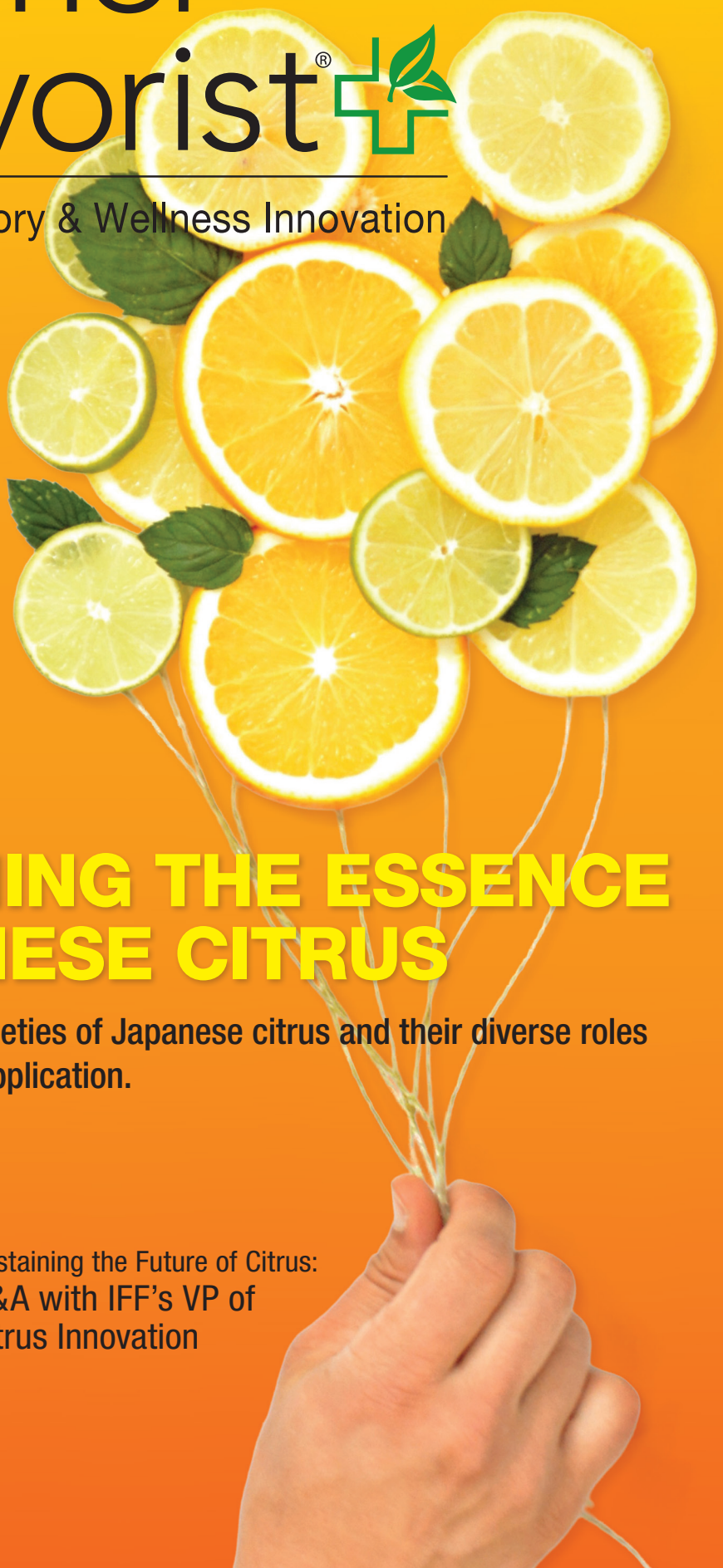
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One Year Later



To all of our readers and the F&F community, thank you.

It's official, dear readers: this is my twelfth editor's note, signifying the end of my first year as editor of *Perfumer & Flavorist+*. It's been such a wonderful year, learning so much about the flavor and fragrance industry and getting to meet so many incredible experts and readers.

As I look back on my very first note, I focused on the idea of making an impact on our industry. I've always said that my goal is for every reader to learn something that will help them in their jobs, and I believe we've achieved that. Flavor and fragrance are certainly making an impact, and I believe *Perfumer & Flavorist+* is at the forefront of reporting that innovation and highlighting the best our industry has to offer.

This was also a year of prioritizing value and continuing how to do more with less. Most experts I've spoken to at various conferences and shows have stressed the importance of efficiency in their production. This is where technologies like artificial intelligence and precision fermentation have been extremely beneficial, and it's only going to become more and more effective. We know that consumers are looking for authenticity in their products, so it makes sense to mimic those natural processes with a little bit of science.

The other area I mentioned in that first note was social media, which continues to have a major impact on flavor and fragrance. From OSF Flavors developing its angel hair chocolate or salted caramel miso latte flavor based on social listening and trends to interviewing the king of gourmands Paul Fino himself, I've seen first hand how important it is to listen to social trends. Consumers are telling the industry exactly what they want; all we have to do is listen.

I'm excited to see where this industry goes next in the future. While I don't think the notions of sustainability and value will go away, I'm interested to see how these trends evolve and how industry leaders continue to adapt. This is the era of creative solutions, bringing the best and brightest together to keep quality high and continue to innovate.

To all of our readers and the F&F community, thank you for a great year of learning and curiosity. I hope to continue that trend in the years to come.

Emily Little



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Methyl-T2-Hexanoate, Natural

Penta Fine Ingredients

http://www.pentafineingredients.com/

Natural methyl-T2-hexanoate (CAS #2396-77-2, FEMA #2709, FLAVIS #09.181, JEFCA #1809) contains a flavor profile of intense, powerful pineapple with odor properties described as fatty, sharp green-fruity pineapple. Our material is Kosher and Halal Compliant.



Natural Farnesol

Axxence USA

http://www.axxence.com/

Natural Farnesol (FEMA #2478, CAS #4602-84-0) brings a warmth that bridges fresh, green and slightly citrusy notes with subtle sweetness. Farnesol offers soft floral and woody notes that create a quietly sophisticated backdrop for fruit and tea flavors while smoothing rough edges in complex profiles. This versatile ingredient works beautifully to round out delicate blends or add a natural lift to clean, modern flavor creations.



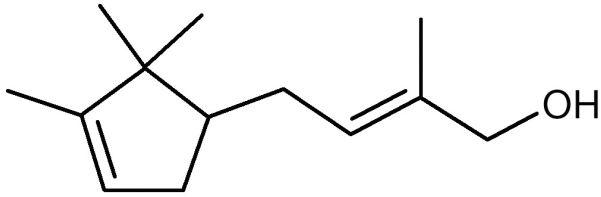
Orange Essential Oil

Agrumaria Reggina

https://www.linkedin.com/company/agrumaria/

Our Orange Essential Oil is cold-expressed directly from the peels of fruits harvested and processed in our facilities in Italy and Egypt. The cold expression of the peels reveals an oil with great aromatic typicity: a floral and juicy roundness balanced by aldehyde and citric notes. Orange Essential Oil can be paired with other citrus notes for a sparkling medley, with an amber accord to reveal its depth, or a mineral accord for a frosty effect.

Images courtesy of the manufacturers



Sandol

Hangzhou Grascent Co. Ltd

http://www.hangzhougrascent.com/

Sandol, or 2-methyl-4-(2,2,3-trimethyl-3-cyclopenten-1-yl)-2-buten-1-ol, has milky and creamy notes with notes of sandalwood. Suggested applications include fine fragrance, personal care, fabric care and home care.



Stevi Lift

Avant Organics

http://avantorganics.com/

Stevi Lift (1078TM and 1079TM) is designed to optimize stevia-sweetened formulations by enhancing mouthfeel and blocking stevia's characteristic bitterness. This product achieves a clean, balanced sweetness that improves overall taste performance. Ideal applications include soft drinks, flavored waters, dairy alternatives, tabletop sweeteners, confections and functional beverages where a smoother, more sugar-like profile is key. Avant Organics provides this material as EU Natural, Kosher, and non-GMO and has the option of ethanol or propylene glycol as a carrier.



Ambrostar

Symrise AG

https://www.symrise.com/scent-and-care/aroma-molecules/perfumery-ingredients/#Ambrostar

Ambrostar ignites the senses with a warm amber signature, powerful yet smooth, versatile and long-lasting, renewable and high impact. This easy-to-handle liquid offers unlimited opportunities from functional applications to fine fragrance.



Citrus Aldehydes

ADM

https://www.adm.com/en-us/products-services/human-nutrition/products/flavors/citrus/citrus-ingredients/

ADM offers key citrus components to help fortify flavor creations, adding depth and body to formulations. As FTNF ingredients, they help drive overall authenticity by emphasizing oily and zesty characters for various citrus profiles. We offer all types of fractions, available in standard and customized purities based on your needs.

Images courtesy of the manufacturers



Natural Nootkatone

Lallemand

https://www.evolva-flavor-fragrance.com/

Lallemand's Natural Nootkatone delivers authentic grapefruit flavor without citrus sourcing risks. Produced via precision fermentation from renewable materials, it ensures consistent quality year-round. Available in 85% liquid and 98% crystalline forms, it meets EU and US natural labeling standards, making it ideal for beverages, sauces, and complex flavor systems.



Tiglic Acid

Penta Fine Ingredients

http://www.pentafineingredients.com/

This material has a fruity and spicy odor with woody and caramel like notes. It has a sweet, fruity Jamy nuance that makes it ideal for use in many beverages, desserts and candy. Offered in Natural and Synthetic, Kosher and Halal.



Isobionics Natural beta-Sinensal 20

Isobionics by BASF SE

https://www.isobionics.com/global/en/product-finder/beta-sinensal-20

The first single isomer Sinensal (FEMA #5088) on the market, produced using fermentation-technology. It's not extracted from orange oil, which opens up the potential for wide use in various flavor applications and it also shows potent effects in savory formulations. It's perfect for enhancing organoleptic properties of orange oil products.



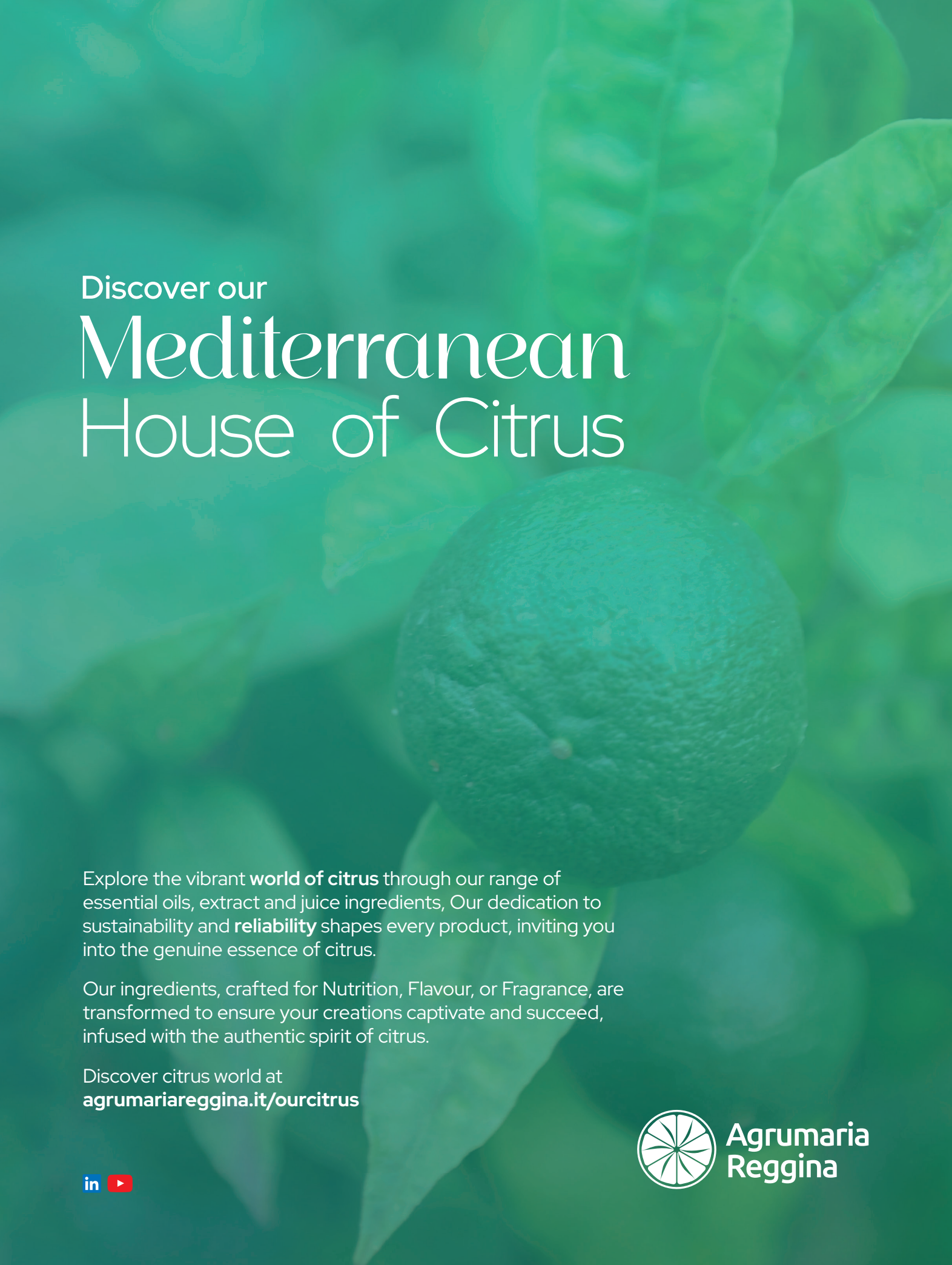
Lime Oil Distilled Peru

Berjé Inc

https://berjeinc.com/products/essential-oils/lime-oil-distilled-peru/

Steam distilled from key lime peels grown in northern Peru, this oil offers a bright, zesty aroma with the freshness of just cut lime peel. Its crisp, fruity character enhances beverages, confectionery and savory applications, while adding a zingy citrus lift to soaps, detergents and fine fragrance compositions.

Images courtesy of the manufacturers


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EXPLORING THE NUANCES OF CITRUS FOR WELLNESS

ADM's latest consumer research shows that citrus represents more to wellness than the conventional immunity boost.

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Everyone knows citrus is a flavor family that is highly associated in consumers' minds with wellness. Whether you are handed a glass of orange juice when you come down with the common cold or you relax with hot herbal tea spiked with bright lemon, citrus inhabits so many aspects of consumer wellness. But for today's consumers, their definition for wellness is more expansive than ever, taking a more holistic view which encompasses the many aspects of physical as well as emotional peace and comfort.

With this new view, we need to shift how we think about classic citrus profiles playing into a brave new world of innovation in wellness. ADM has studied preferences and nuances of citrus flavor preferences across the US, Europe and Asia, but our new study[1] for 2025 helps us examine citrus through the lens of wellness. With data on 44 flavor types collected from the US, UK, Germany, China and Australia, we are able to contrast and compare consumer associations to the 10 key health positionings in food and beverage (F&B) applications, and separately, in dietary supplements (DS): immunity, hydration, digestion, weight management, energy, cognitive health, sleep and relaxation, heart health, and women's health.



ADM's new study for 2025 helps examine citrus through the lens of wellness.

When it comes to citrus flavors, the data shows some universal associations that are commonplace and expected: main tonalities like Orange, Lemon and Citrus are highly associated with Immunity, Hydration and Boosting Energy. But the true value of the study shows in some of the more emerging positionings.

For example, Relaxation and Sleep was the top wellness concern for global consumers – but the question would be which citrus tonalities bring this to life for consumers in food, beverages and supplements? And how do those results vary across regions and countries?

Some key insights for the US include Lemon being highly associated with F&B products that support Cognitive Health (76%), with Lime and Grapefruit also notable for Relaxation and Sleep. In DS, Lemon also features for products for Hydration and Weight Management (75% and 67% respectively).



In the UK, Citrus and Orange profiles win for both dietary supplements and food and beverage consumers for Energy.

Courtesy of ADM

In Europe, we compare and contrast data on UK and German consumers. Citrus, which may refer to a blend or the general taste of citrus fruits, leads in many aspects of health and wellness for both DS and F&B consumers. In the UK, Citrus and Orange profiles win for both DS and F&B consumers for Energy, where both Lemon and Orange communicate digestion in DS while F&B results are less surprising with associations for immunity and hydration. For German consumers, Lemon and Citrus lead across all health benefits in strong associations, with Lime popping for Energy Boost (approx. 80%) and Cognitive Health (approx. 70%) association.

For Chinese consumers, Orange is the "unlock" for wellness in both food and beverage and dietary supplements in nearly every positioning we studied – which will inevitably lead to questions on the character of Orange needed – whether that is the same or different for each wellness need or type of consumer. For dietary supplement consumers in China, Citrus and Grapefruit cue positive perceptions for Heart Health (63% and 67% respectively), topping Orange coming in at 54%.

While the insights help guide flavor choices for product developers, challenges may arise on the bench when trying to deliver the bright, true to fruit profiles that consumers are increasingly expecting in the products they consume. With citrus tonalities already prone to challenges in delivering oxidized notes and stability in various applications, the hurdles get even higher when functional additives are added to deliver the actual health benefits beyond the perception.

Citrus technologies like Corefold™ and EZCore™ will ease some of the primary challenges for citrus flavor formulations for today's health& wellness focused products[2]. Corefold™ can help deliver bold and vibrant flavors in challenging bases and has proved its functionality in DS formats like gummy vitamins and challenging beverage formats like Energy Drinks. EZCore™ citrus flavor technology helps deliver authentic, fresh profiles in all types of applications by expressing all the pieces of the individual citrus fruit to deliver the sensory notes of the aromatic peel, and sweet/sour balance of the juice of the fruit in question. Taste modulation and masking with tools like ADM's TasteSpark™ flavor modulation technology will most likely be needed for specific functionals which have consumer-sought benefits but severely impact taste, for example, ingredients like BCAAs, DHA, caffeine, sweeteners, botanical extracts, or even salts for isotonic/hydration beverages.



For dietary supplement consumers in China, Citrus and Grapefruit cue positive perceptions for Heart Health.

As stated in our Newstalgia Dreamland trend for ADM's Flavor and Color Outlook for 2026, the consumers' connections to product "experiences that are immediately recognizable, trustworthy and timeless" are poised to win in market, even if the profiles are "reborn in [their] memories and come alive in [their] tastebuds today." Health and wellness and consumers' needs around their expanding definition of what that encompasses are evolving – and citrus flavor profiles are evolving in kind through the work of diligent flavorists and product developers to help keep citrus experiences relevant in this new world of wellness.



Citrus technologies like Corefold™ and EZCore™ will ease some of the primary challenges for citrus flavor formulations for today's health & wellness focused products.

References

1. ADM Outside Voice(SM) Consumer Associations with Wellness Study, 2025
2. Add footnote: Corefold®, EZCore® and TasteSpark® are trademarks of ADM or its affiliates registered in the EU and other countries.

Givaudan to Acquire Belle Aire Creations



Belle Aire Creations is a full-service fragrance manufacturer delivering innovations in perfumery and malodor technology.

Givaudan announced its intention to acquire US-based fragrance house Belle Aire Creations. The transaction is aligned with Givaudan's 2030 strategy to extend its customer reach.

Founded in 1982, Belle Aire Creations is a full-service fragrance manufacturer delivering innovations in perfumery and malodor technology. The company is based in the Midwest, creating a central hub to serve a broad and diverse range of customers across the United States. Further, Belle Aire Creations has made strategic investments in talent, technology and resources to drive growth in the fragrance industry.

"The acquisition of Belle Aire Creations represents an exciting milestone for Givaudan as we continue our journey to deliver long-term sustainable growth," said Givaudan's chief executive officer Gilles Andrier. "Their strong customer partnerships and entrepreneurial spirit align perfectly with our vision and values."

Full terms of the acquisition deal will not be disclosed, according to the company's press release. The transaction is expected to close by the end of 2025 or early in 2026. Givaudan plans to fund the transaction with existing resources.

Stacey David, chief executive officer of Belle Aire Creations, added, "This is a transformative moment for Belle Aire Creations. With shared values, complementary strengths and a united vision, we're not just building on our legacy – we're creating something truly extraordinary. Together, we'll amplify our impact, bring even greater creativity to our customers and expand the opportunities we deliver as we shape the future of fragrance."

p&f+

Image by EkaterinaVladimirova at Adobe Stock

OSF Flavors Launches Caramel Miso Latte Flavor

OSF Flavors announced the launch of its new caramel miso latte flavor, a cross-category innovation for coffee, beverages, dairy, confections and desserts. The new flavor is inspired by increased social media popularity for sweet and savory coffee combinations.

According to the company's press release, the caramel miso flavor includes the roasted character of espresso, the creamy sweetness of milk, sweet and slightly nutty notes of caramel and miso for a delicate fermented depth and umami richness. The flavor is available in a natural powder format.

OSF Flavors' caramel miso latte flavor joins its angel hair chocolate flavor of innovations looking to bring social media trends to broader food and beverage categories.

"We are seeing interest in sweet and savory coffee drinks such as miso latte or caramel gochujang latte growing," said Pierre Battu, managing director, Asia, at OSF Flavors. "These offer an alternative to the overly sweet beverages still dominating the market and tap into the demand for umami-driven innovation. With our caramel miso latte flavor, now food, as well as beverage brands, can take advantage of this important trend."



OSF Flavors' caramel miso latte flavor includes the roasted notes of espresso, the sweet and slightly nutty notes of caramel and the umami richness of miso.

BASF Launches New Isobionics Natural Lime Ingredient

Isobionics, the biotechnology brand from flavor and fragrance company BASF, announced the launch of its newest natural ingredient, Natural alpha-Farnesene 95. This ingredient is produced from precision fermentation technology and can be used for a variety of lime applications.

The company's press release describes the scent of Natural alpha-Farnesene 95 as a vegetable odor with celery note, followed by a sappy, plant-stem like note and fruit skin. The taste was described as sappy, slightly floral, waxy apple or pear skin, citrus and some white flower notes. Further, Natural alpha-Farnesene 95 has a 95% purity and can be used in beverages, sweets and a broad range of other citrus and fruit flavor formulations.

"This product represents our strong commitment to providing our customers with innovative, high-quality aroma ingredients," said Steffen Götz, senior vice president of aroma ingredients at BASF. "Like all Isobionics products, Natural alpha-Farnesene 95 is fermentation-based and produced from renewable resources. This means it has reliable availability, independent of weather or harvest conditions. The product boasts an outstanding purity of more than 95% and provides exceptional new opportunities in our customers' formulations."

Isobionics' new ingredient is compliant with EU and US food grade regulations and is certified as natural, pesticide-free, kosher and halal.

Giovanni D'Andola, flavor launch manager at BASF, added, "Isobionics Natural alpha-Farnesene 95 completes our lime oil natural sesquiterpene ingredient portfolio. We're proud to offer this extensive range of flavor ingredients for our customers' lime applications, which is unique in the market."



The taste of Isobionics' new ingredient was described as sappy, slightly floral, waxy apple or pear skin, citrus and some white flower notes.

From top: images by Lamia; valery121283 at Adobe Stock

Turpaz Acquires Nicola-J, Strengthens Position in African Flavor Sector



Nicola-J operates in South Africa with R&D laboratories, a manufacturing plant and office space in Johannesburg.

On September 30, 2025, Turpaz Industries announced that it has signed an agreement to acquire 60% of the shares of South African flavor company Nicola-J. The transaction, which includes Turpaz's subsidiary Sunspray, is expected to be completed in the coming months, and the agreement includes a mutual option to purchase the remaining 40% of shares pending business performance.

Founded in 1997, Nicola-J produces and markets sweet and savory flavors, colorants, essential oils and botanical extracts for the food and beverage industry. The company operates in South Africa with R&D laboratories, a manufacturing plant and office space in Johannesburg. Further, Nicola-J serves customers in Zimbabwe, Mozambique, Zambia, Botswana, Kenya and more.

According to the press release, Nicola-J's founders Jason Vlantis, Nicky Vlantis and Gary Boast, as well as the company's chief executive officer Dr. Karina Rogers, will continue to lead Nicola-J.

"We are pleased to welcome Nicola-J to the Turpaz group," said Karen Cohen Chazon, chief executive officer of Turpaz. "This acquisition represents another step in our expansion in the African flavor markets. Nicola-J synergistically complements Sunspray's operations in South Africa, joining the group with a high-quality product portfolio, experienced management and a broad and diverse customer base. This acquisition adds professional expertise, expands our customer and product portfolio and strengthens our operations in Africa."

According to a recent audit report, Nicola-J recorded annual sales of $6.6 million, with a profitability rate similar to that of Turpaz's Taste division. Turpaz hopes that this acquisition will strengthen its position in South Africa, which has a diverse, young and growing population of over 60 million people.

In a joint statement, Nicola-J's leadership said, "We are delighted to join the Turpaz group and embark together on a new and promising chapter for Nicola-J. The combination of the local knowledge and experience we have accumulated over decades together with Turpaz's global capabilities will allow us to expand our operations and provide our customers with greater added-value. We believe that the partnership with Turpaz will create a strong platform for expansion into additional African markets while continuing to invest in the development of innovative products and deepening our relationships with our customers."

Image by Jikno at Adobe Stock

European Flavour Association Elects New Board for 2025-2027 Term



The newly appointed board will guide EFFA in its strategic priorities and represent the collective voice of the European flavor industry.

On September 25, 2025, the European Flavour Association (EFFA) announced the election of its new board for the 2025-2027 term during its general assembly meeting. Doruk Ongan, previously the association's vice president, will now serve as president.

"I look forward to working with Karel Stoschek, as past president, and with Mr. Walter Ribero as newly elected vice president to represent the interests of the European flavor industry," Ongan said.

The EFFA's assembly brought together representatives from national associations and companies across Europe to review the past year and define priorities for the next, as well as elect its new board. Additionally, the EFFA assisted in creating a new association: the Polish Association of the Flavour Industry (PZPA). The board hopes this new association will strengthen representation across Europe and continue to support the flavor industry in Europe and globally.

"EFFA's strength lies in its members," Ongan said. "With PZPA joining, our family grows stronger, more diverse and even better equipped to shape the future of our industry."

The newly appointed board will guide EFFA in its strategic priorities and represent the collective voice of the European flavor industry. The new Board reflects a wider range of perspectives, with UKFA (United Kingdom) and AEFFA (Spain) joining for the first time. Both members bring experience from small and medium-sized enterprises.

Photo courtesy of EFFA



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dsm-firmenich Opens Global Food Innovation Center in the Netherlands



The center is named after Jacques van Marken, founder of the Yeast and Spirits Factory and a well-known Delft entrepreneur and social reformer.

Photo courtesy of dsm-firmenich

dsm-firmenich announced the inauguration of the Van Marken Food Innovation Center in Delft, the Netherlands. The new center is designed to help customers develop delicious, nutritious and sustainable food and beverage solutions.

"The future of food is not just a vision, it's a reality that we're creating right now together with our customers," said Patrick Niels, president of the company's taste, texture and health business unit. "Our commitment to innovation and sustainability is unparalleled. Strategically positioned at the Dutch Biotech Campus Delft - the global food and biotechnology hotspot - the Van Marken Food Innovation Center underlines our ongoing dedication to contributing to the local environment and to the Netherlands, while honoring our 155-year legacy of food and biotechnology innovation in Delft."

The innovation center will house the headquarters of dsm-firmenich's taste, texture and health business unit as well as a co-creation kitchen, tasting facilities and application labs for the diary, bakery and brewery industries. The center is named after Jacques van Marken, founder of the Yeast and Spirits Factory and a well-known Delft entrepreneur and social reformer.

According to the company's press release, the new facility will be equipped with the latest technologies to develop sugar substitutes, lactose-free products and sustainable plant-based alternatives to fish, meat and dairy. Further, it has been designed to prioritize both human and planetary health.

"dsm-firmenich's Van Marken Food Innovation Center is of great importance to the province of Zuid-Holland," said Wouter Kolff, the King's commissioner in the province of South-Holland. "The center is a driving force in strengthening the knowledge ecosystem and economic growth in the region and beyond. dsm-firmenich is an important employer and a magnet for current and future talent, contributing to the attractiveness of the city of Delft, the province and the Netherlands."

p&f+

Cosmo International Fragrances, Doctor Aromas Announce Strategic Partnership to Develop New Aerosol Fragrance Delivery

Cosmo International Fragrances and Doctor Aromas partnered to develop the new Everspray technology, a next-generation of fragrance delivery though an advanced aerosol system. The companies claim that this patented innovation provides enhanced suspension, long-lasting performance and high fragrance concentration of up to 40%.

According to the press release, Everspray produces micro-droplets that remain suspended 10 to 100 times longer in the air than traditional aerosols. Further, the new technology is alcohol-free, non-flammable and has a low Global Warming Potential (GWP).

"This partnership reflects our commitment to pushing fragrance innovation into new territory," said Marc Blaison, president of Cosmo International Fragrances. "By combining Cosmo's expertise with Everspray's cutting-edge technology, we're opening doors to smarter, safer and more sensorial aerosol experiences for our clients."

The Everspray technology recently received the SATA Innovation Award for Advancement in Formulation from the Southern Aerosol Technical Association.

"Formulating this system challenged us to rethink how we design for diffusion, suspension and fragrance intensity," said Cosmo's technology division director Thomas Delmas. "The result is a fully integrated solution that gives brands a cleaner, longer-lasting and more elevated way to deliver scent."

Marcelo Zelicovich, chief executive officer of Doctor Aromas, added, "This partnership is set to transform multiple sectors — from air care to personal care and specialty scenting applications. [Cosmo's] ability to optimize scent profiles for maximum performance unlocks the full potential of our aerosol technology. Together, we are offering superior sprayed fragrance products across key categories."



The Everspray technology recently received the SATA Innovation Award for Advancement in Formulation from the Southern Aerosol Technical Association.

Photo courtesy of Cosmo International Fragrances



The Estée Lauder Companies Opens Global Fragrance Atelier in Paris



Located in the heart of Paris, La Maison des Parfums unites the company's fragrance, creative, and innovation teams.

On October 14, 2025, the Estée Lauder Companies announced the opening of its new fragrance atelier within its La Maison des Parfums in Paris, France. This new innovation hub is dedicated to world-class fragrance expertise, advanced technologies and cutting-edge capabilities.

"Building on our incredible heritage of creativity and innovation, the Atelier will propel our future growth in this dynamic category – uniting world-class expertise, cutting-edge technology and the artistry of fragrance to accelerate innovation across our portfolio," said Stéphane de La Faverie, president and chief executive officer of The Estée Lauder Companies. "Located in the cradle of perfumery, our teams will blend state-of-the-art technology, data-driven intelligence and olfactive expertise to craft the next generation of extraordinary scents for our consumers worldwide."

According to the company's press release, the Atelier includes specialized co-creation and innovation spaces, including a music room and adjoining laboratories. The laboratories themselves house technologies such as CO_2 supercritical extraction, GCMS molecule analysis and AI-driven sillage measurement. Company officials hope that this new innovation space will help its customers with an AI-enabled, end-to-end creation process and reduce fragrance development lead times by up to 30-50% in the coming years.

"The Fragrance Atelier is an exciting new model for creation – a space that harnesses creativity and science to shape the future of fragrance," said René Lammers, The Estée Lauder Companies' chief research and innovation officer. "This hub brings together experts from across our fragrance brands and partners in an environment purpose-built for experimentation. Together, they will accelerate the journey from inspiration to formulation and ultimately to the final consumer experience." p&f+

Photo courtesy of The Estée Lauder Companies


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PROFILE: VISHAL DESHMUKH

Chief Perfumer at Norex Flavours Ltd explains how perfumery captured his attention and allowed him to combine chemistry with creativity.

What led you to the fragrance industry?

My journey into the fragrance industry began with a deep fascination for how scents can evoke emotions and memories. I was always intrigued by the connection between chemistry and creativity, how a formula could translate into an experience. This curiosity led me to explore perfumery as a career, where I could combine both science and artistry to create robust novel fragrances that inspire people in their everyday lives.

Can you share a defining moment or breakthrough in your career as a perfumer?

My breakthrough came when I was tasked with developing a fine fragrance inspired by Middle Eastern perfumery. It pushed me out of my comfort zone, working with rich ouds, saffron, musk and amber, and taught me how to merge cultural depth with modern elegance. The result became one of my proudest creations and shaped my olfactive signature as a perfumer.

One of the other key breakthroughs in my career was developing a stable, long-lasting accord that balanced performance and cost without compromising olfactive quality. It taught me the importance of technical precision and creative flexibility in how innovation often comes from problem-solving within constraints.

What were some of the biggest challenges you faced when entering the perfume industry, and how did you overcome them?

One of the biggest challenges when entering the fragrance industry was the limited access to training and mentorship. Perfumery is a niche field where opportunities are few and highly competitive. I overcame this by dedicating myself to self-learning, studying raw materials-natural ingredients and synthetics, analyzing existing market fragrances and constantly practicing formulation. I also sought feedback from experienced professionals whenever possible, which helped me refine both my technique and creative direction.



Name: Vishal Deshmukh

Title: Chief Perfumer

Location: Amroha, Uttar Pradesh, India

Can you describe a time when a fragrance formulation didn't turn out as expected? How did you address the issue?

There was a project where the fragrance I developed for a liquid detergent smelled beautiful in the lab, but once added to the base, it lost its freshness and developed a slightly harsh undertone. After evaluating, I realized some top notes were reacting with the alkaline system. I reformulated the accord by adjusting the balance of citrus materials and replacing a few unstable aldehydes with more stable esters. The improved version performed well both in stability and sensory evaluation.

Courtesy of Vishal Deshmukh

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How do you find the right balance between artistic expression and the technical limitations of perfume formulation?

For me, balancing artistic expression with technical limitations is the essence of perfumery, especially in functional products like detergents. I start by translating the creative idea or mood into an olfactive direction for example, "fresh floral with a clean, lasting base." Then I adapt that vision to the technical realities of the product base pH, surfactants, dosage, and cost constraints.

The challenge is to maintain the soul of the fragrance while ensuring stability and performance. I often use creative reconstitution, finding alternative materials that capture the same character but can withstand alkaline environments or high temperatures. In this way, creativity becomes more about intelligent adaptation rather than compromise.

I believe true artistry in perfumery lies not just in composing beautiful accords, but in making them work beautifully in their intended application.

Are there specific skills or knowledge areas you believe are crucial for a perfumer to master?

I believe olfactory memory and sensitivity, recognizing and remembering scents, raw material knowledge of natural and synthetic ingredients, chemistry understanding of how ingredients interact and affect stability, blending and formulation, regulatory awareness and creativity and artistic sense innovating unique scents are top skills crucial for a perfumer to master.





γ-Butyrolactone adds authenticity to caramel flavors.



BY JOHN WRIGHT
johnwrightflavorist@gmail.com

Flavor Bites:
γ-Butyrolactone in Brown, Savory, Nut, Fruit, Alcoholic and Other Flavors

Learn about the diverse flavor applications for γ-butyrolactone.

One of the persistent challenges of our work is the number of different ways many chemicals can be named. γ-Butyrolactone (FEMA GRAS#3291, CAS#96-48-0) is not the worst offender, but 4-hydroxy butanoic acid lactone, oxalan-2-one, 1,4-butanolide, 4,5-dihydro 2(3H)-furanone and tetrahydro furan-2-one are all commonly used alternative names. Thankfully, there are no major trade names to add to the confusion.

γ-Butyrolactone has a mild, but attractive, caramel note, with a hint of cream. It has an obvious role in brown flavors, but can also play a useful role in very many other flavors. Despite the challenge that it is DEA listed, it is widely used in flavors across the globe.

Image by Africa Studio at Adobe Stock

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Note that the dose rates given throughout this article are the levels suggested for use in flavors intended to be dosed at 0.05% in ready-to-drink beverages or in a simple bouillon.

Brown Flavors

Caramel: It is no surprise that one of the highest suggested use levels is in caramel flavors. Three thousand ppm is a good starting level, adding considerably to authenticity.

Chocolate and Cocoa: Levels in these two flavor categories are more moderate, ranging from 300 to 500 ppm.

Coffee: Here we are back to a high suggested level of 3,000 ppm, adding a soft background to all the roasted and burnt notes.

Maple: Levels in maple flavors can vary considerably. More moderate levels, from 200 to 500 ppm, are better in realistic flavors.

Molasses and Brown Sugar: γ-Butyrolactone is found naturally at high levels in brown sugar and this is reflected in a suggested use level between 2,000 and 3,000 ppm in brown sugar and molasses flavors.

Vanilla: In contrast, this raw material plays a modest, but helpful, part in vanilla bean flavors at around 50 ppm.

Savory Flavors

Bacon: Use levels in savory flavors are more often in the middle range. Bacon is a good example, with a suggested use level of 400 ppm.

Beef: All beef flavors gain in authenticity from γ-butyrolactone. Higher levels, around 1,000 ppm, are better in roast type profiles.

Chicken: Chicken flavors also cover a range of levels of addition, but the levels are generally lower, around 100 ppm.

Pork and Ham: Pork and ham flavors also use γ-butyrolactone in a modest supporting role, at levels ranging from 100 to 200 ppm.



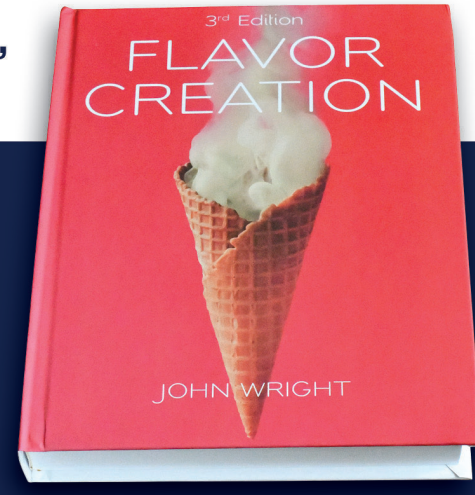
The addition of γ-butyrolactone can smooth harsh smoke flavors.

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Smoke: Eight hundred to 1,000 ppm of γ-butyrolactone smooth even the harshest of smoke flavors.

Tomato: This is not really a category of flavors where γ-butyrolactone can be recommended for fresh profiles. However, it works very well in cooked and sun-dried profiles. Five hundred ppm is a good starting point.



γ-Butyrolactone can be used in both dried and fresh apricot flavors.

Nut Flavors

Cashew Nut: γ-Butyrolactone levels in nut flavors vary considerably. Cashew nut flavors are at the high end, with a recommended level of 2,000 ppm.

Hazelnut: Hazelnut flavors need rather less of this ingredient. Five hundred ppm is more than enough.

Peanut: γ-Butyrolactone adds creamy depth to peanut flavors at 1,000 ppm.

Pistachio and Almond: Some, lightly roasted, flavors benefit from as little as 50 ppm. Alternatively, more aggressive flavors can take up to 800 ppm.

Walnut: Despite their less aggressive profiles, walnut flavors need higher levels of γ-butyrolactone, up to 2,000 ppm.

Fruit Flavors

Apricot and Peach: γ-Butyrolactone might be expected to be found in dried apricot flavors, and it does work well at 1,000 ppm. Much less obviously, it also helps add authenticity to fresh apricot flavors at 100 ppm.

Cherry: Three hundred ppm of this raw material broadens the profile of all styles of cherry flavors.

Grape: γ-Butyrolactone adds realism and complexity to all grape flavors. It works best in Concord grape flavors at 300 ppm.

Prune and Raisin: The somewhat dried character of prune and raisin flavors is notably assisted by γ-butyrolactone. One thousand ppm works well.

Alcoholic Drink Flavors

Beer: γ-Butyrolactone has something to offer in every type of beer flavor. Levels range from a mere hint at 10 ppm in lagers up to 300 ppm in ales.

Rum: Levels in rum flavors also vary dramatically, from around 50 ppm in light rums up to 1,000 ppm in Navy rums.

Sake: Sake flavors can also make good use of this ingredient. Two hundred ppm is a reasonable level of addition.

Whisky: γ-Butyrolactone helps to build the caramel character in all types of whisky flavors, starting at 50 ppm.

Other Flavors

Cereal and Bread: This ingredient is very effective in all cereal and bread flavors at levels from five to 1,500 ppm.

Coconut: It is also successful in coconut flavors at levels from 100 to 400 ppm. Illogically, the higher levels work better in coconut water flavors.

Honey: Honey flavors are often dominated by heavy taste notes, such as phenyl acetic acid, and bright floral notes, such as linalool. Four hundred ppm of γ-butyrolactone helps fill out the middle ground.

Olive: Olive flavors can sometimes end up surprisingly complex, so adding another ingredient might not seem wise. Two hundred ppm of this raw material is worth the risk.

Tea: The contribution of γ-butyrolactone to tea flavors is very closely linked to the type of tea that is the target. Eight hundred ppm for red teas, 500 ppm for black teas, 100 ppm for rooibos teas and, finally, 50 ppm for green teas.

p&f+

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Citrus Solutions

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Smelling in Stereo:
How 3D Olfaction Processes can Revolutionize Perfumery

Introducing a new way to formulate a perfume without changing or adding ingredients.

BY JACQUES BLANC, founder, Jacques Blanc Parfum



Jacques Blanc, founder, Jacques Blanc Parfum

Humans have two olfactory nerves, each of them independent and carrying their own information into the brain.

Image by Antonio at Adobe Stock; courtesy of Jacques Blanc

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In numerous scientific studies, olfactory performance is operationalized as olfactory identification, discrimination and/or odor detection threshold[1]. In this contribution, we will address olfactory threshold between traditionally formulated perfumes and newly formulated perfumes.

Perfumers miss this challenge. Their perfumes are amazing, consumers are satisfied, but there is something missing when they want to reproduce a natural scent: a lack of veracity. The question is: how is it that, having all the skills and ingredients, they can't achieve this goal? The answer is so simple to state that few who hear it really believe in it.

Let's examine why there is always something missing with the perfumers' traditional methods and how is it possible to reproduce the natural scent of a rose – or a garden – with a new simple process.

The Oculus Effect: Two Versions of the Same Information

Human beings, and animals in general, have two eyes, two ears and two nostrils.

Why two and not only one? For survival.

Two organs allow us to have a spatial 3D perception of our environment. For example, try to play tennis with only one eye, you'll miss the ball. It means we only need two slightly different versions of the same information to reproduce its volume.

Introducing Stereo in Music

Until the 1970's, when people used to listen to music at home, they only had one loudspeaker dispensing the music recorded by one microphone during the concert. Everybody was quite content with that. They were so satisfied that they called it Hi Fidelity.

Then comes an innovation: stereophonic records. Two loudspeakers or earphones each dispensing at home the sounds recorded by two microphones during the concert.

Suddenly, you have at home the magic of 3D: more depth and amazing spatialization of the instruments and the voices. The musical threshold had been improved: stereo was definitely better than mono. As a result, stereo sound has been in common use since the 1970s[5].

How Does 3D Work?

Simply put, by dispensing two versions of the same information, the sound perceived by your left ear is not the same sound perceived by your right ear. Likewise, what you see with your right eye is not what you see with your left eye. And to that effect,, what you smell with your left nostril is not exactly what you smell with your right nostril.

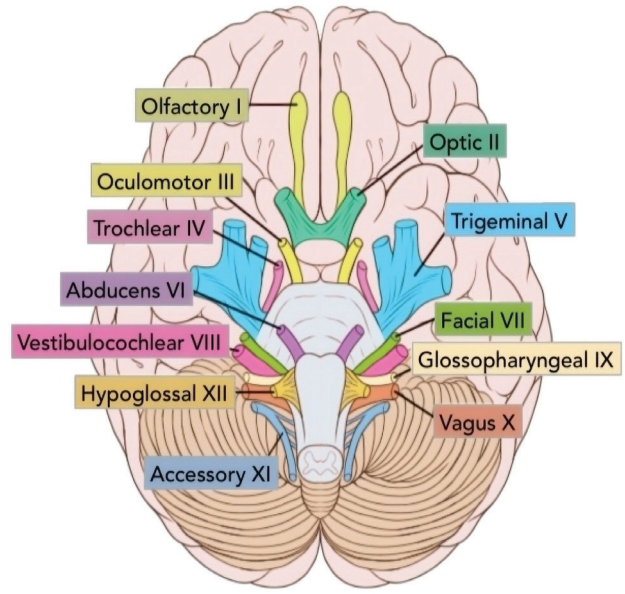


Fig. 1: The two olfactory nerves



Fig. 2: View of the human olfactory bulbs in yellow

These tiny perceived differences of right and left (in fact two versions of the same information) are treated in your brain to create the three-dimensional effect, the volume, the depth. When you walk in nature you feel a natural sensation of an olfactory volume.

From top: images courtesy of Jacques Blanc; StudyBlue



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We can reproduce the same process for fragrances. The challenge is so simple that no one can understand why it has not sooner been on the market, as it has already been achieved for a long time with music and stereophony or sight and stereoscopy.

Why? The reason for this lies in the perfumer's literature. Textbooks, and trade articles almost unanimously write that we have one olfactory bulb, one epithelium[3]. That's what perfumers and student perfumers are told.

It's not simply an error; it's a blunder. In fact, we do have two nostrils, two nasal cavities, two epitheliums, two olfactory bulbs (see fig. 1 and 2). And we have two olfactory nerves, just as we have for sight or hearing, each of them independent and carrying their own information into the brain which turn them into spatial information[4,6].

So, what does it change for a perfumer to know that? Everything.

Scent of a Rose

Flowers have hundreds of different organic compounds. In a rose, for example, we find compounds like geraniol, citronellol, nerol, ß-damascenone, ß-ionone[9], all of them unequally dispersed in a space around the flower like the instruments of an orchestra in a concert hall.

Trying to faithfully reproduce this scent with the traditional methods, perfumers will take these compounds and put them into a bottle. But by doing so, they've just missed the spatial distribution of the rose's molecules in the air. This gives customers only one olfactive information, however great it is. So far, all the perfumes in the world have been formulated in mono-olfaction, as if we only had one nostril, one olfactory bulb.



The stereOscent bottle is designed to recreate the 3D nature of scent.

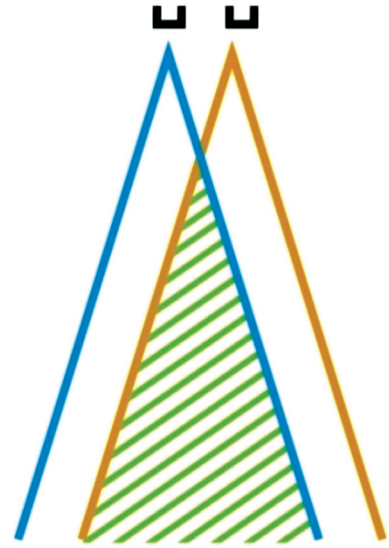


Fig. 3: Diagram of stereOscent design

Introducing stereOscent: Perfumer's Innovation

So, what to do? Should we need 100 different sprays,each spray for one molecule, coming from 100 bottles at the same time?

No. As mentioned before, we just need two sprays – two slightly different versions of the same perfume in each spray – to allow our brain to reproduce the natural volume and depth of our rose. The same molecules, but slightly differently distributed by the means of two sprays coming from two recipients, according to a special brief. It's a new way to formulate a perfume without changing the ingredients, nor the consumer behavior.

How to Achieve This Challenge

Imagine now you want to reproduce a walk along the Swiss Matterhorn mountains, Californian Salt Creek beach or Japanese Katsura Rikyu gardens. You would like to share with your clients this natural olfactive impression of a volume you've been missing till now.

You may have two headspaces and record the two slightly different pieces of information, like two

Images courtesy of Jacques Blanc

microphones in a concert hall. It could work, but this is not a traditional perfumer's process. Up to now for different reasons, the creativity and imagination of a perfumer works better. The only thing you must do is to imagine what your left nostril smells by walking around, and then your right nostril. A little difference, because the scents are unequally dispersed around you: a little more narcissus on this side, a little more lavender and cedar on the other side.

The two sprays will converge and will be partly mixed to reproduce the original 2D perfume (hatched area on fig. 3) while the two "wing" sides will each deliver a different faceted version, giving a 3D quality to your perfume. This specific spatial distribution of the molecules will add a new quality to fine fragrances: depth. Plus, this new patented process[10] now allows all the perfumes to be protected, thanks to the design of an adequate spray system.

Like a Sphere vs a Point

stereOscent has been tested among young perfumers, with blotters turning as a windmill. Young customers are the main target because they are more open and demanding for innovation. The results are positive: "It turns around me," said one; another said, "Compared to the stereOscent, the mono seems more squeezed, bland"; "It's like a sphere compared to a point."[12]

Any perfume, existing or new, can now be formulated in 3D. It will smell like the traditional, but it will gain depth and verticality thanks to a real spatial and temporal distribution of the ingredients.

Just like the same jazz concert provides better feelings when listened to in stereo rather than in mono. Thus, we can say that stereOscent is a nature-like process.

This process can be applied to functional perfumery and to flavors, and will be the subject of another contribution.

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Unearthing the Essence of JAPANESE CITRUS (Part 1)

Explore two different varieties of Japanese citrus and their diverse roles in flavor and fragrance application.

BY KETAN SHAH, president, Esha Flavor Solutions, LLC



Ketan Shah, president, Esha Flavor Solutions, LLC

This article is part one of the two-part series on the unique Japanese citrus becoming increasingly popular globally. In this part one, we will discuss Kabosu and Yuzu.

Kabosu and yuzu are two prized Japanese citrus fruits; each celebrated for their unique flavors and culinary versatility. Kabosu, native to Ōita Prefecture, is characterized by its tart, lemon-like juice and fresh fragrance. Typically harvested green, this fruit is a staple in the regional cuisine of Ōita, enhancing grilled fish, sashimi, hot pot, and serving as a substitute for vinegar in many dishes. Kabosu's history in the region stretches back centuries, with some trees believed to be up to 300 years old. Today, kabosu juice finds its way into a diverse array of foods, drinks, and even fish feed, which helps produce specialty seafood unique to the area.

Yuzu, closely related to kabosu, is equally beloved for its powerful aroma and sharp, citrus flavor. Harvested when yellow and fully ripe, yuzu is a key ingredient in Japanese culinary traditions, lending brightness to sauces, soups, sweets, and beverages. Its distinctive fragrance and acidity make it an irreplaceable element in Japanese kitchens, and its influence has spread globally, inspiring chefs and food enthusiasts worldwide.

Kabosu

Kabosu (*Citrus sphaerocarpa*) is a citrus fruit produced by an evergreen, broad- leaf tree in the Rutaceae family. Highly regarded in Japan, particularly in Ōita Prefecture, kabosu juice is widely used to enhance the flavor of various dishes, especially cooked fish, sashimi and hot pot dishes.

Description

Kabosu is closely related to yuzu and is valued for its tart, lemon-like juice, which is sometimes used as a substitute for vinegar in Japanese cuisine. The fruit grows on a flowering tree equipped with sharp thorns and is typically harvested while still green, although it will turn yellow if allowed to fully ripen. Kabosu is sometimes mistaken for similar citrus fruits like sudachi, but it can be identified by the slightly raised torus shape at the apex, where the pistil has fallen off.



Courtesy of Esha Flavor Solutions

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Kabosu and yuzu are two prized Japanese citrus fruits; each celebrated for their unique flavors and culinary versatility.

Image by ZeNDaYa via Adobe Stock

Origin

Kabosu is believed to be a hybrid between ichang papeda and bitter orange. The term "kabosu" did not appear in literature until the mid-Showa period. According to legend, cultivation in Ōita Prefecture began when a doctor named Sogen brought a kabosu seed or sapling from Kyoto during the Edo period. Notably, some kabosu trees in Ōita are older than those found elsewhere in Japan, leading to the belief that kabosu may be native to the region. In Usuki, there are numerous trees estimated to be 200 years old, with some believed to be as old as 300 years.

The 1960s saw an increase in kabosu cultivation in Ōita, and the fruit began to be shipped to other prefectures. Prefectural promotion in the 1970s fueled further growth, making kabosu a well-known Ōita specialty throughout Japan by the 1980s and 1990s.

Usage

Kabosu juice is notable for its sourness and unique fragrance. It is commonly used with sashimi, grilled fish, ponzu for hot pot and as a vinegar alternative in Japanese dishes. In Ōita Prefecture, it is also incorporated into miso soup, noodles and shōchū, where a few drops of juice provide additional flavor. When squeezing kabosu, cutting it into vertical quarters and pressing with the peel side down helps prevent seeds from entering dishes or drinks.

Kabosu juice is an ingredient in a wide array of products, including condiments, beverages (both non-alcoholic and alcoholic), frozen desserts, snack foods, traditional Japanese wagashi and pastries. Furthermore, when added to fish feed, kabosu's polyphenols help prevent discoloration and odor in fish meat, resulting in specialty products like Kabosu Buri (Japanese amberjack) and Kabosu Hirame (summer flounder) in Ōita.



As of 2018, Ōita Prefecture produced approximately 99% of all kabosu in Japan.



Kabosu is closely related to yuzu and is valued for its tart, lemon-like juice.

Production

As of 2018, Ōita Prefecture produced approximately 99% of all kabosu in Japan. The fruit is grown across most areas of the prefecture, particularly in Usuki, Taketa, Bungo-Ōno and Bungotakada.

In 2007, total kabosu production in Japan was 5,185 tons, with Ōita contributing 5,019 tons, Aichi Prefecture 144 tons and Miyazaki Prefecture 17 tons. The main production district of Ōita accounted for 97% of national output.

Production volumes can vary year to year: 2009 was especially productive, yielding about 6,587 tons in Ōita, while 2010 and 2011 saw 3,623 and 5,273 tons, respectively. Kabosu is typically in season from August to March; however, storage methods and greenhouse cultivation enable year-round availability.

Kabosu Essential Oil Composition

The essential oil derived from kabosu features a complex and rich profile of aromatic compounds, contributing to its distinctive fragrance and sensory qualities. The following table lists the major and minor components identified in kabosu oil, including their retention times (RT) and relative percentages:

Yuzu

Overview

Yuzu (*Citrus* × *junos*), is a citrus fruit and plant belonging to the Rutaceae family and originates from China. Traditionally cultivated across East Asia, yuzu has more recently been grown in countries such as

From top: images by Picture Partners; yamasan at Adobe Stock

New Zealand, Australia, Spain, Italy and France. It is believed to have arisen in central China as a hybrid between the mangshanyeju, a subspecies of mandarin orange, and the ichang papeda.

Description

Yuzu fruits resemble yellow clementines with uneven skin, and their color ranges from yellow to green depending on ripeness. The fruit is highly aromatic and generally measures between 5.5 and 7.5 cm (2 1⁄8 and 3 in) in diameter, though some fruits can reach the size of a grapefruit (up to 10 cm or 4 in, or larger).

The yuzu plant forms an upright shrub or small tree, often with many large thorns. Its leaves are distinguished by a large, leaf-like petiole, similar to those of the related makrut lime and ichang papeda and are strongly scented.

Analytical data provided courtesy of Berje, Inc.

Peak #	RT	Description	%
1	6.30	alpha Thujene	0.19
2	6.45	alpha Pinene	0.98
3	7.22	Sabinene	0.14
4	7.31	beta Pinene	0.39
5	7.65	Myrcene	17.84
6	8.17	alpha Terpinene	0.04
7	8.25	para Cymene	1.22
8	8.59	Limonene	70.10
9	8.83	trans-, beta Ocimene	0.17
10	9.07	gamma Terpinene	3.94
11	9.20	1-Octanol	0.08
12	9.70	Terpinolene	0.21
13	9.82	Linalool	0.27
14	10.23	trans-, para-Mentha2,8-dien-1-ol	0.04
15	10.50	cis Limonene oxide	0.28
16	10.59	trans Limonene oxide	0.14
17	11.34	1-Nonanol	0.06
18	11.46	Terpinen-4-ol	0.06
19	11.69	alpha Terpineol	0.06
20	11.95	Decanal	0.38
21	12.23	trans Carveol	0.04
22	12.48	Nerol	0.18
23	12.58	d-Carvone	0.06
24	13.40	Decyl alcohol	0.06
25	14.01	Undecanal	0.04
26	15.08	Neryl acetate	0.18
27	15.41	Geranyl acetate	0.08
28	15.69	alpha Copaene	0.17
29	15.89	Germacrene D	0.30
30	16.45	beta Caryophyllene	0.32
31	16.99	trans-, beta Farnesene	1.03
32	17.50	Germacrene D	0.05
33	17.92	beta Elemene	0.05
34	18.18	delta Cadinene	0.21
35	19.01	Spathyulenol	0.09
36	19.11	Caryophyllene oxide	0.10
37	24.73	meta Camphorene	0.34
38	25.19	para Camphorene	0.12

From top: image by taiyosun at Adobe Stock; courtesy of Berjé, Inc.



Yuzu fruits resemble yellow clementines with uneven skin, and their color ranges from yellow to green depending on ripeness.

Yuzu closely resembles sudachi (*Citrus sudachi*), a Japanese citrus from Tokushima Prefecture that is a cross between yuzu and mandarin orange. However, yuzu eventually ripens to an orange color, unlike sudachi, and there are subtle differences in the flavors of their fruits.

Cultivation

Originally growing wild in Tibet and central China, yuzu was introduced to Japan and Korea during the Tang dynasty and continues to be cultivated there. The plant grows slowly and typically takes ten years to bear fruit, although grafting onto karatachi (*P. trifoliata*) can shorten this period. Remarkably, yuzu is relatively frost-hardy due to its Ichang papeda ancestry and can survive winters as cold as –7 °C (19 °F), unlike many more sensitive citrus species.

Varieties and Similar Fruits

Japan cultivates an ornamental yuzu variety known as hana yuzu for its flowers. The sweet yuko variety, only present in Japan, became severely endangered in the 1970s and 1980s, prompting extensive efforts to revive it in southern Japan. Another Japanese yuzu variety, shishi yuzu, is characterized by its knobby skin.

Dangyuja, a Korean citrus fruit from Jeju Island, is often considered a type of yuzu due to its similar shape and flavor, though it is genetically a pomelo variety.

Production and Culinary Uses

Japan's domestic yuzu production was about 27,000 tons in 2016. Although yuzu is rarely eaten fresh, it is a staple ingredient in Japanese cuisine. Its aromatic zest and juice are used similarly to lemons in Western cuisines. The fruit's flavor is tart and fragrant, reminiscent of grapefruit with mandarin orange notes.

Yuzu is a key ingredient in ponzu, a citrus-based sauce, and yuzu vinegar is also produced. The fruit is commonly combined with honey to create yuzu hachimitsu, a syrup used for yuzu tea and as a component in alcoholic beverages like yuzu sour. Yuzu kosho (also yuzukosho, "yuzu and pepper") is a spicy Japanese condiment made from yuzu zest, chili peppers and salt.

The fruit is also used to make liquors, such as yuzukomachi and wine, and is featured as a garnish for dishes like chawanmushi (savory egg pudding) and miso soup. Yuzu is used alongside sudachi and kabosu and is incorporated into various sweets, such as marmalade and cake, as well as the flavoring in many snack products, including Doritos.

Yuzu in Korean Cuisine

In Korea, yuja is primarily used to make yuja-cheong (yuja marmalade) and yuja tea. Yuja-cheong is made by sugaring peeled, depulped, and thinly sliced yuja, while yuja-cha (yuja tea) is prepared by mixing hot water with yuja-cheong. Another common dessert is yuja-hwachae (yuja punch), a variety of hwachae (fruit punch). Yuja also appears in Korean-style Western dishes, such as salads.



The essential oil derived from Yuzu features a complex and rich profile of aromatic compounds.

Cultural and Other Uses

Yuzu is celebrated for its strong aroma, and its skin oil is marketed as a fragrance. In Japan, bathing with yuzu on Tōji, the winter solstice, is a tradition dating back to at least the early 18th century. Whole fruits are floated in hot bathwater, sometimes enclosed in cloth bags, releasing their scent. The fruit may also be halved, allowing its juice to mix with the water. The yuzu bath, known as yuzu yu or yuzu buro, is believed to prevent colds, treat skin roughness, warm the body, and relax the mind.

Yuzu in Western Countries

In the early 21st century, yuzu gained popularity among chefs in the United States and other Western nations, notably featured in a 2003 New York Times article. The U.S. Department of Agriculture restricts the import of fresh yuzu and most citrus plants, including both fruit and trees, to prevent the spread of crop diseases. However, due to its introduction to California in 1888, yuzu is cultivated and available for sale within the United States.

Yuzu Essential Oil Composition

The essential oil derived from Yuzu features a complex and rich profile of aromatic compounds, contributing to its distinctive fragrance and sensory qualities. The following table lists the major and minor components identified in Yuzu oil, including their retention times (RT) and relative percentages.

Analytical data provided courtesy of Berje, Inc.

Peak #	RT	Description	%
1	8.10	alpha Thujene	0.34
2	8.33	alpha Pinene	1.50
3	9.93	Sabinene	0.07
4	10.02	beta Pinene	0.78
5	10.92	Myrcene	2.03
6	11.36	alpha Phellandrene	0.32
7	11.97	delta-3-Carene	0.12
8	12.15	para Cymene	3.27
9	12.90	Limonene	78.80
10	13.63	trans-, beta-Ocimene	0.21
11	14.07	gamma Terpinene	8.53
12	15.10	p-(1-Propenyl)-toluene	0.08
13	15.38	Terpinolene	0.45
14	15.85	Lianlool	1.18
15	17.09	cis-Limonene oxide	0.09
16	17.32	trans-Limonene oxide	0.07
17	19.20	Terpinen-4-ol	0.11
18	19.75	alpha Tterpineol	0.09
19	24.43	Thymol	0.06
20	25.61	Limonene glycol	0.03
21	27.82	alpha Copaene	0.03
22	29.09	Isocaryophyllene	0.16
23	30.10	alpha Humulene	0.03
24	30.37	trans-, beta-Farnesene	0.58
25	30.90	Germacrene D	0.06
26	31.39	Viridiflorene	0.07
27	32.14	delta Cadinene	0.13
28	33.00	Germacrene B	0.07
29	33.36	Spathulenol	0.50
30	33.81	Viridiflorol	0.10
31	35.38	Cadin-4-en-10-ol	0.11

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The Middle East as the Next Global Fragrance Innovation Hub

From ancient formulas to modern brands, this region is significantly influencing the fragrance industry.

BY EMILY LITTLE, Associate Managing Editor, *Perfumer & Flavorist+*



Emily Little

The Middle East's influence on the fragrance industry shows the importance of historical and cultural considerations in formulations.

Image by Rotana at Adobe Stock

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The Middle East, a sub-continent of Asia, has become a major regional market. The estimated population exceeds 300 million people, according to Indiana University Bloomington's Center for the Study of the Middle East, and makes up about 6% of the world's population. The area is known for its diversity: in language, in religion, in cultural traditions. And this diversity is making its way across the globe.

The Middle East is having its own moment in the fragrance space. Brands from the region are beginning to gain international attention, and industry leaders are opening labs and innovation centers to get closer to their customers. The Middle East's influence on the fragrance industry shows the importance of historical and cultural considerations in formulations and maintaining authenticity when using these ingredients.

A Historical Scent Trail

The world's first perfumer on record is a woman named Tappūtī-Bēlet-ekallim, commonly shortened to Tapputi. According to the Journal of the World Sensorium/Conservancy[2], her work is referenced on a tablet, KAR 220, which outlines a formulae for perfumery and was housed in the ancient library of Assur, located in modern-day northern Iraq.

Tapputi's formula included a mixture of the flowers of the calamus, myrrh oil, balsam and cyperus root, ingredients still used in perfumery today. And it was considered a perfume "fit for the king," signalling a luxury status associated with fragrances (sound familiar?).

Research from the Journal of the Royal Asiatic Society[3] suggests that fragrance materials were further brought to the Western world by the Arab conquests. About 20 common perfumes were brought to the medieval world, including agarwood, camphor, musk, frankincense and balsam.

"Throughout history, the use of subtle perfumes increased and some of the exotic materials became expensive and valuable commodities," Amar Zohar and Efraim Lev explained in their journal article[3]. "They were the source of wealth for cultures and rulers. Transformations in perfume fashion were in fact only part of a wider revolution of the Arabic material culture which the Middle East, the Mediterranean region and even many European countries experienced due to the Arab conquests."

As fragrance brands began looking for bolder, more intense ingredients to meet consumer demand, they turned to this region for inspiration. Notes like



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Research suggests that fragrance ingredients like agarwood were brought to the Western world during the Arab conquests.

oud, sandalwood and musk began to appear on the fragrance notes of new launches. In July 2022, Louis Vuitton released Fleur du Desert, a fragrance that perfumer Jacques Cavallier Belletrud described as a "tribute to Middle Eastern notes" with hints of jasmine, orange blossom and Damascus rose. Christian Louboutin worked with perfumer Fanny Bal to develop Loubiprince, an homage to Egypt after learning of Louboutin's heritage.

And newer Middle Eastern brands are working their way into the conversation. KAYALI, founded in 2018, was launched by founder Mona Kattan to bring her cultural tradition of fragrance layering to more consumers. Lattafa was founded in the 1980s, but recently has been one of the top-searched fragrance brands on Amazon and TikTok.

This region's rich history of fragrance isn't just stuck in the past; rather, it's helping shape the future of the industry.

A Cultural Boldness

I asked several experts what separates the fragrance preferences of Middle Eastern consumers from Western consumers. The consensus: Middle Eastern fragrance users prefer bold, complex scents.



Amna Al Habtoor, founder, Arcadia

"Ingredients like oud, amber, musk and rose are not trends here – they are timeless and revered," said Amna Al Habtoor, founder of Arcadia. "There's also a generational understanding of layering scents and the ceremonial use of incense and oils, which gives the region an unmatched olfactory sophistication."

Fragrance is deeply ingrained in Middle Eastern culture. The use of perfumes was encouraged by the Prophet Muhammad in the Quran. He advocated for their use as a personal hygiene method and considered perfumes part of *sunnah*, or a guideline for the highest model of life for Muslims to follow.

At the grand opening of Intense Oud, a storefront in Skokie, Ill. specializing in Middle Eastern fragrance brands, I learned about bakhoor and its cultural significance. Bakhoor is made of wood chips that have been mixed with aromatic ingredients, such as frankincense, perfume oils and sandalwood. These blends are then burned like incense, allowing the scent to travel through the air and perfume the area. Some families have their own custom-made blends, allowing them to use fragrance as a form of self-expression and identity.

"Unlike many Western markets where lighter, skin-like scents and minimalism often dominate, Middle Eastern consumers seek fragrances that make a statement – intense, luxurious and expressive," explained Abdulwahab AlRefai, chief technical officer and business development manager at CZAR Fragrances. "There's also a cultural practice of scent-layering and generous application, which adds further complexity to the user experience."

Scent-layering is still a relatively new trend in Western markets. Consumers are realizing that they can use different fragrances and concentrates to create their own distinct signature. Thanks to Gen Z and TikTok, the concept that began as a cultural tradition is now a distinct form of identity, with consumers collecting fragrances and discovery sets to try new combinations.

Let's use KAYALI's Oudgasm collection as an example. The collection, added two new fragrances in the fall of 2025, showcases the different uses of oud in fragrance while staying in the gourmand space.

"Oudgasm is all about sensuality, individuality and storytelling through scent," said founder Mona Kattan in a press release. "With Chocolate Oud and Milky Musk Oud, I wanted to show the full spectrum of oud – its ability to be both wild and warm, sweet and seductive, comforting and captivating. These two new juices are major steps in building the Oudgasm world with bold, unforgettable expressions that push boundaries and invite play. We want to continue redefining what oud can be, for every mood, every layer and every story."

Courtesy of Arcadia



"With Chocolate Oud and Milky Musk Oud, I wanted to show the full spectrum of oud," said KAYALI founder Mona Kattan



Abdulwahab AlRefai, chief technical officer and business development manager, CZAR Fragrances

Authenticity in Innovation

Recently, leaders in the fragrance industry have opened new labs and innovation centers in the Middle East. The companies see this region as one of major potential, where heritage can meet creativity. Several major players in the fragrance industry, including Iberchem, IFF and Eurofragance have opened new innovation centers in the Middle East and are specifically focusing on this area in their new strategies.

"Fifteen to twenty years ago, the fragrance industry was desperately looking for innovation as well as different storytelling, and they found it in the Middle East," said Oumayma Tabet, director of Eurofragance's Creative Centers in IMEA. "The world started to discover a very different olfactive universe, where oud was the new king ingredient. The fabulous heritage of the Middle East is more than oud, and brands started to discover other olfactive notes, such as incense, amber and saffron. The Middle East became a gold mine for fragrance house perfumers, who could unleash their creativity with a new palette of raw materials and design bolder perfumes."

And the consumer demand is clear and apparent. Market intelligence firm Spate NYC noted oud as one of the top trending search terms in the beauty category, with 676.6 thousand average monthly searches and 5.5 million average weekly views on social media platforms.

But many brands told me that it isn't enough just to label your fragrance as Middle Eastern. They have to balance authenticity with global appeal.

"It's easy to fall into the trap of over-relying on cultural motifs without innovating," AlRefai said. "This challenge also presents a tremendous opportunity – to educate, to inspire and to lead."

"At Arcadia, we don't simply use oud or bakhoor as ingredients – we honor them as storytelling devices," Al Habtoor explained. "For instance, Edition 3: The Tribute Edition is our homage to the UAE, blending oud, amber and musk to reflect the soul of the region, past, present and future. Our Bakhoor 'Spirit' is a poetic celebration of growth and determination, crafted with oud, rose, saffron and musk. The way we use heritage notes is not nostalgic alone – it's layered with contemporary narratives that allow global consumers to experience our cultural depth in a universally resonant way."

Looking Ahead

I asked all of the experts I interviewed about their predictions for the Middle Eastern fragrance market in the next five to ten years. Almost everyone mentioned the blend of personalized fragrance technology with storytelling through ingredients and scent notes. Sustainability will also become a major focus, as companies shift priorities on ingredient traceability and ethical sourcing.

L to R: courtesy of KAYALI; CZAR Fragrances

"The next decade will likely see the rise of homegrown niche brands making international waves, a shift from global imports to regional exports," Al Habtoor said. "Consumers are becoming more discerning, seeking authenticity, ethical production and personalization."

This region has a clear influence on the fragrance industry, and fragrance houses and manufacturers alike are taking notice. They want to be in the room where it happens, where innovations and consumer preferences are shaping the market. The Middle East has become a hub of innovation, and it's only going up from here.

"This is an exciting time for the Middle Eastern fragrance market," said Rawya Catto, general manager at CPL Aromas in a 2024 interview with *Perfumer & Flavorist+*. "The world is in love with perfume, and the more intensity, punch and character, the better. Be it in terms of packaging, fragrance design, dosage and intensity, Middle Eastern brands are innovating in ways we've never seen before."



Intense Oud, located in Skokie, Ill., features fragrance brands from around the East and Middle East to start a conversation around Eastern fragrance.

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Sustaining the Future of Citrus: Q&A with IFF's VP of Citrus Innovation

Karel Coosemans explains what customers are looking for at the Citrus Innovation Center and how this space is helping secure the citrus supply for the future.



The Citrus Innovation Center is a 30,000 square-foot facility that includes state-of-the-art capabilities in botanical research and a 360-degree digital immersion room.

Courtesy of IFF

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The global citrus market has seen its fair share of challenges in the past few years. Climate change has caused disruptions in crop yields, leading to price instability and uncertain supply chains. Industry leaders are working together to ensure a strong, sustainable citrus supply for the future.

Earlier this year, IFF announced the opening of the Citrus Innovation Center, located in Lakeland, Fla., in partnership with Florida Polytechnic University.

The new center is a 30,000 square-foot facility that includes state-of-the-art capabilities in botanical research and a 360-degree digital immersion room. The center will also leverage LMR Naturals by IFF's expertise in natural ingredients, processing, analytics and product creation.

"Citrus is vital to our creations in scent and taste, with enormous potential for innovation across our businesses," said chief executive officer Erik Fyrwald at the center's opening. "The Citrus Innovation Center embodies our unwavering dedication to innovation and our commitment to creating enduring partnerships that help us bring leading solutions to our customers while doing more good for people and planet."

Perfumer& Flavorist+ caught up with Karel Coosemans, IFF's vice president of citrus innovation, to learn how the new center is operating in its first six months and find out what solutions citrus customers are looking for.



Karel Coosemans, vice president, citrus innovation, IFF

What are the biggest challenges in the citrus market currently?

The citrus market is facing significant challenges due to climate volatility, which has disrupted crop yields in major producing regions such as Brazil, Argentina and Spain. Droughts, freezes and shifting weather patterns, all driven by climate change, are fragmenting supply chains and causing price instability. Meanwhile, citrus greening disease continues to impact orange production and destabilize the citrus market.

At the same time, rising consumer demand for sustainability and clean-label products is prompting brands to reformulate using upcycled, organic and traceable citrus sources, all while managing cost pressures and preserving flavor authenticity.

IFF opened the Citrus Innovation Center in April of this year. What kind of solutions does this center offer to IFF's customers?

IFF's Citrus Innovation Center offers a comprehensive range of solutions tailored to customer needs. These include end-to-end product design support, advanced research in citrus processing and biotechnology, rapid prototyping for customized applications, and sensory science capabilities.

The Center also provides direct access to industry-leading experts and academia, including our training program. The Citrus Academy and flavorist school offer training programs, innovation rotations, and academic curricula, ensuring the next generation of industry professionals is equipped with the latest knowledge and skills.

With this Center, IFF can deliver authentic citrus experiences while addressing technical, regulatory and market-specific challenges across the food, beverage, fragrance and home care sectors.

The center was opened in partnership with Florida Polytechnic University. Can you describe that partnership and how the two institutions plan to work together?

IFF's partnership with Florida Polytechnic University is a strategic collaboration that combines academic research infrastructure with industry expertise. As Florida Poly's first industry partner, IFF

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The Citrus Innovation Center focuses on applications in food and beverage, fine fragrance, body care, fabric care and home care.

is helping to establish a research park aimed at fostering innovation, economic development and STEM education. The partnership includes joint research initiatives, student training programs and faculty engagement, creating a dynamic environment for advancing citrus science and technology.

What kinds of citrus are your customers most often seeking? Are lemon, lime and orange still supreme, or are other varieties gaining traction?

Lemon, lime, and orange continue to be the most sought-after citrus varieties. However, there is growing interest in niche and regional options such as yuzu, calamansi, blood orange and pomelo. These varieties are gaining popularity due to their distinctive flavor profiles and appeal in premium and regional markets.

Citrus is also increasingly used as a flavor masker in reformulated beverages, particularly those containing artificial sweeteners. Additionally, upcycled citrus ingredients are becoming more desirable for their sustainability benefits.

Why was it important for IFF to open a space dedicated entirely to one ingredient category?

Citrus is a strategic pillar across multiple IFF product categories, and we recognized the need for a dedicated space to explore its complexity and innovation potential. The Citrus Innovation Center enables focused research and development, immersive customer experiences, and sensory exploration. This specialization allows IFF to unlock new value in citrus, respond more effectively to market demands and lead the industry in citrus innovation.

How is the Citrus Innovation Center addressing supply chain uncertainties within this market?

To mitigate supply chain risks, the Citrus Innovation Center develops citrus extenders and modulators that reduce reliance on volatile raw materials. It also invests in sustainable sourcing practices and responsible ingredient storytelling. Acting as a command hub for operational coordination and customer engagement, the center enhances resilience and transparency across citrus supply chains.

What do you see as the next"big thing" in the citrus market in the next 5-10 years?

The citrus market is poised to evolve through digitally enabled flavor design, where AI and sensory science converge to create personalized citrus experiences. There is also increasing interest in citrus applications for health-focused products, particularly within the emerging GLP-1 consumer segment. Regional flavor preferences and sustainability will continue to drive innovation, with new citrus varieties and delivery formats gaining prominence.

What are IFF's overall goals for the Citrus Innovation Center?

IFF's overarching goals for the Citrus Innovation Center are to establish itself as the global leader in citrus innovation, deliver sustainable and authentic citrus solutions, and foster collaborative partnerships with academia and industry. The Center is designed to drive scientific advancement, support customer success and build a holistic citrus ecosystem that fuels growth and innovation across the value chain. p&f+

Courtesy of IFF

















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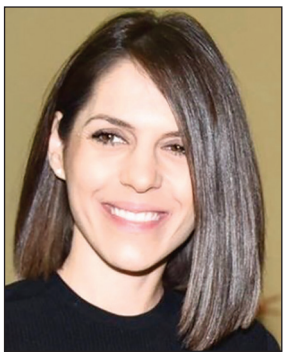
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Lionel Hitchen, based in the UK, offers an extensive range of flavor ingredients to the food and beverage industries around the globe.



BY MARIA PALASSAROU
Flavorist, Givaudan

Flavor Reports: EU Edition

Our BSF panel evaluates ingredients for their flavor applications.

Organoleptic Evaluation Panelists

- **Andrea Albertino, Ph.D.,** Senior Flavorist, Esarom
- **Aine Walsh,** Principal Flavorist, Keurig Dr Pepper
- **Bimal Karmakar, Ph.D.,** Principal Flavorist, Givaudan
- **Britta Nobis,** Senior Flavorist, Silesia
- **Jack Nicol,** Flavorist, IFF
- **John Forbes,** Consultant, Ceressence Consultancy
- **Ján Peťka, Ph.D.,** Head of Flavor Development, Austria Juice
- **Kavita Bhatnagar, Ph.D.,** CEO, Kanegrade Flavors & Ingredients
- **Maria Palassarou, Ph.D.,** PrincipalFlavorist, Givaudan
- **Michele Pezzotta,** Flavorist, Silesia Flavors

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In this month's column we evaluate ingredients from Lionel Hitchen, an independent family-owned company, founded in 1965 as a business sourcing, creating, manufacturing, and supplying the finest flavor ingredients. Lionel Hitchen, based in the UK, is now offering an extensive range of flavor ingredients to the food and beverage industries around the globe.

Yuzu Oil, 2-fold

Description: A folded oil obtained by high vacuum distillation of yuzu extract (*Citrus junos*).
FEMA#4862, CAS#233683-84-6.
Odor Descriptors@100%: Fresh, green, herbal, peely, zesty, seedy, terpenic, spicy-peppery, mandarin-clementine notes, albedo, pithy, floral anthranilate note.
Taste Descriptors@50ppm: Mandarin-tangerine notes, albedo, pithy, waxy, zesty, juicy, fresh, peely, seedy, terpenic, spicy-peppery, herbal, floral anthranilate note, hay coumarinic, slight rubbery petroleum.
Possible Applications: Its dominant fresh citrus character would complement, apart from yuzu flavors, all citrus profiles, especially mandarin, tangerine and clementine due to its characteristic albedo, pithy notes. The spicy, peppery element would make it a great addition to cola profiles, but could also give another dimension to savory tonalities. The green, seedy attributes could blend well in tropical fruit profiles, whereas the zesty, floral, coumarinic notes could complement honey flavors.

Blood Orange, Fresh

Description: A blend of blood orange and sweet orange oil components that capture the full fruit, concentrated by high vacuum distillation (*Citrus sinensis* and *Citrus sinensis(L.) Osbeck*).
FEMA#2825 and 4856
CAS#8008-57-9.
Odor Descriptors@100%: Juicy, fresh, fruity, estery, ripe, sweet orange, pulpy, peely, albedo, pithy, aldehydic, fatty, green, floral, orange essence notes.
Taste Descriptors@50ppm: Juicy, fresh, sweet orange, fruity, estery, ripe, floral, albedo, pithy, aldehydic, fatty, slight peely, herbal notes.
Possible Applications: Its characteristic juicy, fresh, sweet elements would complement various citrus tonalities, like blood orange and sweet orange profiles, as well as clementine, tangerine and mandarin due to its albedo pithy note. The estery, fruity character would make it a great addition to candy fruity tonalities, like Tutti Frutti, whereas its sweet, floral aspect might blend well on red berry and chocolate profiles.

HIPER Thyme

Description: A hexane extraction and distillation of thyme (*Thymus vulgaris L.*), further concentrated and purified by physical processes.
FEMA#3063, CAS#84929-51-1.
Odor Descriptors@100%: Herbal, fresh, camphoraceous, green, rosemary notes, earthy, slight wormwood character, medicinal, sweet honey notes, spicy-peppery, cooling sensation.
Taste Descriptors@20ppm: Camphoraceous, herbal, green, fresh, rosemary notes, earthy, medicinal, slight woody, spicy, peppery, honey notes, cooling sensation.



The fresh blood orange ingredient would work in several orange applications as well as fruity candy applications.

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Possible Applications: The dominant fresh, herbal, camphoraceous character would complement herbal and spice blends flavors in a variety of tonalities and applications, from aperitif, punch and bitters to savory seasonings, broths and soup mixes. The woody, earthy notes would make it a great addition to lime-distilled profiles, and the additional thymol aspect would fit well on mandarin tonalities. The spicy, peppery element could benefit cola flavors, whereas the floral note might blend well with honey profiles.

Ginger, Supersoluble

Description: An acetone extract of African ginger root (*Zingiber officinale R.*) further concentrated and purified by physical processes.

FEMA#2523, CAS#84696-15-1.

Odor Descriptors@100%: Fresh, pungent, woody, ginger root notes, spicy, earthy, herbal, citrus notes, sweet, honey, chocolate back end, warm sensation.

Taste Descriptors@20ppm: Spicy, peppery, woody, ginger root notes, earthy, herbal, citrus terpenic, fresh, Frankincense incense notes, slight brown notes, warm sensation.

Possible Applications: The characteristic spicy, woody, rooty elements would complement all ginger tonalities, from ginger ale and ginger beer to spice mix profiles. The spicy, peppery character could benefit cola flavors, whereas the floral aspect might blend well with honey profiles. Its woody, earthy, herbal notes would make it a great addition to various tea profiles, like green and black tea.

Serrano Chilli Oleoresin

Description: A natural extract obtained by solvent extraction and distillation of dried serrano peppers (*Capsicum annuum L.*), standardised for flavor and heat content.

FEMA#2233, CAS#68023-77-6

Odor Descriptors@100%: Spicy paprika, bell pepper notes, herbal, green, woody, smoky, grilled, roasted chilli, waxy, slight metallic.

Taste Descriptors@0.01%: Spicy, smoky, woody, roasted chilli, bell pepper notes, grilled, alliaceous, metallic, pickle, celery notes, intense heat sensation.

Possible Applications: The dominant spicy, smoky character would complement all chilli and bell pepper profiles, as also smoked and grilled tonalities. The spicy, peppery notes would blend well in spice mix flavors, as well as in ginger profiles. Its delayed but intense heat sensation would make it a great addition as a hot and burn booster in various savory tonalities.



The serrano chili oleoresin has a delayed but intense heat sensation.

Lovage Root Soft Extract

Description: A natural extract obtained by aqueous ethyl alcohol extraction and distillation of lovage root (*Levisticum officinale L.*) .

FEMA#2650, CAS#8016-31-7.

Odor Descriptors@100%: Celery, brown notes like maple and chocolate, herbal, walnut, malt, dried fruit notes, spicy, fenugreek character, leathery, earthy.

Taste Descriptors@0.01%: Celery, vegetable notes, herbal, walnut, fenugreek character, liquorice, brown notes like maple, caramel and chocolate, slightly metallic, earthy, leathery, bitter, astringent.

Possible Applications: The characteristic sweet caramel notes would complement various brown tonalities when added at low levels, like maple, chocolate and toffee, as well as liquorice, but also dried fruit profiles, like raisins. Its earthy element would make it a great addition

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in nut profiles, like walnuts. The dominant vegetable character would blend well in various savory tonalities, from celery to seasoning and soups profiles.

HIPER Cassia

Description: A natural cassia extract obtained by acetone/hexane extraction and distillation of dried cassia bark (*Cinnamomum cassia B.*) to increase solubility.

FEMA#2257, CAS#84961-46-6.

Odor Descriptors@100%: Warm, cinnamic, sweet, woody, oak notes, spicy, dry, earthy, hay tonka, coumarinic, dried fruit notes.

Taste Descriptors@50ppm: Warm, cinnamic, sweet, woody, dry, spicy, clove, coumarinic, balsamic, powdery, slight tingling sensation.

Possible Applications: Its dominant warm, sweet, cinnamic character would complement all cinnamon tonalities, spice blends, like chai and bunspice, or dried fruit profiles, like plums and raisins. It would also blend well in bakery flavor profiles, like biscuit and cereals. The spicy clove note in combination with the warm tingling sensation would make it a great addition in cola flavors, as well as in brown spirits profiles.

HISPEC Lime

Description: A concentrated lime oil obtained by a series of physical processes including High vacuum distillation of cold pressed Tahiti (Persian) lime oil (*Citrus latifolia T.*).

FEMA#4744, CAS#8008-26-2.

Odor Descriptors@100%: Fresh, sweet lemon, zesty, lime peel notes, lime expressed oil profile, aldehydic, soapy, coumarinic.

Taste Descriptors@20ppm: Fresh, zesty, cold pressed lime peel, tangy, fruity lemon, aldehydic, soapy, coumarinic, floral, slight creamy note.

Possible Applications: Its characteristic fresh and zesty notes would complement various citrus tonalities, especially lemon- and lime-expressed profiles, for beverages, candies and cocktails with a distinct coumarinic note, like mojito and caipirinha. The fresh lemon element would also be a great addition in cola flavors, as well as in various savory tonalities providing a citrus note.

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