incentive to operate in the market if the number of annual boxes produced falls too low.

As one audience member remarked, “It’s plant or die.”

In response to the stresses on orange supplies, The Coca-Cola Co. has partnered with Cutrale and Peace River to partially irrigate groves with rainwater and employ an irrigation system to cut groundwater usage by half. The Coca-Cola Co. previously invested in huanglongbing disease research at the University of Florida's Citrus Research and Development Foundation. Finally, the company has announced a \$2-billion investment in the planting of 25,000 acres of new orange groves.

Cooksey noted that regional growers have found that dense groves are the healthiest, and that a collective effort is underway to manage grower practices, tree removals, oversight of abandoned groves, public education on residential trees and more.



From left: Colin Ringlieb (Pepsi-Cola Co.), Mary Beth Ringlieb and Gary Voorhees Jr. (Ungerer).



From left: Alan Brown (Lebermuth) and Laure Moutet at Lebermuth's party.

The group approach is necessary as disease does not respect property lines.

Brazilian Citrus and Essential Oil Production

Brazil, a key orange producer, is expected to experience low crop yields in 2013–2014, explained Fernando Cardoso of Sucocitrico Cutrale. The country's highly concentrated citrus belt is being hit by huanglongbing disease. The phenomenon is a major issue as a significant portion of orange juice traded in the world is from Brazil. Cardoso noted that 230,000 direct and indirect jobs are connected to the Brazilian citrus chain. The industry represents 2.9% of Brazilian agribusiness exports in value, or about \$2 billion. The productivity of growers has increased as the area planted has decreased.

Cardoso explained that the country's citrus interests have invested in Florida citrus because “there have to be two bases” for sustainable orange production. Greening is hitting both the United States and Brazil, he said, necessitating a two-location solution to try to ensure stability. If Brazil doesn't participate in the Florida program, marketers lose the ability to use “100% Florida orange juice” claims. Finally, he noted, the fruit base should be expanded. In 1985, there were



From left: Ravi Sanganerla and Priya Sanganerla (both Ultra) during Ultra International's party.



From left: Stephen Manheimer (Kerry), and Rob Brown and Irv Brown (both Lebermuth) at the Lebermuth party.



From left: Francis Thouvenin (DRT) and Thierry Duclos (Quimdis).



The IFEAT Annual Dinner took place aboard the USS Hornet.

33 U.S. orange processors. Today, there are seven. In responding to questions from the audience, Cardoso concluded that, while the extent to which huanglongbing is impacting Chinese production is unknown, with the so-called “greening” affliction just a question of time in the region.

João Andreas Dierberger of Dierberger SA outlined sustainable agricultural practices in Brazil for the production of bitter orange, lemon, bergamot and mandarin. As part of producing IBD-certified oils (www.ibd.com.br), “the only 100%-Brazilian certifier with international reach,” no chemical pesticides or herbicides are used, with tree trunks cleared by hand. The waste material from essential oil production can be repurposed as fertilizers or cattle feed. Plantations, said, Dierberger, are not high-density, while some extraction is done using mobile facilities, with oil shipped elsewhere for reprocessing.

Green Chemistry and Biotech

Green chemistry was defined by P.T. Anastas and J.C. Warner 15 years ago, said Gennadiy Kolomeyer of Renessenz.¹ He added that while any process that is marginally better than the alternative is green, that does not automatically mean the green process is clean.

Kolomeyer encouraged delegates to consider where their processes fell on the greenness scale and what quantitative tools were being used to assess them. He noted that the non-restrictive/intentionally vague definition of green chemistry allows for continuous improvement of processes, materials and waste output.

Quantitative tools for assessments include atom economy, which calculates the theoretical percent of atoms of the reagents incorporated in the product. This is applicable in early stages of process development. The ideal value is 1 (100%). Process mass intensity deals with the quantity of all raw materials, including water and solvents, needed to produce 1 kg of product. This calculation requires a complete material balance. In the manufacture of F&F materials, a value of 50–60% is considered good. Other considerations include use of sustainable carbon and overall carbon footprint.

In the case of L-carvone, a clean process can reduce atom economy from 47.2% to 88.2%. The clean process uses no toxic reagents or solvents. In addition, the clean process uses nine times less wastewater per kilo of product, compared to conventional processes. The wastewater that is produced by this revised process is also cleaner than conventional wastewater. An official company stewardship report claims the patented L-carvone process reduces waste water by 8 million kg per 1 million kg of product and eliminates chlorides and nitrogen from the final product. In addition, the resulting ingredient is reportedly cost-competitive.



From left: Jens-Achim Protzen and Maren Protzen (both Paul Kaders GmbH).

Kolomeyer warned that any novel technology or product will initially be viewed as “guilty until proven innocent.” The burden of proof is on the industry, he said, and so industry must use quantitative tools to evaluate processes to back up claims, identify gaps, find solutions, and implement continual improvement of greenness and sustainability. Finally, Kolomeyer urged companies to adapt their cultures to offer financial support for green and sustainable processes.

Representing one player in the latest generation of cultured



From left: Pia Henzi (MCI Miritz), and Jennifer Romano and Chris English (both Bontoux).



Raul Amigo (Amigo & Arditi S.A.) chaired the Latin American essential oil speaker session.

ingredients, Reshma Shetty of GinkgoBioworks discussed the production of F&F ingredients using microorganisms, which offer new approaches to the world's food supply.

So-called cultured ingredients that have already been produced include l-glutamic acid, nootkatone, vanillin, β -elemene, *trans*-2-hexenal, resveratrol, saffron extracts and steviol glycosides. These materials offer potential sustainability advantages. Shetty gave the example of omega-3s, which can help combat the onset of heart disease. Fish is the most popular source of omega-3s, which has resulted in an overfishing problem, decimating some populations, while farm-grown salmon, a common alternative to wild-caught fish, require significant feedings. As a result, cultured omega-3s produced using yeast can offer a sustainable solution. Interestingly, said Shetty, cultured omega-3s have received a “buy” rating from the Monterey Bay Aquarium’s Seafood Watch program.

Traditionally, synthetic ingredients have offered a cheaper alternative to naturals, but could have problematic manufacturing and waste stream issues. On the other hand, naturals have an attractive complexity, but suffer a volatile agricultural supply. Both sides have a trade-off on price, labeling and sensory effects. Cultured ingredients, Shetty argued, are consistent, offer stable supply, can be labeled as natural and possess a reduced environmental footprint.

Cultured ingredients are going to move up from the low end of the ingredients market, taking over increasing numbers



From left: Lorenzo Schiavone was recognized for his accomplishments as a student at the 2013 Flavourist Training Programme held at Reading University and developed by the British Society of Flavourists and supported by IFEAT; Schiavone was welcomed on stage by Michael Boudjouk (Medallion).

of large-volume aroma chemicals, said Shetty during a Q&A session. She added that when the subject of genetically modified enzymes or feedstock comes up, it is the industry's responsibility to show consumers that these processes are safe and beneficial. It is crucial, she concluded, to capture mindshare of those who have not yet made up their minds on the subject.

China's Innovation Pipeline and Intellectual Property Issues

In 2011, China's producers manufactured 390,000 tons of aromatic material, with total sales of 22 billion RMB, said Yupeng Fan of Hangzhou Grascent Co. Ltd. In 2012, F&F sales totaled 24.5 billion RMB. There are 1,000 F&F manufacturers in China, a number that continues to grow. Few of these have significantly large sales.

The industry is at a transition point, Fan explained, with companies seeking new innovations in molecules, technology, manufacturing methods and applications. Recent ingredient launches have included strawberry furanone (Xiamen Bestally Biotechnology Co., Ltd.) and leaf alcohol (Zhejiang NHU). Generally, however, Fan said new molecule development is too expensive for Chinese companies. New technology application requires monetary investment and talent, and should net cost efficiency or solve impurity and other issues. New methods could include alternative routes for existing products or processes that afford greater efficiency and lower costs.

Fan explained that China's F&F industry's core competitiveness stems from the potential to reduce costs and improve quality. However, environmental issues must be resolved. In addition, there is a general lack of innovation in the country's industry, Fan continued. Technology is often dated, and a lack of strategic planning has led to overproduction of some ingredients. To illustrate, he said, the top 10 companies in China hold 110 patents. According to Fan's figures, Zhejiang NHU holds 83, Apple Flavor & Fragrance Group Co., Ltd. holds 21

and Hangzhou Grascent Co. Ltd. holds 12. This total is quite small compared to the thousands of patents held by Western F&F companies.

In the future, China's industry will have to innovate on commodities, such as implementing an epoxidation method for phenethyl alcohol and producing vanillin from catechol. The country's manufacturers will pursue high-value-added products and become more resource-oriented by focusing on downstream derivatives. In addition to producing natural and nature-identical aroma chemicals, Fan said Chinese producers would pursue biotech-derived (cultured) ingredients.

The foundations for making China an innovative country are already in place, Fan argued. However, "disorderly competition" and infringement on patents and trade secrets have created roadblocks to coherent growth and innovation. Enforcement of intellectual property law is still in the "toddler" stage, Fan explained, and argued that China is in need of a patent administration system that would support ongoing investment in technological and scientific innovations.

Despite the challenges cited by Fan, Mao Haifang of the School of Chemical and Environmental Engineering at the Shanghai Institute of Technology noted that China's industry has experienced significant multinational investment. The Chinese government has also increased environmental management, while companies have established more robust waste management. Haifang explained that the top 10 companies turn out 25% of the domestic F&F industry's total output. While there are many smaller players, more than 80% have sales less than 10 million Yuan. In fact, the smallest 800 companies make only about 28% of output. Such small-scale organizations have relatively limited resources for improvements of processes; however, advances are occurring in Chinese manufacturing.

In China, said Haifang, green chemistry has been applied to products such as vanillin, 2-phenylethanol, salicylaldehyde and raspberry ketone. The speaker explained that more than 12,000 tons of vanillin have been produced using the oxoacetic acid method. The new method has increased yield, reduced solid waste and chemical oxidation demand of wastewater, and removed any use of ammonia.

Meanwhile, solid acid catalysts for esterification reactions have been used for the production of esters. Total ester output globally is more than 30,000 tons/year, 20,000 of which is used in the white spirit industry. Pervaporation, a membrane-separation technology is also being used in esterification processes. Haifang said it reduces energy use by more than 20%, in part because only water needs to be evaporated. As a result, it is cheaper than traditional methods.

About 6,000 tons of ethyl caproate is produced each year, the speaker noted. The material is produced by esterification and fine distillation. Today, they are run continuously, increasing efficiency and yield, and lowering power and wastewater needs.

Salicylaldehyde is being produced via a phenol, said Haifang, at a rate of 5,000 tons a year. This key component for coumarin is traditionally produced using the phenol chloroform method, yielding high-salt wastewater that must be treated. However, the cresol chlorination method nets waste



The event featured a trade exhibition in the hotel's Grand Ballroom; pictured in the foreground is Mario Di Lallo (TFS Corp.).

that is difficult to manage due to highly corrosive materials that can erode equipment. A new method employs phenol and paraformaldehyde catalyzed by magnesium, which lowers cost and significantly reduces waste.

In the future, there will be a growing focus on improved technology and environmental management, said Haifang. Those companies that cannot improve green issues may disappear. An odor pollution issue could close down 10% of small companies, Haifang argued, with new development being done in industrial zones set more than 1 km from residential areas.

The Changing World of Mint

U.S. production of peppermint in the 1990s was almost twice what it is today, explained Rocky Lundy of the Mint Industry Research Council (MIRC). When harvesting, 10% bloom is the best time to cut, primarily in July through August and into September. A 30% moisture level in the mint hay is ideal to prevent dry-out or plant damage. Spent mint hay can be used as fertilizer or animal feed post-processing. Lundy noted that 2.5 million sticks of chewing gum can be flavored per 55-gallon barrel of mint oil. This oil is destined for various applications: 42.5% chewing gum, 42.5% dentifrices and 15% other (confectionery, digestive remedies, etc.).

While MIRC has not pursued genetically modified mint, it has obtained broad licensing rights to all genes responsible for the biosynthesis of mint oil yield and composition. The field of use for these patents includes many mint family Labiatae genera, including *Mentha*, *Lavandula* and *Thymus*. The genes can be used for higher yields, improved quality, disease and pest resistance and tolerance of climate conditions. MIRC conducts varietal improvement plots and maintains research stills to process oils in commercial grade.

Lundy noted that MIRC has looked at microwave distillation and the use of parabolic solar steam boilers in distillation processes. While perhaps not practical, these initial explorations are addressing conventional distillation's environmental impact, since a significant amount of CO₂ emissions derive from the distillation process. Lowering the water footprint of mint is also being pursued.

These issues are crucial, Lundy noted, due to the increasing environmental regulations, emergence of high-quality synthetic



From left: Michael Klamm, Gennadiy Kolomeyer, Stanley Sun and Debby Chan (all Rennezenz).

mint alternatives, increased production costs and expansion of mint product markets around the world.

References

1. P.T. Anastas and J.C. Warner, *Green Chemistry: Theory and Practice*. p 30, Oxford University Press, New York (1998)

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