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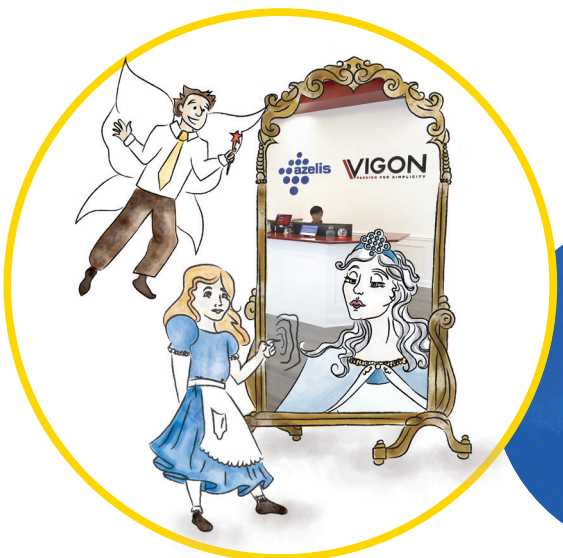
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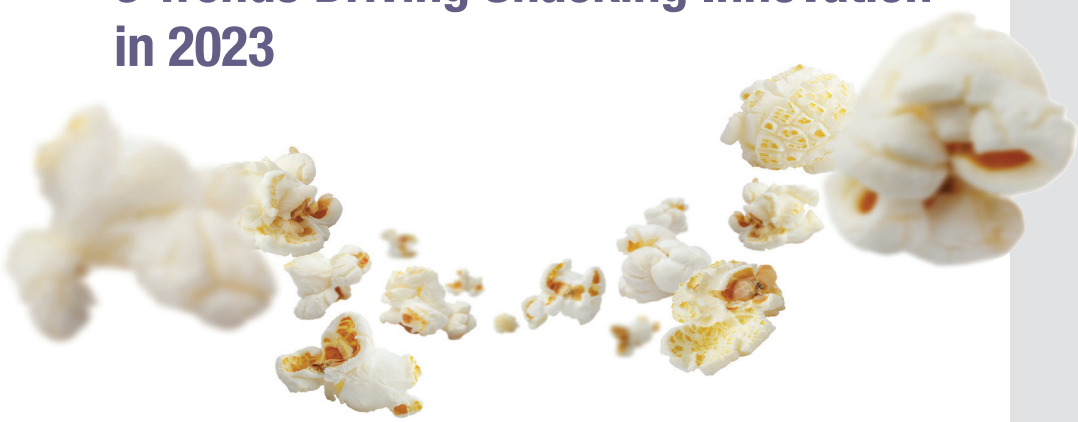
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3 Trends Driving Snacking Innovation in 2023



In the snack market, securing a place in daily routines is an opportunity to gain consumer allegiance in a market where consumers are less loyal in purchasing.

From functional bites to funky flavors, the snacking category is getting a facelift in 2023. In the article, "Emotional support snacks? The shifting salty snack market[a]," penned by Mintel U.S. Food and Drink analyst Kelsey Olsen, the author touches on some developing consumer trends that could drive flavor innovation. Olsen writes, "Brands should appeal to consumers' emotional needs first with salty snacks that support a somewhat slowed-down experience [..] Brands have an opportunity, both with messaging and product development, to reimagine what a snack is and what snacking can mean."

Olsen highlighted 3 trends driving the market:

1. Consumers are most likely to choose snacks to meet emotional needs, with over two-thirds choosing snacks for relaxing and to satisfy a craving.

2. Flavor innovation can keep consumers from getting bored or slowing down consumption in the future. Resealable and smaller packaging works well for on-the-go consumers and will keep salty snacks at their fingertips regardless of what the day brings.

3. Products that provide a consumption experience that brings joy, comfort and nostalgia will foster a connection with consumers in a market when purchases are split. Securing a place in daily routines is an opportunity to gain consumer allegiance in a market where consumers are less loyal in purchasing.

Flavorcon 2023

Speaking of flavor development, are you registered for *Flavorcon* 2023 (*www.flavorcon.com*)? Time is ticking, but you still have a few weeks to register for the two-day flavor-forward event of the year. Scheduled for November 8-9 in Cincinnati, OH, at the Duke Energy Convention Center, this year's event will be loaded with informational sessions, a bustling expo hall and plenty of networking opportunities. More details on ***Flavorcon*** 2023 on **page 40**.

[a]*https://www.mintel.com/food-and-drink-market-news/emotional-support-snacks-how-brands-can-capitalize-on-shifting-snack-market/*



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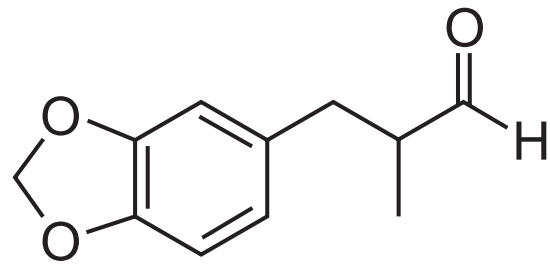
Natural Advantage introduces 2,4-Decadienal (CAS# 25152-84-5, FEMA# 3135). 2,4-Decadienal occurs naturally in cooked beef, fish, potato chips and roasted peanuts. It gives the deep fat flavor of chicken, beef, potato chips and French fries. It can also be used in grapefruit. Typical use rate is 0.005 ppm-10 ppm as consumed. 2,4-Decadienal is EU and U.S. Natural, kosher, vegetarian and non-GMO.



Maple Lactone Natural

Berjé Inc.
www.berjeinc.com/products/naturals/methyl-cyclo-pentenolone-natural/

Maple Lactone Natural (CAS# 80-71-7, FEMA# 2700) has a potent aromatic profile that is heavily reminiscent of maple syrup. It imparts a mouthwatering sweetness complimented by nutty and woody undertones, often compared to caramel or brown sugar. These aspects can enhance the smoky qualities of savory products such as bacon, ham and barbeque sauce.



Floramelon

Hangzhou Grascent Co., Ltd
www.hangzhougrascent.com

Floramelon (CAS# 1205-17-0, FEMA# 4599) features a fresh floral odor with melon top-note. Its applications include fine fragrance, personal care, fabric care and home care. The recommended use level is up to 10%.



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www.symrise.com/de/scent-care/aroma-molecules/ingredient-finder/#Palisandal

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Prenyl Mercaptan

Penta International Corporation

www.pentamfg.com

Prenyl mercaptan (CAS# 5287-45-6, FEMA# 3896) containing a flavor base of onion, smoky and leek. Odor notes also include sulfurous, smoky, leek and onion. Our material is Food Grade, Kosher, Halal and EU and U.S. Natural. Custom dilutions are available in a variety of diluents.



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Olfactory Art Keller Launches Permanent *Adnose* Installation Featuring Experimental Prosthetic AI Device

Olfactory Art Keller has debuted a new installation to its permanent collection, Adnose. The multimedia artist Adnan Aga was born without a sense of smell and has never experienced what others described to him as the superpower of being transported through time and space by volatile molecules entering his nose.

Aga's installation *Adnose* is an experimental prosthetic device in the shape of a wall-mounted nose which uses Computer Vision and OpenAI's system, GPT-4, to predict the smell of any object presented to it. If an object is presented to one of *Adnose*'s nostrils, the other nostril prints out the description of the object's smell.

According to a release, *Adnose* "serves not only as Adnan [Aga]'s nose, but as the nose of all members of the anosmic community, who constantly wonder what the things around them smell like." The artist hopes that his project will draw attention to the often-neglected sense of smell and to the challenges faced by those who can't smell.

Adnose is on view during regular opening hours in the gallery's Cubiculum Odoratus (25 Henry Street, New York, New York, 10002, United States).



If an object is presented to one of Adnose's nostrils, the other nostril prints out the description of the object's smell.

CPL Aromas Acquires Global Fragrances Labs

CPL Aromas has acquired Global Fragrances Labs (GFL) in Spain and its entire operations in El Prat de Llobregat, Barcelona.

CPL Aromas will combine its current operations in Spain with Global Fragrances Labs to create one division, expanding its capabilities to better serve its customers.

CPL Aromas will retain all 19 existing employees from GFL, as well as the current premises that will be run under the CPL Aromas Spain division.

Nick Pickthall, chief operating officer of CPL Aromas said, "Global Fragrances Labs are a complimentary business to our own in Spain, we share similar visions for the future of fragrance and our values align. GFL have a strong reputation for quality and customer service, and combined with CPL's strengths it will offer our domestic customers in Spain a comprehensive experience."

Nelly Di Mercurio López, founder of GFL said, "We are so happy with this agreement, and we know that it will be an opportunity, not only for CPL's growth but for our customers to grow with them."



CPL Aromas will retain all 19 existing employees from GFL, as well as the current premises that will be run under the CPL Aromas Spain division.

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MycoTechnology Appoints Ranjan Patnaik, Ph.D., as Chief Technology Officer

MycoTechnology, Inc. has appointed industry veteran Ranjan Patnaik, Ph.D., as chief technology officer (CTO). This newly created role is designed to strategically align R&D, food science and technical services teams under a single executive leader.

Patnaik brings over 25 years of experience in the fields of fermentation, strain engineering and bioprocess product development. He joins MycoTechnology from EVERY (formerly Clara Foods), where, as CTO, he led a multi-disciplinary technology team of over 50 to pioneer the manufacturing of egg proteins using precision fermentation. During his tenure, the company transitioned from laboratory-phase research to commercial production. Educated in India and the United States, Patnaik holds bachelors and doctoral degrees in chemical engineering, and previously spent over 16 years in domestic and international senior leadership roles at DuPont.

Patnaik shared, "I'm thrilled to be taking up this new role with MycoTechnology at such an important and exciting stage of its journey. The potential for mycelial fermentation in food and beverage applications is huge and remains largely untapped. MycoTechnology's fermentation platform is based on highly sophisticated science and technology know-how and intellectual property assets, putting the company many steps ahead of others in this space and on a clear path to success."

Alan Hahn, MycoTechnology co-founder and CEO added:,"Ranjan has an unparalleled track record of steering businesses from the science and tech stage towards becoming manufacturers and suppliers of scalable, commercialized products. His experience and expertise will be invaluable as we execute on our vision to expand our presence globally and establish international partnerships, while continuing to build on our plans in the Middle East."



Ranjan Patnaik, Ph.D., brings over 25 years of experience in the fields of fermentation, strain engineering and bioprocess product development.

MycoTechnology, Inc. Updates

MycoTechnology has debuted its updated branding and revamped website designed to represent the company's brand vision and commitment to "harnessing the power of mushrooms to create foods that are better for both people and the planet."

Jonas Feliciano, director of Marketing, commented, "MycoTechnology has continued to evolve, and this is the perfect time to implement new branding to reflect the huge progress made in recent years. Our aim is to highlight our ability to combine natural food technology with the culinary world to create nutritious and transformative ingredients. This new brand direction reaffirms our position as a trusted partner for chefs and R&D professionals seeking to realize their innovation ideas–all while meeting our goal of evolving the current food system for the benefit of all."

p&f+



Givaudan Expands Protein Hub at Zurich Innovation Center with Dairy Alternative Capabilities



To accelerate co-creation efforts, the Protein Hub incorporates the latest digital tools and artificial intelligence solutions for rapid concepts, prototyping and testing with consumers.

Givaudan has expanded the Protein Hub at its flagship Zurich Innovation Center in Kemptthal, Switzerland to support the growth of dairy alternatives. The expanded Hub offers specialized expertise, state-of-the-art digital technologies, and an integrated portfolio of solutions designed specifically for dairy alternatives to accelerate product development and co-create new food experiences in collaboration with customers.

To accelerate co-creation efforts, the Protein Hub incorporates the latest digital tools and artificial intelligence (AI) solutions for rapid concepts, prototyping and testing with consumers. For example, Givaudan's unique ATOM technology uses the power of AI to enhance the taste and aromas of alternative dairy products, and the company's patented VAS technology, which can be used to test and co-create aromas directly with consumers in real time. The facility also incorporates a state-of-the-art show kitchen, and laboratories with capabilities in chemistry, biotechnology, fermentation, flavour delivery technology, sensory, applications and food science.

Givaudan president Europe Taste & Wellbeing Doruk Ongan shared, "At Givaudan, we have a unique approach to co-creation where we work side-by-side with our customers, partners, start-ups, chefs, academics and many others as a driving force for innovation. We're excited to open the doors of the Protein Hub to customers in the alternative dairy space, so we can shape the future of this dynamic category together."

Fabio Campanile, global head of Science and Technology, Taste & Wellbeing, commented, "At Givaudan, our experts in science and technology focus on satisfying today's consumer needs, while exploring the taste and functionality of various protein sources–from plants to precise fermentation–and leading new innovations for the future. In addition to our in-house knowledge, technology and research programs, we have created a global innovation ecosystem to support our customers in markets around the world with facilities such as the Protein Innovation Center in Singapore, the MISTA Center in San Francisco and the Tropical Innovation Lab in Brazil."

OnScent and Ascents Labs Launch World's First Clinically Validated Scent Wellness Platform



The collaboration is designed to combine the technical and regulatory abilities of OnScent with Ascents Labs' research and development in the field of clinically-validated wellness scents.

OnScent and Ascents Labs have announced a collaboration to launch what is said to be the world's first and only clinically validated scent wellness platform, based on the foundation of clinically validated proprietary essential oil blends.

The collaboration is designed to combine the technical and regulatory abilities of OnScent with Ascents Labs' research and development in the field of clinically-validated wellness scents.

Founder and CEO of Ascents Labs Mark Kohoot shared, "We are thrilled to join forces with OnScent. Our mutual dedication to innovation, quality, and wellness resonates through every facet of this collaboration."

CEO of OnScent Achim Daub added, "With this partnership, we can help brands create meaningful connections with their customers through scents that are not only beautiful but have a powerful, positive impact on their well-being."

p&f+



PROFILES:
BERTRAND DUCHAUFOUR and JASON DARLING

Two creators share their industry journeys and past project wins.

Bertrand Duchaufour, perfumer, AMAFFI Perfume House

***Perfumer & Flavorist*+ [*P&F*+]: What led you to the fragrance industry?**

Bertrand Duchaufour [BD]: I came to perfumery because of a passion about fragrances I discovered quite early during my teenage-hood (thanks to a girlfriend of my age when I was 16 years old who was passionate about perfumes). She had an extensive perfume collection and she passed on this passion to me.

We started dating, we fell in love, and I fell into this love story… the discovery of the world of perfumery.

***P&F*+: Are there any recent projects/wins you're particularly proud of?**

BD: I really like the last perfume I created for AMAFFI, which is unreleased yet, it's very dark, deep, very profound, it feels like a golden dust effect … and has a powerful secret ingredient.

***P&F*+: Describe yourself in three ingredients.**

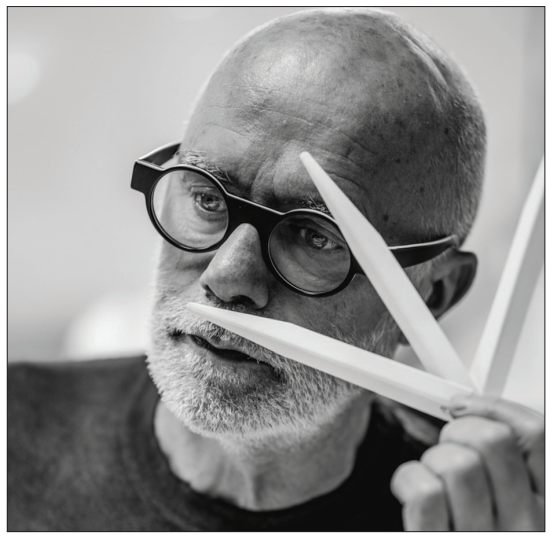
BD: 1. Frankincense: I particularly appreciate this in the base note of my compositions.

2. Davana: Which I always consider as one of the most valuable top notes of a fragrance—mostly for the narcotic oriental ones.

3. Tuberose: The very mysterious one. Still enigmatic for me after 38 year of work.

***P&F*+: How has the job of perfumer/flavorist changed during your career?**

BD: Yes, the style of work changes and evolves undoubtedly surrounding certain trends of the market, which is a bit annoying. However, this problem doesn't exist with AMAFFI. The AMAFFI team (led by Madame Amaffi) is consistently open to any style of fragrance I propose. Working with AMAFFI is all about freedom. They provide the opportunity to work with a wide, limitless olfactory spectrum and deal with a range of notes that are each completely unique. This is invaluable!



Name: Bertrand Duchaufour

Title: Perfumer

Location: Paris, France

***P&F*+: What is the best part of your job?**

BD: The best part is to notice that after 38 years of work, the field of possibilities remains limitless. The passion is still there.

Jason Darling, senior flavorist, Colgate-Palmolive

***P&F*+: What led me to the flavor industry?**

Jason Darling [JD]: I entered the flavor industry by accepting an opportunity with the Flavor division of ConAgra Foods (formerly Spicetec Flavors & Seasonings) in the Quality department. I had no prior knowledge of flavor creation or what a flavorist even was. My role was centered around daily evaluations of raw materials, flavor compounds, commodity ingredients, finished flavors

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and seasoning blends. The finished flavors were a wide variety—top notes, sweet, savory, processed/reactions, spray dries and dry blends. I spent my last three years in Quality dedicated to organoleptically evaluating and approving/rejecting every lot of inbound flavoring material for our entire creative catalog. The repetitious evaluations provided me with an ideal foundational knowledge that I used to advance myself into formal Flavorist training. During my training, I took special interest in encapsulated flavors and took pride in gaining hands-on experience learning and operating the spray dryer. I established an appreciation for encapsulated flavors, particularly while cleaning the equipment and its parts. Last but not least, my mentors were incredibly talented, experienced, and patient. I cannot praise them enough for teaching me correct flavor creation techniques and for also never holding back the knowledge they accrued from their many hard-earned years in the flavor industry.

***P&F+*: What is the best piece of advice you have given?**

JD: I have been surrounded by incredible mentors and colleagues that allowed me to learn and grow within the real world of flavors through on the job training. It is very difficult to pick just one piece of advice, as I have been given so many nuggets in my career. One that applies the most is: don't be afraid to make mistakes because mistakes provide learning. I vividly remember accidentally over-pouring on specific flavor materials when compounding, then setting this mistake/incorrect flavor up to taste. My gross mistake of a higher than desired addition of a material contributed to a unique and memorable flavor attribute that I would later apply to my future creations. That is only one example of how I have strengthened my skills more from trying and failing rather than quick, easy successes. I believe that with mistakes, experience is gained. I also believe that with experience, confidence is gained. Embrace and learn from your mistakes.

***P&F+*: What applications do you formulate for? Do you have a favorite?**

JD: I have created flavors across the categories of Sweet and Savory. I am currently creating and enhancing flavors for oral care products, which is a new chapter in my career as a senior flavorist. I have always viewed career challenges as opportunities, and I am thrilled to gain experience and grow within the Oral Care segment.

***P&F+*: Advice for people coming into the flavor field.**

JD: Patience! Becoming a successful flavorist is a journey that requires years of commitment. Dedication is also very important—dedicate yourself to learning flavor molecules, solubility, commodity ingredients, finished applications, and flavor stability. Learn manufacturing equipment to see the big picture and understand how flavors scale up, so you can troubleshoot production issues. Immerse yourself in project work and always look to improve yourself and your skillset. Flavor creation is ever evolving and learning never ends; your flavorist journey is what you make of it.



Name: Jason Darling

Title: Senior Director, Senior Flavorist

Location: New Jersey, United States

***P&F+*: Are the types of projects you're working on changing over time? How are the creative demands of the job evolving?**

JD: Yes, change is the only constant in life, and I have experienced change every year that I've been a flavorist. The early years of my career were spent matching flavors, creating replacements for commodities, and achieving cost reductions. When matching, I would also be tasked with removing upwards 1/3 of the cost. Creativity and understanding flavor compounds, their synergies and delivery methods were how I achieved success.

Today's consumers are more well-informed and have a deeper understanding of product labels, ingredient statements, nutritional claims and even verifying agencies. The way a product is labeled has the power to dictate consumer acceptance and purchase intent. Flavorists must be incredibly creative to adapt to consumer needs while formulating within a restricted palette. Supply chain disruptions, rising costs of goods and cleaner label materials have narrowed our materials, and we must continue to deliver winning flavor performance in finished products.



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Bacon, in particular, gains impact and complexity from 50 ppm.



■ BY JOHN WRIGHT
johnwrightflavorist@gmail.com

Flavor Bites: Pentan-2-one

Pentan-2-one in fermented, dairy, tropical, savory and other flavors.

Pentan-2-one, sometimes called methyl propyl ketone (FEMA# 2842, CAS# 107-87-9) has a very bright, fruity, rum note. There is also a very subtle, ethereal aspect to the profile, which is entirely positive. It can outperform or enhance the obvious alternatives, ethyl acetate and ethyl propionate, as a top note, lifting a very diverse range of profiles.

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.

Fermented Flavors

Beer: Nobody would suggest replacing ethyl acetate in fermented flavors, it is too important. Pentan-2-one serves to add a bright, attacking, top note and enhances impact. Levels from ten to 20 ppm work well in all styles of beer flavors.

Brandy: Twenty ppm is also a good level in brandy flavors and the effect is similar, adding brightness and impact.

Dough: This ingredient is effective in dough flavors as well as bread flavors. Ten ppm is a reasonable starting point.

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Rum: With rum flavors, unsurprisingly, we hit the most obvious use of this raw material. Levels can vary, but 30 ppm is the minimum in the lightest of light rums. Otherwise, the sky's the limit.

Whiskey: Much more modest levels, around 10 ppm, add subtle lift to all styles of whiskey flavors.

Dairy Flavors

Butter: Fresh butter flavors contain a legion of very substantive components and often need brightening. Pentan-2-one adds freshness at levels of addition in the region of 100 ppm.

Cheese: Pentan-2-one excels in all cheese flavors. Cheddar and similar styles can make good use of 200 ppm, more if a toasted character is required. Blue cheese flavors move the needle significantly. Levels vary but can run up to 800 ppm, brightening the blue cheese notes of the higher ketones.

Cream and Milk: Levels vary dramatically in cream and milk flavors. Fresh milk flavors need the lowest levels, even 5 ppm is quite effective. Cream flavors need more, up to 100 ppm in sour cream flavors. The highest levels apply to condensed milk flavors, where 200 ppm can offset the dominant heavy characters.

Yogurt: Only 10 ppm of pentan-2-one is needed to lift fresh yogurt flavors. Higher levels can also work, but 10 ppm is enough.

Tropical Flavors

Banana: The most obvious iso-amyl ester to use in banana flavors is iso-amyl acetate. A much more authentic and pleasant taste effect is achieved by adding an equal quantity of iso-amyl butyrate. Pentan-2-one completes the picture and replicates nature very effectively at around 500 ppm.

Coconut: The addition of pentan-2-one to coconut flavors, at around 100 ppm, pushes the profile in a distinctly fresh direction.

Jackfruit: Nobody could say jackfruit flavors lack impact! The sulfur notes could be tamed and integrated by substantial additions, around 500 ppm of pentan-2-one.

Passionfruit: Passionfruit flavors certainly contain sulfur notes, but not quite as impactful as jackfruit. Twenty ppm is a better level of addition here.

Pineapple: The same could be said of pineapple flavors, but the ester note can be improved by pentan-2-one at 200 ppm.

Orchard Fruit Flavors

Apple: This ingredient is a much more modest contributor to all orchard fruit flavors, adding brightness and impact. Ten ppm works well in apple flavors.

Apricot and Peach: Pentan-2-one works well in apricot and peach flavors. Twenty ppm is best in apricot flavors and 10 ppm does the trick in peach flavors.

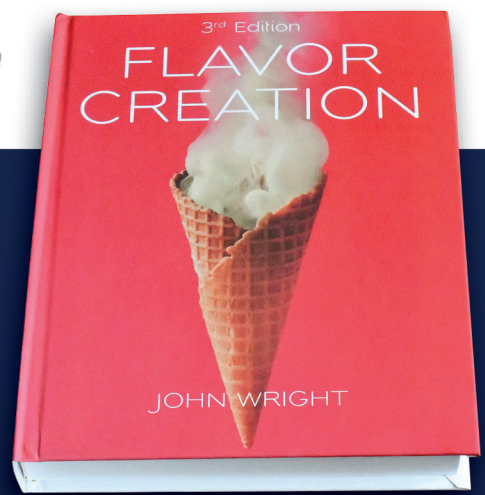
Cherry: Cherry flavors are often in dire need of a bit of complexity. Twenty ppm of pentan-2-one makes a modest contribution.

Pear: The effect of this raw material in pear flavors is similar to that in apple flavors, and the dose rate, 10 ppm, reflects that.

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Other Fruit Flavors

Blackberry: Fifty ppm of pentan-2-one lifts all styles of blackberry flavors and provides an attractive counterweight to the musk note.

Blueberry: The same 50 ppm level works equally well in blueberry flavors, having a similar brightening effect.

Citrus: This ingredient brightens and freshens all citrus flavors at levels of addition in the region of 20 ppm. Higher levels, up to 50 ppm are very effective at enhancing the juice notes, particularly in orange.

Raspberry: The ideal level in raspberry flavors varies, but 30 ppm is probably ideal in authentic style flavors.

Strawberry: Strawberry flavors stand out in this group for a naturally high ester level. Consequently, pentan-2-one at 150 ppm, significantly enhances freshness.

Savory Flavors

Bacon: Most "heated" flavors benefit from the addition of pentan-2-one. Bacon, in particular, gains impact and complexity from 50 ppm.

Beef: Most roast beef flavors also find an optimum level of addition around 50 ppm. More BBQ and grill oriented profiles can easily use 100 ppm.

Bread: There are many different profiles to bread flavors. Levels need to be adjusted in proportion, but 100 ppm is a good starting point.

Chicken: In contrast to beef, chicken flavors work best with lower levels of this raw material. Twenty ppm is generally ideal.

Smoke: Smoke flavors are most obviously defined by the harshness, or softness, of their phenolic components. Pentan-2-one works equally well in both styles at around 200 ppm.

Soy Sauce: Soy sauce flavors have very obvious furanone anchor points, but getting the top notes right can be tricky. Twenty ppm of pentan-2-one adds a modest, but helpful, nuance.

Other Flavors

Chocolate and Cocoa: Twenty ppm of pentan-2-one brightens and freshens cocoa flavors nicely. The ideal level in chocolate flavors is difficult to define, starting at around 30 ppm for very dark chocolate flavors and moving up as the dairy aspect increases.

Coffee: The elusive challenge in coffee flavors is often to add freshness. Pentan-2-one, alone, obviously cannot completely solve the problem, but it is distinctly helpful at around 30 ppm.

Hazelnut: Pentan-2-one can be beneficial in many nut flavors. The most obviously harmonious interaction is in hazelnut flavors, where levels up to 200 ppm add lift.

Popcorn: Popcorn might seem such a simple flavor that added complexity is superfluous. Replacing diacetyl with other buttery ingredients has flattened the profile. Pentan-2-one, at 50 ppm, can help restore brightness.

Vanilla: I should hesitate before I suggest yet another trace ingredient for use in authentic vanilla bean flavors! That said, pentan-2-one is not a game changer, but it is distinctly helpful at 5 ppm.



The elusive challenge in coffee flavors is often to add freshness, but it is distinctly helpful at around 30 ppm.

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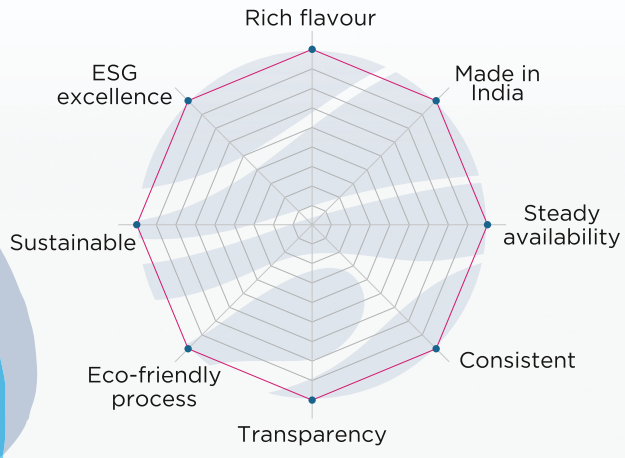
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Inside Technology Designed Specifically for Fragrance Evaluators

Introducing tools created to assist in the fragrance evaluation process.

Fragrance creation has many components—from the ingredient selection and formulation process to evaluation, each scent must deliver the experience it promises. With evolving consumer demands, technology in the fragrance industry must advance to meet these innovations.

Osmose chief technical officer Pascal Torres joins *Perfumer & Flavorist+* to discuss the common challenges faced by fragrance professionals during the evaluation process and how the company's resources can assist in overcoming those obstacles.



The Scent Box allows fragrance evaluators to assess a wide array of products including candles, perfumes, personal care and even home care.

What are some of the challenges fragrance professionals are facing during the evaluation process?

Pascal Torres [PT]: There are three main components during the evaluation process:

1. An important phase in the creation of fragrances is the comparison—comparing your creation with competing products, or comparing your own creations with each other.

2. Evaluating the product in the environment for which it was designed.

3. Finally, the evaluation tests must be carried out in a neutral environment, not polluted by the previous test and where the most common challenges are face:



Osmose chief technical officer Pascal Torres discusses fragrance evaluation technology.

- This environment must be representative of real life, of the place where the consumer will use the product (an office, a shower, a bedroom, etc.).
- The tests must be reproducible. A test performed with the same parameters should give the same result. During a comparative test, only the product tested should have an impact on the result.
- Decontamination must be effective and rapid. The evaluation booths are both marketing tools (presentation to end customers), but also production tools (in creation mode). The number of tests that can be performed in a day should be maximum. The decontamination phases must therefore be the fastest, and very effective so as not to generate cross-contamination.

How does Osmose's Scent Box differ from what's currently available for fragrance evaluators? What makes Scent Box more versatile for users?

PT: Osmose has been designing and manufacturing olfactory evaluation cabins for nearly 30 years. A

cabin is not just a ventilated box, it is a technological product, with a catalog of more than 50 options. It is a real industrial product, designed by digital simulation and full of innovations. Osmose offers evaluation cabins of all sizes to cover all evaluation applications (from shower to bathroom size).

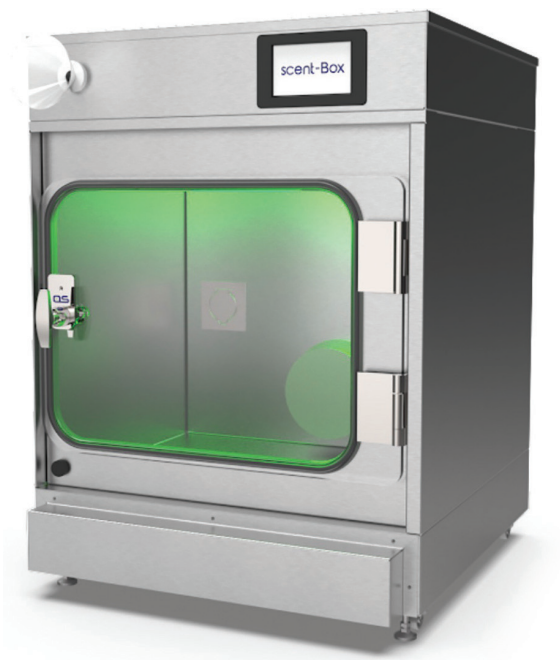
The Scent Box is a new experience in terms of olfactory evaluation. Simple and effective, the Scent Box works in three steps—configure, evaluate and decontaminate. With flexibility in mind, fragrance evaluators can assess a wide array of products including candles, perfumes, personal care and even home care.

The Scent Box can simulate any room size, any climatic environment (temperature and humidity), making it possible to evaluate many samples with reliable and reproducible results.

The Scent Box is an economic asset—increasing the number of tests in a reduced space and with a reduced financial investment with the added benefit of the Quick Purge function that allows you to quickly chain the tests one after the other.

Can you touch on the added benefits that the Osmose Scent Booths provide for fragrance evaluators?

PT: As mentioned above, Scent Box offers precise control over assessment conditions, such as room size, temperature and humidity. This allows evaluators to simulate different environments in which the fragrances will be used, which is essential for understanding their performance in real-life situations.



Scent Box offers precise control over assessment conditions, such as room size, temperature and humidity.



The smart-Flow guarantees absolute safety for laboratory operators while having the capability to not disturb the weighing phase.

The benefits can be summed up in 7 points:

1. Tests in a neutral environment, without cross-pollution
2. Simulation of rooms of different volumes
3. Simulation of different climatic conditions (temperature and humidity)
4. User friendly and easy to use
5. Easy to install or move
6. Space saving
7. Lower budget

In terms of equipment, what kind of equipment is valuable for streamlining lab procedures while also ensuring quality control?

PT: Osmose can support you in the design and optimization of your laboratories and factories. Among these solutions, we also offer a second family of products—The smart-Flow Range. It is a new generation hood, based on push-pull technology.

The smart-Flow guarantees absolute safety for laboratory operators while having the capability to not disturb the weighing phase, down to the thousandth of a gram. The smart-Flow divides airflows by 6 and operating costs by 30. In one sentence: smart-Flow protects better and consumes less.

Osmose products are available worldwide. They cover all needs for olfactory evaluation and source capture of gaseous or powder pollutants, in the laboratory or production workshop.



A OnePoll survey found that 51% of Americans experience "scent-stalgia," missing the comforting scents of their homes after being away for a couple of days.



BY AMY MARKS-MCGEE,
Trendincite LLC; amy@trendincite.com

Forward Thinking: 6 Trends and Innovations in Ambient Scent

Italy, and summer scents are popular home fragrance themes while collaborations, sustainable candles and air care innovations continue.

According to Technavio[a], the candle market size is expected to grow by $2.8 billion from 2022 to 2027 at a CAGR of 5.79%. North America is estimated to account for 28% of the market's overall growth. Candle and air care usage was popular before the pandemic and was further boosted by the pandemic. Candle scents' ability to transport consumers to faraway places and evoke positive childhood memories has made them a mainstay. In addition, individuals use candles and air care at home to create a spa-like environment to help alleviate stress and anxiety.

A OnePoll[b] survey of 2,000 people on behalf of AlEn USA, found that 51% of Americans experience "scent-stalgia," missing the comforting scents

[a]*https://www.prnewswire.com/news-releases/candle-market-size-to-grow-by-usd-2-844-87-million-from-2022-to-2027-north-america-is-estimated-to-account-for-28-of-the-global-growth---technavio-301847582.html*
[b]*https://swnsdigital.com/us/2023/05/these-are-the-scents-americans-associate-with-their-childhood-homes/*

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of their homes after being away for a couple of days. The top scents people enjoy at home are floral (17%) and clean or sanitizing (e.g. chlorine bleach) (14%), followed by citrus (13%), baked goods (11%) and wood/natural scents (13%). To boost the scent of their home, the study found that people opened windows for fresh air (47%), cleaned regularly to remove odors (45%) and burned scented candles (43%). Furthermore, 77% are comforted by the smell of home, and they most often feel relaxed (38%), happy (36%) and centered (32%). Books, Italy, and summer scents are popular home fragrance themes while collaborations, sustainable candles, and air care innovations continue.

1. Bookworm

Books have been a muse for fine fragrance, now they are one of the latest muses for candle launches. Assouline Publishing is a book publisher and luxury lifestyle company best known for its coffee table books. Inspired by the brand's popular Travel Series collection of six rainbow-hued hardbacks, Assouline created the Travel From Home Candle line of corresponding scented candles that use the same iconic serigraphy of symbols from the books.

The Gstaad Glam candle features notes of cypress, cedar, black tobacco leaves, juniper berry, and palo santo, while Ibiza Bohemia highlights lemon, bergamot, and green apple with fresh and earthy undertones of patchouli. Marrakech Flair offers cypress, sweet cedarwood, and juniper berry with black tobacco leaves, bergamot, neroli, and citrus, while Moon Paradise Travel is a complex mix of black pepper, sweet bamboo, musk, and cashmere wood. Mykonos Muse contains cyclamen, almond, green fig, and tonka bean notes and Tulum Gypset has eucalyptus, sage, black pepper, black amber, and spicy cardamom.

Anecdote Candles and Barnes and Noble collaborated on the exclusive Book Lover Collection, which "includes six bookish candles celebrating universal favorite genres, book tropes, and characters." The Anti-Hero Good (Peppered Rose & Cedar) is described as "intentions and questionable morals," while The Book Club Banter (Black Currant & Red Wine) is inspired by "lively discussions and endless wine." Dark Academia (Vintage Leather & Oud) channels "melancholy moods and secret societies," and Enemies To Lovers (Vanilla Orchid & Jasmine) is "heated fights and steamy nights." Main Character Energy (Wild Iris & Santal) is "a memoir in the making," and Plot Twist (Sea Minerals & Water Lily) leans into "chills and thrills."

2. Take Me To Italy

Candle scents are often inspired by destinations. Italy is trending as a current source of inspiration. According to RateGain International Inbound Flight Bookings for June-Aug'23[c] , Italy was the top three most visited countries for summer 2023 for overall, business, and leisure travel. Byredo and luxury resort ISSIMO launched L'Orto Italiano, a limited-edition candle inspired by Italian Culinary "that captures

[c]*https://hoteltechreport.com/news/new-data-5-summer-travel-trends-and-top-destinations-in-europe-for-2023*

(Continued on Page 26)



Assouline's Travel From Home Candle line features six scented candles that correspond to the book series and use the same iconic serigraphy of symbols; courtesy of Assouline.



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ScentAir's Limited Edition Summer Fragrance Collection features six scents: Bergamot & Herbs, Earl Grey & Lily, Herbal Lavender & Eucalyptus, Neroli & Linden Blossom, Sheer Lime & Apple, and Watermelon & Sugared Lemon; courtesy of ScentAir.

(Continued from Page 23)

the essence of summer and the escapism of la dolce vita." The candle highlights tomato leaves and basil rounded out with bamboo and crisp amber. Fashion and lifestyle brand La DoubleJ dropped the Scents from the Motherland candle collection inspired by founder J.J. Martin's favorite Italian locales. The collection is available in four scents: Capri, Lago Di Como, Milano, and Pantelleria.

Each candle is housed in a porcelain vessel with an original La DoubleJ print and trimmed in 18K gold. Capri is a juicy mix of blackcurrants, pomelo, lemon, and applewood, while Lago Di Como is a luxe blend of rose, white musk, mimosa, amber, and leather. Milano is a sultry blend of jasmine, cedar, and peppercorn, while wild and herbaceous Pantelleria contains fig, wild lavender, sandalwood, and bergamot. Woodhouse Spa has launched Revive, a limited-edition signature fragrance inspired by the invigorating scenery and scents of the Amalfi Coast in Italy. Offered in an Aromatherapy Essential Oil Blend and Room Spray, the fragrance "marries notes of sun-kissed Italian citrus with hints of fresh eucalyptus, sweet rosemary, and the clean, restorative breezes of the Mediterranean Sea." Siblings' latest artist collaboration La Dolce Vita was developed in partnership with English-Italian artist Chiara Perano. The La Dolce Vita - Rosemary, Lavandin, Salt Water scent description reads "where the warm salty waves of the Mediterranean meet the lush Italian coast dotted with lemon groves, gardens and sandy cove beaches."

3. Summer Scents

Trendincite's *Perfumer & Flavorist+*[d] "Forward Thinking: Candle Scent Trends and Seasonal Staples," article, which appeared in the September 2021 edition, explored seasonal scents. Hot summer days often conjure memorable moments such as the great outdoors, herbs, fruits, flowers, and ice cream. Candle brands continue to lean into these memories with seasonal summer scents. Byredo has created a Summer Rain candle "that captures the restorative power of nature, especially on a hot day" with notes of basil, spearmint, fig, and sparkling ginger. Loewe's latest release is two new candles designed specifically to be burned outside. Housed in sculpted terracotta pots and filled with high melting-point wax, the scents are offered in Geranium and Thyme variants. Bath & Body Works launched Endless Sea and Wild Sand candles for the summer season. The Endless Sea contains fresh bergamot, saltwater lily, and ocean driftwood notes, while Wild Sand has notes of prickly pear fruit, cactus flower, and warm agave nectar. Inspired by frozen treats, PartyLite introduced four summer scents: Frozen Matcha Latte, Mango Lime Sorbet, Pistachio Ice Cream, and Sweet Berry Gelato candles. For the first time, ScentAir released a Limited Edition Summer Fragrance Collection for its Whisper HOME cartridge collection. The six summer scents include Bergamot & Herbs, Earl Grey & Lily, Herbal Lavender &

[d]Page 24; *https://perfumerflavorist.texterity.com/perfumerflavorist/september_2021*

Eucalyptus, Neroli & Linden Blossom, Sheer Lime & Apple, and Watermelon & Sugared Lemon.

This summer, Alexander McQueen released its first home fragrance collection with a trio of scented candles. Ghost Flower features fresh freesia and peony with earthy patchouli, while Pagan Rose contains wild rose, cognac and peat moss, and Savage Bloom highlights saffron, tuberose and oud. The candles are made from black mineral waxes and rapeseed wax and encased in black lacquered glass with three different lids in silver metal, antique dark metal and antique gold housed in a recyclable wooden crate.

4. Collaborations Continue

Trendincite's *Perfumer & Flavorist*+[e] "Two Sense: Candle & Air Care Market Trends with Amy Marks-McGee," podcast in September 2022, discussed limited-edition candle collaborations. Food and culture continue to collide as brands collaborate on candle and air care scents inspired by pop culture. Boy Smells' latest candle collaboration is with Magnolia Bakery. The Boy Smells x Magnolia Bakery Banana Pudding candle captures the scent of Magnolia Bakery's iconic Banana Pudding. It has a classic banana-and-vanilla fragrance with hints of cardamom, elemi resin, and burning leather.

See's Candies and Ritual + Fancy crafted a Chocolate Shop candle with vanilla, caramel, and cacao notes. The signature scent is intended to capture the experience of walking into a See's shop. Goose Creek and Strawberry Shortcake team up for a branded candle line inspired by Strawberry Shortcake and her friends in Strawberryland. The six classic scents include Strawberry Shortcake, Blueberry Muffin, Custard, Lemon Meringue, Orange Blossom, and Raspberry Tart.

The July Barbie movie release has generated a variety of fun product partnerships. In collaboration with Mattel, Homesick created the Barbie Dreamhouse candle. Designed to capture the signature scent of Barbie's Malibu Dreamhouse, the candle features notes of sweet peony, pink jasmine, and plush velvet. Diptyque and Highsnobiety have partnered on a Diptyque x Highsnobiety Not In Paris limited-edition candle inspired by the smell of roses found at the Bagatelle Gardens and the Marché aux fleurs. The fresh rose chypre scent with patchouli is housed in a glass container decorated with a custom green label. Brooklyn's Nose Best Candles and the Museum of Sex launched a Sex Symbol candle. The smoky cashmere scent is described as a sweet, leathery scent and comes with a curated Spotify playlist and a cocktail recipe.

5. Sustainable Candles

Like other categories, consumers demand sustainable and eco-friendly candles. There's been some interesting innovation with refillable candle formats and DIY candle kits. According to Google's Holiday 100[f] , candle-making classes saw a 110% increase in search interest. Additionally, searches[g] for professional candle making kits rose by 140% in

[e] *https://www.perfumerflavorist.com/multimedia/audio/podcast/22236460/podcast-two-sense-candle-air-care-market-trends-with-amy-marksmcgee*

[f] *https://shopping.google.com/m/holiday100/?modal=product-candle-accessory-kit*

[g] *https://shopping.google.com/m/holiday100/categories/toys/?modal=product-candle-making-kit*



The Boy Smells x Magnolia Bakery Banana Pudding candle captures the scent of Magnolia Bakery's iconic Banana Pudding with notes of banana, vanilla, cardamom, elemi resin, and burning leather; courtesy of Boy Smells, LLC.

2022. For example, Siblings is a DIY candle brand that offers 20+ scents in olfactive categories such as Earthy & Woody, Florals, Fresh & Fruity, Warm & Spiced, and Sweet. Some of the products are limited-edition and collab scents with various artists. Customers make their own candles by microwaving the 100% compostable bag for two minutes then pouring the liquid wax into their favorite vessel and letting it set. Notes Candle Refill System creates Sustainable Starter Kits, which include a candle glass, silicone clean out insert, highly fragranced wax beads, and a cotton wick. Customers thread the wick through the silicone insert, pour wax beads, and then light. There are six starter sets: Evergreen & Spicy Duo, Smokey & Woody Duo, Warm Cozy Duo, Watery Floral Duo, Woody Floral Duo, and Zesty Fresh Duo with a selection of scent refills.

Trudon's sister brand Carrière Frères introduced a collection of low-waste refills made from 100% organic European rapeseed wax and packaged in an innovative compostable box. For the launch, Carrière Frères partnered with the Parisian Museum of Natural History on a collection of four candle scents: Absinthe, Acacia, Geranium, and Waterlily. Murphy's Naturals debuted a Refillable Mosquito Repellent Candle using a nature-stoneware vessel in Cloud White, Stone Gray, or Forest Green. The reusable vessel features a bamboo lid and a candle made from essential oils that repel mosquitoes for up to 30 hours, according to the company.



Carrière Frères and the Parisian Museum of Natural History collaborated on a candle collection of low-waste refills made from 100% organic European rapeseed wax and packaged in an innovative compostable box; courtesy of Carrière Frères.

Scottsdale Candle Co. creates luxury candles that are packaged in repurposed champagne and liquor bottles. The 100% soy wax candle features the brand's signature scent, "a sweet blend of tangy grapefruit with a punch of citrus, peach and a hint of vanilla." In 2023, founder Mikyla Harter, launched Recycle Responsibly, a non-profit organization that collaborates with local bars, hotels, and other retail locations to create a network of eco-conscious businesses working together to reduce waste and promote a greener Arizona. Scent Lab "is the first digital destination that leverages immersive video experiences and AI tech to curate scents for the individual consumer." The first product is a customizable 14 oz, double wicked candle. The product is made with 100% sustainable soy wax and an organic cotton wick. It is packaged in a customizable matte glass vessel or an eco-friendly satin bag. There is an option to have an old vessel refilled at a discounted price.

6. Air Care

In addition to candles, the latest air care activity includes motion detection air fresheners, liquidless fragrance infused reeds, and EPA approved air sanitizer. Procter & Gamble debuted Bloom, a new motion-controlled air freshener that looks like a planter with four faux replaceable succulent toppers. Inside the faux planter is a pair of scent cartridges that are said to last up to 30 days and contain no dyes, phthalates, or formaldehyde. Bloom features a rechargeable battery and two

adjustable fan speeds with three available scents: Crisp Greenery, Fresh Dewdrops, and Lavender Fields. Bloom can be purchased online at Bloomplanter.com and scent pack refills will be available in October 2023.

Pura unveiled a new car diffuser with magnetic properties for users to mount the device anywhere in their vehicle. The device features motion detection and powers on and off. It is Bluetooth-enabled and comes with interchangeable fragrances that connect to an app to control the intensity. There are eight scents: Coastal Palm, Cucumber & Mint, Fairway Morning, Ivory Woods, Linens & Surf, Red Rock & Amber, and Teak & Leather.

Aera continues to partner with a variety of brands to launch their signature scents into Aera home scents. Recent collaborations include Skylar Clean Beauty in three scents: Coconut Cove, Lime Sands, and Vanilla Sky and Monique Lhuillier's signature scents in Citrus Lily, Dolce, and Limone. ScentAir released a patent pending line of Liquidless Fragrance Infused Reeds in 10 fragrances: Asian Garden, Black Orchid, Dark Vanilla Pomelo, Eucalyptus Mint, Golden Bamboo, Green Clover & Aloe, Lavender Lemon Verbena, Patchouli Blanc, Santal & Red Cedar, and White Tea & Thyme. The pre-infused reeds use cruelty free, phthalate free, and respiratory allergen free scents. Lysol launched Lysol Air Sanitizer, "the first and only air sanitizing spray approved by the EPA, which kills 99.9% of airborne viruses and bacteria while eliminating odors in the air." The Lysol Air Sanitizer is offered in Light Breeze, Simply Fresh and White Linen scents.



Bloom is a motion-controlled air freshener that looks like a planter with four faux replaceable succulent toppers and three scents; courtesy of Procter & Gamble.

Conclusion

Scented candles were once a destination purchase. Now scented candles are available through all distribution channels and all price points. From home décor to transportive fragrances, consumers have an infinity for candles and air care. Books, Italy, and summer scents are popular home fragrance themes. As fall approaches, expect to see warmer fall and holiday scents. Collaborations and limited-edition scents create newness, interest, and demand. Watch as unexpected partnerships and home fragrances arise. Sustainability is a hot topic in all sectors including home fragrance. Keep your eyes peeled for eco-friendly and sustainable products as well as tech-driven innovations.

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Essential Oils and Forest Extracts: Complex, Unique and Vulnerable Industries Facing EU Green Deal

In light of the laudable EU Green Deal perspectives for a cleaner and safer environment, this article presents a holistic approach to the world of natural scents and extracts.

BY ALAIN FRIX, director, BioM-Allchemix Consultancy

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Transforming arid tropical savannahs into vast forests of noble sandalwood: essential oils are also an economic driver for sustainable reforestation. Photo courtesy of Santanol, Australia

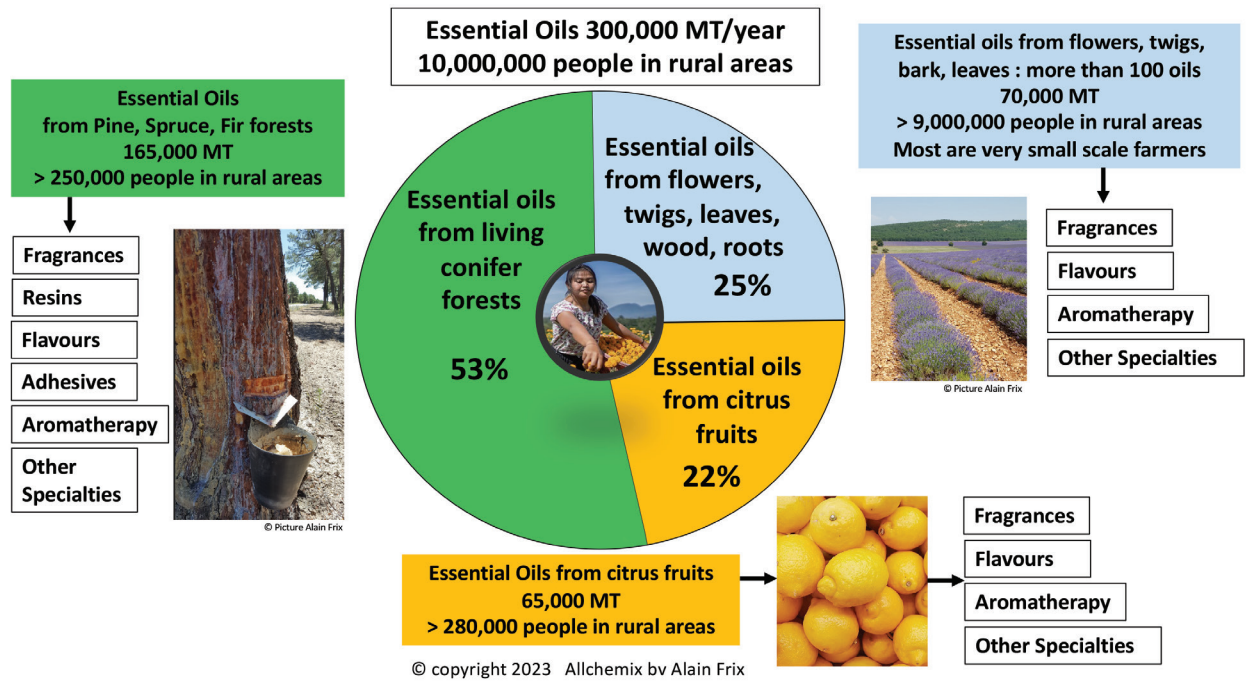
In light of the laudable EU Green Deal perspectives for a cleaner and safer environment, this article presents a holistic approach to the world of natural scents and extracts, and in particular essential oils, from different angles such as their intrinsic complexity, socio-economic importance and vulnerability, underlying dynamics and reflections on petrochemical alternatives for our society. Forests, shrubs, flowers and essential oils are very complex and fragile worlds with many similarities. All plants produce very large amounts of Volatile Organic Compounds (VOCs) as a result of their metabolism. These biogenic VOCs are numerous (more than 1,000 types of volatile chemicals) and have been part of a natural ecosystem for millions of years. Many VOCs have what we have found to be identifiable functions, such as a means of communication (between plants, but also between plants and animals) or protection against climatic factors. Some of these VOCs have an odor and determine the different scents between flowers, shrubs and forests. Their beneficial effects on human health are becoming better understood; these same VOCs are also the basis for that relaxing walk in the woods we love. Most essential oils are produced by the steam distillation of plants, flowers, herbs, barks and woods, and the resulting natural oil contains the valuable VOCs captured from the biomass. As such, essential oils carry the natural footprint of plants.

Essential oils (citrus and non-citrus) and forest extracts (mainly from conifer trees) are produced in every continent, in more than 60 countries, including many European countries such as France, Spain, Italy, Hungary, Germany, Romania, Slovakia, Greece, Belgium, Croatia, Bosnia, and forest extracts mostly by Sweden, Finland, Poland, Germany and Austria who play a predominant role. The total amount of essential oils averages 300,000 metric tons (MT) worldwide (including turpentine essential oil derived from conifer trees). Essential oils are mainly used in fragrances (125,000 MT per year), followed by flavors (65,000 MT per year), pharmaceuticals (40,000 MT) and the remaining 70,000 MT (mainly forest essential oils) are used as renewable specialty products such as resins, adhesives and inks (**F-1**).

Essential oils compete with petrochemical ingredients in the fragrance and flavor sectors. Petrochemical ingredients dominate in these industries, mainly because petrochemical derivatives can provide a low-cost alternative to natural products, sometimes because petrochemical derived ingredients can offer unique olfactive qualities, or better functional properties than naturals, such as stability in home cleaners, etc.

The fragrance market is a good example of the importance and vulnerability of natural products. Today, petrochemicals account for over 70% of fragrance ingredients, compared to only 30% for essential oils and other forest products. Interestingly, more than half

F-1 Essential Oils: Main Segments and Main Markets (metric ton MT)



of the petrochemical ingredients in fragrances are nowadays produced mainly in China, often at the lowest cost using coal as the main energy source for manufacturing. Biotechnology also represents a growing competition for essential oils, but it is not a significant volume because their production costs are still far too high, not to mention their GMO—questionable aspects for some, which slows their growth.

In addition, main markets such as perfumery markets are now under unprecedented cost pressures, leading perfume manufacturers to progressively replace essential oils and other natural extracts with cheaper petrochemicals or other synthetic substitutes. In the last 50 years, natural ingredients such as essential oils have lost a significant share to petrochemicals, some naturals are even disappearing. Farmers (and the entire natural ingredient supply chain) are being overwhelmed by a combination of hurdles, they are under pressure to guarantee availability, at cheaper prices, while complying with often excessive regulations and certifications from many compounding and consumer goods companies. However, most of the aromatic crops grow in remote places, the essential oils obtained from them are often in the hands of small and medium sized enterprises (SME) who are not equipped to deal with additional complexities and more stringent regulations. The essential oil industry needs time to adapt cultivation methods and extraction technologies, time to properly train farmers and processors, time to produce and present additional peer-reviewed safety data on essential oil products.

Favorable results will be achieved if regulators and the essential oil industry work together to find sensible and pragmatic ways to encourage natural product processors to reinvest. Clear, predictable, and realistic expectations are needed, with mutual guidance on how to improve sustainability and the circular economy. This requires a two-way approach that involves people from both sides, business and government regulators. Such partnerships can generate new momentum, and there are fascinating examples such as the creation of new forests in Australia, with the support of the authorities and industry, bringing into the world millions of sandalwood trees. Finally, a forest that offers economic value while being managed sustainably is the best guarantee against deforestation. In this way, a responsible essential oil industry enhances the value and preservation of forests and plants, and acts as a good provider of local jobs in remote areas.

One should not forget the principle of proportionality; farmers, pickers and tappers are at the base of some 300,000 MT of essential oils annually



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produced. Compared to nature's 1,000,000,000 MT of scents released every year by forests, the essential oil segment is several thousand times smaller. However, for tens of millions of farmers and pickers, this industry is vital; it is a basic, substantive need, enabling them to avoid malnutrition while providing access to education and other basic needs for their families. Even a one-year distortion in demand for essential oils is enough for farmers to turn to other livelihoods. Indeed, many cannot afford to wait and see how markets will develop; they live from day to day in rural areas with poor social systems.

Regulators and politicians have a great responsibility in preventing the loss of biodiversity in essential oils and extracts from forests, and the loss of income for rural farms in both developed and developing countries. It is also about preserving a cultural heritage, a world patrimony that emerged more than 7,000 years ago, a long period of time during which there is undeniable evidence that mankind mastered the chemistry of naturals, the same naturals that one can find in forests. We must not forget that the history of humanity has been closely linked to forests for millions of years. Paleoanthropologists are gathering evidence that the first pool of humans evolved in forest ecosystems. The relationship between the human body and forests, and thus their biogenic VOCs, is probably the result of a very long evolution. This adaptation could not happen the same way with petrochemical VOCs, because crude oil has only appeared on a massive scale in the last two centuries, after being buried for millions of years between layers of sedimentary rock deep below the earth's surface.

The implementation of the European Green Deal must consider the complexity and fragility of the essential oils industry. If regulations on essential oils become too stringent, many multinational compounding and consumer goods companies will not be able to keep using them; they will phase them out as the regulatory burden and associated costs become excessive. These natural products will simply be replaced by petrochemicals or biotech GMOs, often produced in-house by the same multinationals. This would wipe out an entire natural supply chain and further strengthen the dominant position of some large compounding companies. So, it is not the final formulator who will suffer most from over-regulation of natural products, but consumers and many small and medium sized family-owned businesses (many of which are still based in Europe) that have been processing, extracting, and refining quality natural products, sometimes for over a century. And behind them, the millions of invisible farmers who are never heard from and who will be deprived of their main resources for survival.

Many of them will see their lavender, patchouli, vetiver, agarwood, ylang-ylang, jasmine, etc. replaced by petrochemical derivatives of oil, gas and coal. This can certainly not be the objective of the EU's Green Deal and one must be aware of the adverse effects of any unilateral decision if it is based on too narrow of an approach.

1. Introduction

Every day, humans live and experience a world full of natural (not produced by man) aromatic botanicals. We breathe every minute, yet we are not always aware of our experiences. Often, these invisible aromatic sensations are produced in nearby forests…not surprising, our relationship with forests continues to be important, if not fundamental. Regular visits to the forest are known to be beneficial to health, a concept ingrained in culture and traditions. Don't we always feel invigorated after a walk among these tall, cellulose-rich living organisms? While bathing in the forest is known to reduce the incidence of stress-related and lifestyle-related diseases, it is also recommended to relieve allergic respiratory diseases and asthma.[1,17] But there is more, much more.

2. Trees are Perfumers

What we may forget, or simply do not know, is that this invigorating walk is a walk into a dense natural perfume factory. Yes, trees are perfume plants; they produce "biogenic" Volatile Organic Compounds (VOCs) and are not in short supply. Recent estimates show that forests emit about 1 billion metric tons of VOCs every year.[2] Not surprisingly, these VOCs are a reflection of plant metabolism; trees (and all plants on earth), capture billions of metric tons of carbon dioxide from the atmosphere each year and use it as a natural catalyst to produce the active biochemicals desired. They patiently incorporate the carbon elements into a very complex biomass, forming many types of biochemicals such as cellulose (whose fibers are each composed of thousands of glucose units), hemicellulose (composed of many other types of sugar units), and lignin, another organic polymer which is an extremely strong binder for cellulose and hemicellulose, largely responsible for the stiffness of wood. Several thousands of other biochemicals are produced daily by trees, a vast pool of forestry molecules that eventually find many industrial uses, such as construction wood, plywood, fiberboard, paper, cardboard, energy, and a variety of useful molecules for mankind known as "forestry chemicals" which will ultimately become parts of

our daily lives, such as cleaners, inks, adhesives, cosmetics and perfumes.

3. From Carbon Capture to VOCs

When a plant makes biochemicals from carbon dioxide, it produces by-products that are released into the atmosphere every second, every day and night, winter and summer. For this reason, forests always smell like forests. A pine forest reminds you of its "VOCs" in every breath you take, its typical scent is always present. As with animals, the metabolism of plants continues uninterrupted until death occurs. In fact, it's all about survival; many of the biogenic VOCs have a protective function, some regulate a tree's canopy temperature, some are messengers to other plants, while others can repel insects. Only a few of these mechanisms are understood, and there is so much more to discover. Forests are by far the largest biogenic VOC emitters on earth, especially our treasured tropical forests like the Amazon or the Congo Basin.

4. What is "Pollution"?

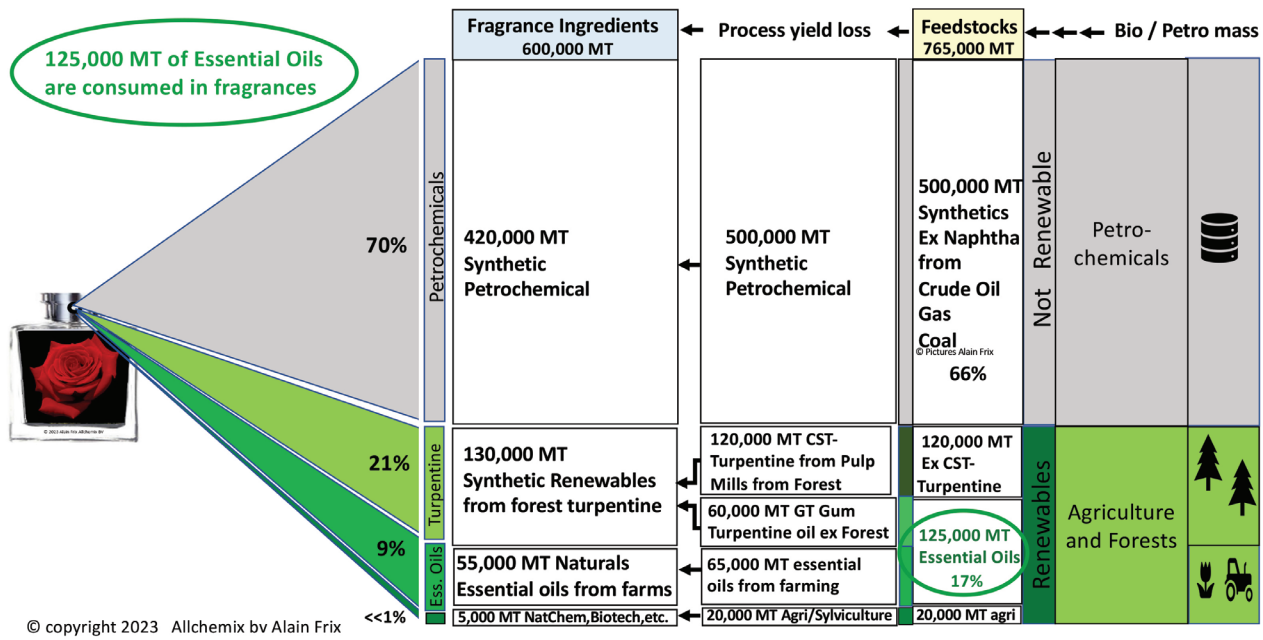
Some regulators perceive these VOCs in the forest as "polluters," but can we really qualify a system that has been self-regulating for millions of years this way? We need to better understand plant biomasses, and their interconnections with the rest of our world, before we could call any of its product's pollutants. Each chemical must be understood in its complex interaction with thousands of other chemicals, but we do not have such analytical models today. Forests are not the only ones that produce VOCs—all plants produce them, and every part of the plant plays a role—leaves, fruits, flowers, and even roots, release most of the biogenic VOCs into the atmosphere. Who can resist the delicious smell of a perfect peach or a fragrant strawberry? It is their volatile organic compounds that increase your desire to eat them. While plants are the largest biomass on Earth, bacteria and fungi are the second most important biomass generators, although it is not clear how many VOCs they release. We know, bacteria are already responsible for significant amounts of alkenes, alcohols, ketones, and terpenes and fungi are rich in benzene, aldehydes, and ketones.[1,8]

5. Talking about Biodiversity

The diversity of plant VOCs is high; more than 1,000 different volatile chemicals are released from plants and from trees, the main one being a 5 carbon chemical isoprene (around 50% of all biogenic VOCs is isoprene, probably because the isoprenoid metabolic pathway is a major one in plants), followed by methanol, acetaldehyde, α-pinene, β-pinene, d-limonene, β-ocimene, sabinene, myrcene, camphene, cineole, camphor, linalool, para-cymene, δ-3-carene, linalool oxide, borneol, bornyl acetate, terpinen-4-ol, copaene, humulene, α-phellandrene, β phellandrene, α-terpinene, α terpineol, α terpinolene, bergamotene, longifolene, methyl jasmonate, methyl salicylate, α thujene, β farnesene, then hundreds more terpenoids and other smaller molecules, many of which are likely still to be detected.[9] Many of the above-mentioned forest monoterpenes have anti-inflammatory properties and reduce oxidative stress. It is also known that the olfactory perception of the



F-2 Importance of Essential Oils in the Fragrance Industry (metric ton MT)



pleasant scents of trees and flowers have a positive effect on our psychological well-being. And most of these molecules mentioned above are basic perfumery ingredients as well.

6. A Very Large Natural Cloud

It is reported that the annual emission of forest monoterpenes could reach over 400 million metric tons. This is not surprising, as scientists have estimated that nature produces up to 40,000 different types of terpenes. Physical stresses such as plant injury and heat stress lead to increased release of other types of VOCs, particularly 6-carbon fatty acid derivatives such as *cis*-3-hexenol (this is the smell of freshly cut grass, which is a result of cutting their leaves), *cis*-3-hexenyl acetate, *cis*-3-hexenyl butyrate, *cis*-3-hexenyl valerate, a group of molecules that could release over a hundred million metric tons worldwide. Forests also produce significant amounts of benzene and phenylpropanoids.[1,3,4,5] Insects, fires, high winds, and high humidity also affect the release of VOCs by trees, with deciduous trees apparently releasing even more VOCs than conifers. Many types of chemicals are involved in communication between plants or between plants and animals. This area of phytohormones is far from well understood, but there has been some progress in identifying some messengers such as ethylene, jasmonic acid, etc.[1,6,7]

7. Importance of Essential Oils

Essential oils are the result of distillation (using steamed water) of plants, flowers, fruits, herbs, barks, woods and root, and the resulting natural oil contains the valuable components of the biomass. In fact, the scented molecules already formed by the plant are captured by the distillation process, before the plant has had a chance to release them into the atmosphere. Essential oils therefore carry the olfactive footprint of plants. The essential oils are in very small quantities compared to the massive forest VOCs. The world of essential oils is microscopic and not always well understood, often perceived as complex as it revolves around the use of more than 200 essential oils mainly in fragrances, flavors, pharmaceuticals and aromatherapy. They have all one thing in common—they are big work providers for people, especially farmers. There is a worldwide biodiversity of essential oils, with more than 200 commercial essential oils, some of which have a history of more than 7,000 years, true vectors of culture and tradition. Essential oils are vital resources for rural communities in both developed and less developed countries, they are produced in more than 60 countries.

The world is producing some 300,000 MT of essential oils:

- 165,000 MT of gum turpentine oil (and some other conifer extracts such as pine needle oils)

obtained from living trees: Many people are not familiar with gum turpentine, though it is the world's biggest essential oil. Gum turpentine is obtained from the resin exudates of living conifers (mostly pine, spruce and fir) through ancestral tapping techniques; tens of thousands of people across the world manually collect resins from millions of trees, revisiting them several times a year. After distilling the natural resin, a fully natural gum turpentine essential oil is obtained. This ancestral technique preserves trees and forests, providing work to many inhabitants of rural areas, particularly in Asia and South America. It is also an incentive for local populations to protect their surrounding forests, as it is a source of income through the tapping activity. Over 250,000 tappers worldwide benefit from this activity.[16]

- 70,000 MT of essential oils from flowers, twigs, leaves, bark, wood and roots: These are most diverse essential oils such as cornmint, spearmint, peppermint, eucalyptus, clove, lavandin, lavender, citronella, litsea cubeba, patchouli, sage, lemongrass, tea tree, anise, ginger, nutmeg, vetiver, coriander, cinnamon, geranium, basil, petitgrain, verbena, cassia, caraway, marjoram, palmarosa, rosemary, fir needle, amyris, fennel, artemisia, fenugreek, helichrysum, thyme, dill, juniper, cypress, ajowan, chamomile, cajeput, cananga, valerian, lovage, hyssop, tarragon, jasmine, rose oil and another 100 different essential oils and other natural extracts, providing work to many millions of mostly small scale farmers and pickers.
- 65,000 MT of essential oils from citrus fruits: These are familiar essential oils mainly obtained by cold-pressing the peel of more than 20 types of citrus fruits, such as orange, lemon, lime, tangerine, grapefruit, bergamot, yuzu, etc. They also are very important for many local communities across the globe, and often the result of patient investments, since it takes several years to harvest the first fruit from a citrus tree. Many growers face a range of challenges, including pressure on land availability, changing weather patterns, diseases such as citrus greening and rising input costs such as fertilizer, energy, transport and labor.
- Essential oils are used in many industries such as fragrances, flavors, aromatherapy, pharmaceutical, organic phytosanitary products and other ancillary industries (**F-1**).[10]

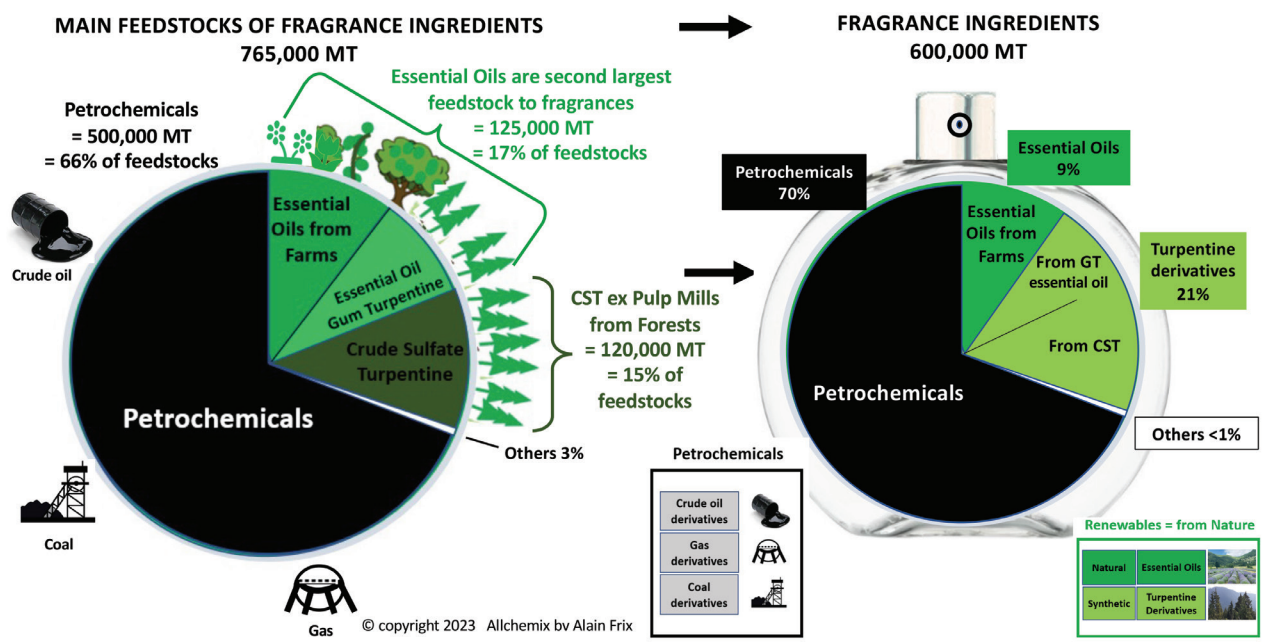
8. Illustrate the Dynamics of Essential Oils in the Fragrance Industry

Let us analyze the dynamics of essential oils in their most important applications —perfumes. The calculations which follow are estimations of a fragrance's aromatic components, in metric tons following correction referring to all masses being expressed as 100% pure products (**F-2**).

- **Essential Oils and Extracts:** Approximately 125,000 MT of essential oils are used each year in the fragrance industry, some 17% of the total fragrance ingredient feedstock. In addition to being an essential raw material for perfumes, essential oils are the only real provider of natural ingredients—about 55,000 MT of these natural oils will be used as final ingredients in perfumes, or 9% of all fragrance ingredients worldwide (**F-3**). As their

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F-3 Main Feedstocks of Fragrance Ingredients (metric ton MT)



production provides work for millions of farmers and pickers, essential oils are by far the most important socio-economic contributors of the fragrance industry. Essential oils are an important driver to make fragrances "greener," more natural, more renewable.

- **Turpentine Derivatives:** These derivatives are obtained from two types of turpentine:
  1. **Gum Turpentine (GT)** Out of the world pool of 165,000 MT of natural gum turpentine oil, 60,000 MT will then be further processed into 45,000 MT of various fragrance ingredients.
  2. **Crude Sulfate Turpentine (CST)** This turpentine is also extracted from pine trees, but as a by-product of sawmills/paper industries. CST is not considered to be an essential oil as it has been sulphated. Approximately 120,000 MT of CST, or some 15% of feedstocks to fragrance ingredients, are processed into 85,000 MT of fragrance ingredients each year.

While both CST and GT are all of natural origin, their derivatives are mainly produced through catalytic chemical processes, as such these derivatives are mostly all synthetic. Turpentine derivatives from CST and GT account for up to 130,000 MT, or 21 % of all fragrance ingredients worldwide (**F-3**).





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Other industries also consume turpentine derivatives, such as agrochemicals, polyterpene resins, solvents, pharmaceuticals and camphor. As these are natural and sustainable products, more industries will require larger quantities of turpentine derivatives as a renewable raw material source in the near future, at least if regulations allow. [10,13]

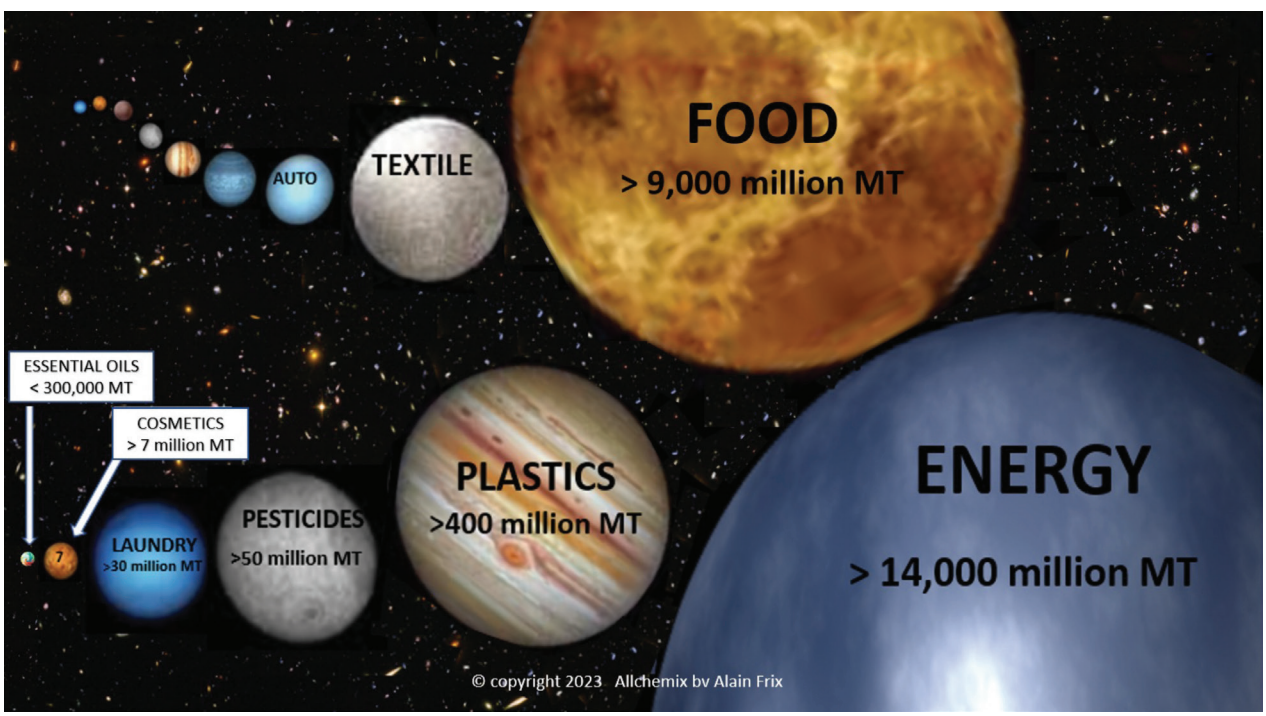
- **Petrochemicals:** All petrochemical derivatives are synthetic and not renewable. Petro-derived aroma chemicals are prevalent in fragrance ingredients; up to 420,000 MT per year are used in perfumes, petrochemicals represent about two third of the perfumery ingredient's feedstock.

Many petrochemical fragrance molecules aim to mimic existing natural chemicals, but often not exactly, as petrochemicals tend to be predominantly racemic mixtures, which means that they may not have the same chirality properties (nor always the same physiological effect) as the natural molecule they are trying to imitate. Some petrochemical molecules are entirely invented, which means that they are not (or not yet) found in nature, but offer unique properties, such as very delicate notes, powerful effects, better stability in detergents and cleaners. These properties are welcome in the perfumers' palette, as the fragrance must adhere, not discolor and not interact overly with the other substances that define a detergent, cleaner, fine fragrance or cosmetic. Petrochemicals are by far the cheapest fragrance ingredients and the main driver for the expansion of fragrance in the world.

Petrochemical companies are launching initiatives to replace part of their fossil feedstocks with certified renewable feedstocks through a biomass balance approach. This principle involves the measured injection of biomass into the traditional petrochemical feedstock at the refinery. This ratio will be certified throughout the production chain according to the proportion of "green versus gray" carbons, resulting in a certified partially renewable, synthetic product. This involves rigorous certification schemes and possibly carbon credit schemes where the biomass is remote or where it is practically impossible economically to transport it to the refinery.

- **Biotechnology and Natural Chemicals:** These natural chemicals are produced complying with either United States or European natural chemical protocols. An estimation of annual volume is 2,000 MT, which includes biotechnologically produced products.10 Their use in fragrances is extremely low due to their high price, usually above 200 euros/kg of final material, and their olfactory profile which is often different from that of natural extracts and does not always meet the requirements of perfumers. A majority of these

F-4 Comparative Carbon Requirements from Various Industries



natural chemicals are manufactured in China, sometimes without clear evidence of full compliance with United States or European natural processes, yet these materials are still available with the desired certificates for the fragrance and flavor industries. This deserves more attention and possibly an investigation by the authorities, as it is very unfair competition for producers of genuine natural chemicals. It is very likely that some large respected multinational companies buy these dubious products, while there are sufficient tools and equipment to detect falsifications. It must be admitted that many of these doubtful naturals are bought at significantly lower prices.

9. The Shift from Natural Ingredients to More Petrochemicals and Coal…

Over a period of 50 years, natural ingredients have lost much of their share to petrochemicals, mainly due to cost factors and limited availability, while petrochemicals are cheaper and much more abundant, even these are in the hands of a limited number of large companies.

Today, many natural ingredients are on track to disappear from the fragrance palette as regulatory pressures on essential oils continue to increase at an astonishing pace. Over the past 20 years, many Western companies have been seduced by the large and efficient operational skills of Chinese producers. Under cost pressure, European and US ingredient manufacturers and compounders moved some of their production to China. Other Western manufacturers preferred to stop production of certain product lines. As a result, many ingredients today are produced exclusively or mainly in China. Besides the less sustainable distances and the geopolitical risk profile of this shift, there is also an often overlooked environmental issue that cannot be ignored: most of the energy for Asian manufacturers, especially in China, comes from coal, while Western manufacturers mainly use gas and oil, which releases proportionally much less carbon dioxide.

The author estimates that more than 60% of today's petrochemical fragrance ingredients come from raw materials produced in China. The country continues to grow and the emergence of new petrochemical giants in key molecules such as citral and menthol will strengthen China as the undisputed leader in fragrance ingredients.

10. Comparative Carbon Requirements from Various Industries

Petrochemicals are produced specifically as key products for much larger industries besides the perfume industry. Petrochemicals are the main source of plastics (400,000,000 MT/year) but also the main raw material for other applications such as construction, textiles, agrochemicals, solvents, vitamins, printing, etc. The cumulative consumption of fossil carbon to produce consumer goods probably amounts to over 750,000,000 MT/year.[10] These figures are still small compared to the all-powerful energy industry, which probably consumes over 14,000,000,000 MT/year of fossil carbon.[12] Compared to these industries, the essential oil planet is extremely small to almost negligible, with its 300,000 MT of scented natural molecules. (**F-4**)

In fact, the comparison is more astonishing when you consider that a single crude oil sea tanker (300,000 MT) could carry by itself the entire world's production of essential oil. The crude oil industry probably produces more than 5,000,000,000 MT of crude oil per year (**F-5**), or more than 16,000 sea-tankers, producing massive amounts of petroleum VOCs such as toluene, benzene, xylene and other related products, which are known to have adverse effects on the human body. It is also interesting to compare the small size of the essential oil industry, with its annual 300,000 MT of pleasant-smelling biogenic hydrocarbon molecules, with the weight of biogenic VOCs released by nature, the latter very likely exceeding 1,000,000,000 MT per year (**F-5**).[1] The concept of proportionality should never be forgotten. How much smaller could the essential oil industry be?

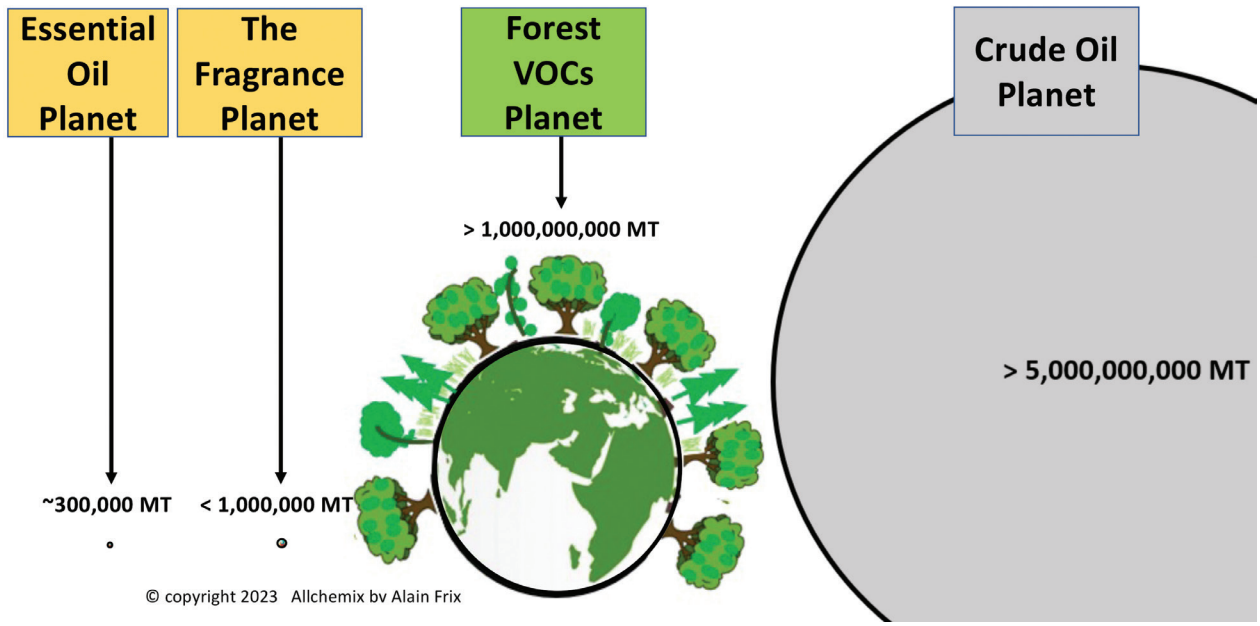
11. Differences between Petrogenic VOCs and Biogenic VOCs

Crude oil or a crude oil composition, is an unrefined substantially liquid mixture of hydrocarbons, resins and asphaltenes, extracted from geological formations underground and formed from large quantities of dead organisms as a result of decay, heat and pressure over millions of years.

The exact composition of a crude oil varies from location to location depending on the materials from which, and the conditions under which it was formed.

These petroleum substances were formed from the remains of animals and plants (diatoms) that lived millions of years ago in a marine environment, buried for millions of years between layers of sedimentary rock deep beneath the earth's surface, so—in contrast to biogenic VOCs—there was probably little or no interaction or adaptation between living organisms and petroleum VOCs. It should not come as a surprise that crude oil and many of its VOCs are found particularly toxic to humans and other living organisms. This very different history is another fundamental distinction between biogenic and petrogenic VOCs.

F-5 The concept of Proportionality: Yearly Outputs



We can also assume that crude oil contains few or virtually no terpenes, or certainly in the same state as the terpenes present in essential oils, as the degradation of ancient biomass over millions of years has resulted in the transformation and degradation of the original terpenes. Further research is needed to identify clear markers of current biomass versus petromass, as these are two very different product families in terms of content, safety, size, and socioeconomic dynamics and should therefore be clearly separated.

12. Sustainability is Much More than Carbon Footprint Claims

Sustainability is a concept that is prevalent in many recent discussions and plays a key role in future investment decisions. However, people may not always fully understand what sustainability is really all about; they often forget the social aspect.

Sustainability can be defined as a complex and dynamic balance between economic (increased yields, energy savings, etc.), environmental (renewable feedstocks such as biomass and energy, waste reduction, biodegradability, biodiversity, preservation of natural resources such as water, soils, etc.) and social matters (fair trade, profit sharing, access to genetic resources, rural economy, women empowerment etc.)

Some companies, especially chemical producers, still express their sustainability efforts–sometimes myopically—through carbon footprint estimates. But carbon footprint itself is absolutely not a guarantee of a sustainable contribution to biodiversity, biodegradability, fair trade, rural employment, and so many other indicators that warrant a balanced business model. Social criteria are integral to the sustainability picture of each ingredient, and it is of increasing emotional value to many consumers in their purchase decision.

Millions of farmers, laborers and pickers are highly dependent on the essential oil sector. Their lives form the third pillar of sustainability, the human footprint. In fact, there are very few, if any, entirely perfectly sustainable solutions, and here again each feedstock has its advantages and its inconveniences.

Often, a very good carbon footprint comes at the cost of a reduced social impact and vice-versa. In the end, a successful sustainable company is one that adopts the challenge to continuously improve on its own internal framework, year by year, regardless of whether it transforms petrochemicals or agricultural products into a fragrance ingredient. The progress and desire to improve is more important than the score one keeps.

Moreover, the sustainability scores of both petrochemical-based and natural-derived industries are complementary. In other words, their weaknesses are different.

13. Essential Oils are a Big Provider of Rural Jobs

Cultivation, harvesting, and processing botanicals has a significant impact on rural welfare, an aspect often forgotten. The world needs to improve its efforts to provide work and income to rural communities, often operating in very remote areas. Experts from IFEAT (The International Federation of Essential Oils and Aroma Trades) have estimated that over 10 million farmers, pickers and tappers are saved from poverty thanks to the aromatic crops which are produced, often on their small plots of land and at times with very ancient techniques. IFEAT provides high quality information on the socio-economic aspects of many essential oils. These reports are also regularly published in IFEATWORLD. The same IFEAT is organizing educational courses on essential oils, explaining the diversity of their production and applications, and their uniqueness from an economic standpoint, under the leadership of the chair of IFEAT Education Committee Alan Brown.

It is a moral pledge, by some, to better support these challenged and often impoverished farmers, by generating corporate reports and obtaining various certifications.

Without work, the situation of these families becomes very precarious, many would have to leave their rural villages and move to the cities in search of an income. This is fueling migration: youngsters that don't make enough money in the villages have little to no choice but to migrate out of the countryside by millions, driven by hope and desperation to seek sustentative opportunities in big cities. Some would even risk their lives, like the people who cross the Mediterranean Sea in terrible conditions in search of a better life in Europe. Everything is somehow interconnected.[10]

14. Natural Products are Way Too Cheap

There is a real cost for sustainable practices. Farmers, especially small scale-farmers, are by far the weakest link in the full value chain of essential oils. While consumer goods companies rightfully impose more sustainability requirements and regulations on their entire supply chain, it is the farmer who mostly gets hit by the domino effect. As explained previously, over 10 million farmers and pickers, in the case of the essential oil industry, live at or just above the poverty level. They cannot be made the sherpas of sustainability. They need to be supported financially and socially and be educated in sustainable practices.

Unfortunately, the prices that are being offered for their natural products often do not allow them to properly invest in better practices and to implement new technologies. Consumer goods companies and brands need to educate consumers that there is a premium to pay to really improve the livelihood of the farmer and the environment. Some consumers will agree to pay a premium if they understand why they must pay more and how these premiums impact our planet.

Therefore, traceability needs to go in both directions—consumers need the ability to follow a product from the farmers' hands, but they also need verifiable evidence that the price premium effectively goes to the farmers and better farming practices. Blockchain technologies could possibly be a solution, but millions of farmers still have no access to cell phones. Only then will sustainability be truthful and impact the entire product lines, much more than today's initiatives, which are often limited and selected by major companies as required.[10] And yes, petrochemicals are also far too cheap, considering the environmental costs associated with their use.

15. Effects on Rural Economy, Food Chain and Biodiversity

Some people often hastily claim that the essential oil industry has a negative impact on biodiversity and that it competes with food in terms of land use.

They may not always be aware of the small size of the essential oil industry compared to food production. Nor are they aware of the efforts and successes of the essential oil industry in preserving biodiversity and its amazing achievements including the creation of new forests and protecting endangered species.

Of the 300,000 MT of essential oils, 60,000 MT of citrus oils are produced from by-products of the food (fruit juice) industry. This leaves 240,000 MT of essential oils that could potentially 'compete' with food crops, although most of these essential oils come from conifer forests located in remote mountains, where food is not produced on a big scale.

The UN FAO has estimated in 2021 that annual primary food crops exceed 9,000,000,000 MT.[14] The 240,000 MT of annual essential oils production represent an extremely small fraction—there is only one kg of essential oil produced for every 37,500 kg of food produced. Moreover, some previous estimates suggest that the cultivation surface area of essential oil crops in relation to food crops is no less than 1 in 10,000.[15,18] The disproportion is such that it is fair to believe essential oils do not compete with food. In fact, the opposite is rather true—essential oils can be a complementary crop, supporting the farmer between two food crops.

A good example is the Indian cornmint, Mentha arvensis, one of the largest essential oils in the world with a production of almost 40,000 MT, and a good source of income to several millions of Indian farmers. It shows how mint crops complement food crops on the same field—these farmers take short duration mint crop in the summer season (sown and harvested between March and June), which is after the harvesting in spring of "winter" food crops (sawn in November or December) such as potato, mustard, lentil, Bengal gram or wheat, barley, peas. The mint crops are harvested before the planting in June/July of rainy season food crops which is mainly rice or pigeon-pea. Mint crops are important crops as they can double the (still very low) earnings of farmers, diversify their income, which is extremely important with climate change factors making crops overly less predictable.

Some producers of biotechnology products often claim that they provide a great alternative to "endangered" species, citing Santalum album, the East Indian sandalwood. It is true that this tree was almost extinct due to grievous over-harvesting in India, three decades ago. In the late 1990s, the Forestry Department of Western Australia began to grow East Indian sandalwood trees as part of a global conservation program. Santalum album showed promising potential. Today, more than 10,000 hectares of arid savannah landscape in Kununurra (Western Australia) have been transformed into an immense plantation of sandalwood trees, creating a new ecosystem, and providing income to the local population. Millions of trees today define a new landscape, creating a new source of sandalwood essential oil, which are perfectly managed according to the principle of sustainability, as compared to when this same species was on the brink of extinction several decades ago. Such projects should be acclaimed, as they are true vectors of biodiversity preservation, they are the fruit of 25 years of patient investment and dedication. However, still today some producers of chemical alternatives continue to spread the idea that Santalum album is almost "on the verge of extinction." Nothing could be further from the truth, and the best evidence of this is the millions of Santalum album trees that stand beautifully tall in Australia, as well as new plantations in other parts of the world. Once again, a forest that offers economic value while being managed sustainably is the best guarantee against deforestation.

16. Certificates, Regulations & Casualties

In recent years, further requirements such as renewability, traceability, sustainability programs, organic or vegan, and compliance with the rules of a myriad of other certifying bodies have added a sizable burden and complexity, especially to the farmers.

Although the intention is undoubtedly good, these additional constraints have proven to be very demanding to many small producers, as they lack the personnel or expertise to complete the paperwork being requested. Ultimately many small players discontinue or sell their business to larger entities, which are facing continued consolidation themselves. The pond of raw material producers is being drained at an alarmingly fast rate because of excessive and often unnecessary regulations. This leads to a uniformization of ingredients, the constitution of major compounding houses which goes against other fundamental principles of these same regulations. We need to be more responsible, and that means protecting farmers from over-regulation and over-certification.[10]

17. Essential Oils and Safety Assessments

Regulatory bodies from the EU and other regions seem to struggle to understand natural complexity. The current mindset towards safety assessment protocols—evaluating natural complexes according to their individual constituents—is of great concern. This approach implies that the NCS's (Natural Complex Substance), like essential oils, will react as if each individual component were to behave in isolation. This has been proven on several occasions not to be entirely the case. For example, several studies performed by the RIFM (Research Institute for Fragrance Materials) in collaboration with IFEAT indicate that the genotoxicity profile of whole oils containing chemicals of concern often demonstrates a much better profile than may be expected based on individual component analysis and pass the various genotoxicity endpoint tests. As an example, NCSs such as rose oil, which contains methyl eugenol, yielded favorable results, contrary to similar test results conducted on methyl eugenol alone, which by itself is deemed to be unsafe.

The approach to breaking down essential oils into individual constituents and establishing their safety profile based on algorithms using existing chemical databases could likely save costs and facilitate bureaucratic documentation, but it does not necessarily reflect reality.

There is only one way to accurately assess essential oils safely and that is by testing the whole essential oil per se. Under the leadership of IFEAT, RIFM conducted genotoxic tests on more than 70 essential oils over the past five years, and, the tests conducted so far have not revealed any genotoxic

concerns for almost all, as only a very few oils need to undergo further testing. Therefore, in various cases, the interactions between the constituents in NCSs attenuate certain properties and characteristics of the individual constituents in a favorable manner.

Recent studies conducted by other institutions on various essential oils indicate the physiological effects observed with the individual key constituents of these oils were very different from those observed with the entire oils. This is another strong indication that essential oils are very complex mixtures, and that it is essential to study whole oils rather than their constituents individually in safety assessment.[19]

Critically, it is important to the world to understand natural aroma chemicals do not necessarily have the same chirality as synthetics. Living organisms produce chiral molecules predominantly with a specific optical rotation, while chiral substances synthesized in the laboratory tend to be mostly racemic mixtures. It is well known that chirality can play a critical role in the physiological impact of chemicals on humans. Let us not forget that any combination of ingredients, as safe as they could be individually, will undoubtedly lead to chemical reactions once they are mixed, with the formation of some new compounds and degradation of others. Every consumer product has a complex structure and is subject to certain molecular dynamics that stabilizers might not always fully master.

18. Some Final Reflections

One might wonder why our world of essential oils is subject to so many misconceptions and even misperceptions. One has never heard of anyone dying from using commercial essential oils. Nor have we ever heard of anyone dying from walking in the woods. Of course, any substance can be a safety hazard if used improperly. Water may even be the most dangerous substance in the world, from that perspective.

There is little difference between forests and essential oils, both contain similar molecules, except that forests are much more complex and a much bigger reservoir of natural chemicals. Fortunately, people are still free to walk through a forest and relax by smelling the trees. We should not forget that our history has been closely linked to forests for millions of years. Early humans were already evolving in forests—and probably preferred them —rather than in grasslands. Their bodies were exposed to the hyper-complex abundance of natural chemicals, inhaling VOCs from the forest, chewing leaves, branches, barks. They lived in and with natural extracts, in biogenic VOCs.

Over-regulation of a small market like essential oils seems to be reaching strange proportions. And if we are going to go down this road, let's be consistent and fair: shouldn't we then label forests and perhaps sometimes ban access to them based on their complex VOC profile, which, by the way, changes with the seasons.

Certainly, we are all striving to protect what we still have today —7,000 years of cultural and industrial heritage of essential oils and natural extracts. Humans very likely obtained natural chemicals from forests and shrubs long before archaeological findings.

Regulators need to be aware that the production of natural extracts is very difficult and exposed to many uncertainties, today even more than in the past —climate change factors, currency exchange rate fluctuations, customer concentration, globalization of the economy, rapid urbanization. Producers need time to adapt, while nature—despite being the world's largest chemical factory—cannot respond to immediate demands for change.

Finally, it must be recognized that industries are cost driven. If regulations on essential oils become too stringent, many multinational compounding and consumer goods companies will phase them out as the regulatory burden and associated costs become excessive. These natural products such as essential oils and forest extracts would simply be replaced by petrochemicals and biotech products, mainly GMOs, a combination between biotechnology and chemistry. Many of these chemicals and biotechnology products are produced in-house by the same multinationals compounders that buy essential oils from farmers. An over-regulation on essential oils would wipe out an entire natural worldwide supply chain and further strengthen the dominant position of some large compounding companies.

So, it is not the final formulator who will suffer most from over-regulation of natural products, but consumers and a large number of small and medium-sized, mostly family-owned businesses (many of which are still based in Europe) that have been growing, producing, processing, extracting and refining quality natural products, sometimes for over a century. And behind them, the millions of invisible farmers, pickers and tappers who are never heard from and who will be deprived of their main resources for survival. Many of them will see their lavender, patchouli, vetiver, agarwood, ylang-ylang, jasmine, etc. replaced by petrochemical derivatives of oil, gas and coal.

This can certainly not be the objective of the EU's Green Deal and one must be aware of the adverse effects of any unilateral decision if it is based on too narrow of an approach.

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About the Author

Alain Frix dedicated 30 years to the business of renewable materials, from forest products such as turpentine and its perfumery derivatives to aromatic plants and essential oils. After chairing the IFEAT for several years, he currently sits on IFEAT's Scientific Committee and is involved in various projects related to fragrance and flavor markets, natural and synthetic ingredients, biodiversity and climate change issues. In 2020, Alain Frix founded an independent, wholly owned consultancy company, Allchemix BV. He also set up BioM Consultancy, which is the advisory part working on biomass. Alain Frix has a master's degree in biology and in management.

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How to Make the Most of Your *Flavorcon* 2023 Experience

Here's how to map out your trip to Cincinnati to experience *Flavorcon* 2023.

BY JENNA TROYLI, managing editor, *Perfumer & Flavorist+*



Don't forget to ask questions! Each conference session has a Q&A for attendees to ask their burning questions.

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We are just two months away from the return of *Flavorcon*! The two-day event is packed with education sessions (and samples) as well as a bustling expo hall for attendees to explore. Visit *www.flavorcon.com* to secure your ticket at the best price.

If you're having trouble getting your itinerary together for your trip to Cincinnati, I've done a little of the legwork for you. Don't worry about meals digging into your travel budget, breakfast and lunch are included in your ticket, as well as happy hour on day one (November 8).

After you've registered, booked your hotel and arranged your travel, jot down these notes for the best *Flavorcon* 2023 experience.

Tuesday, November 7

Slide over to Cincinnati a day early to experience this first-come first-served pre-*Flavorcon* session designed to take attendees on a guided tour through a lineup of organoleptic materials with the help of Bell Flavor & Fragrances principal flavorist, Cyndie Lipka, and independent flavorist and "Flavor Bites" columnist, John Wright. Attendees will be split into two groups, first attending a 45-minute session with one of the flavorists and then swapping to join a 45-minute session with the other. These sessions are a $50 add on to your conference registration.

> "Can't make the sessions but still want to explore the expo hall? Attendees can also snag an Expo Only pass for Thursday, November 9."

This event is limited seating so be sure to register ASAP secure your seat, visit *www.flavorcon.com*.

Later that evening, Women in Flavor and Fragrance Commerce (WFFC) is set to host a night of Cincinnati-themed food, fun and karaoke as a pre-*Flavorcon* event at Tokyo Kitty (575 Race Street, Cincinnati, OH). To register, visit *www.wffc.org*.



*Women in Flavor and Fragrance Commerce is set to host a night of Cincinnati-themed food, fun and karaoke as a pre-*Flavorcon *event at Tokyo Kitty.*



We've spaced out the sessions for attendees to get in meaningful time in the expo hall and for networking.

Wednesday, November 8

Get the day started by heading over to the Duke Energy Convention Center to register last minute or to grab your badge before digging into breakfast bites and coffee prior to the kickoff of conference sessions. In between these educational seminars spanning from flavor development to neuroscience to the latest research in taste and smell, attendees can explore the expo hall filled with ingredients, technology and equipment the flavor industry thrives on.

The final session of the day, hosted by Surely Wines flavor chemist Michael Colangelo, will dig into the challenges and how to rebuild the flavor profiles in low-to-no wines and non-alcoholic sips. And yes, there will be plenty of samples ranging from full to non-alcoholic so that attendees can get a taste of the process. Following immediately after will be a cocktail hour with a buffet-style selection of eats included in ticket pricing.

Thursday, November 9

Make sure to have a notepad handy, because the conference sessions keep rolling on day two! Grab your breakfast at the convention center before Thursday's talks that cover the latest trend insights on market categories including plant-based, sports nutrition and more by Euromonitor and Spate. Did we mention Graeter's will be returning? That's a sweet surprise. You won't want to miss these scoops from industry insiders.

We've also spaced out the sessions for attendees to get in meaningful time in the expo hall and for networking.

Pre or Post-Con

Prior to arriving in Cincinnati, be sure to download the *Flavorcon* app. Through the app you can connect with speakers, rate sessions and keep track of the event agenda.

Sticking around Cincinnati for the weekend post-*Flavorcon*? Or maybe you're arriving early to find your footing. One way to dig into Cincinnati's food culture is by taking a guided tour. Riverside Food Tours (*https://www.riversidefoodtours.com/*) is an option for attendees and exhibitors to take your team, or fly solo, on a food and culture tour.



Riverside Food Tours co-owner Laura Noyes shares, "Our team of professional guides offer three-hour food and culture tours seven days a week. Our tours are the fun way to see and explore the city, while enjoying delicious food at locals restaurants! We can accommodate any size group with advanced notice. Choose from one of our 10 public tours or we can customize a private tour just for you."

How to Register

There's still time to register for *Flavorcon* 2023! Scheduled for November 8-9 in Cincinnati, OH, be sure to visit *www.flavorcon.com* to receive the best rates. Can't make the session but still want to explore the expo hall? Attendees can also snag an Expo Only pass for November 9.

The two-day conference will include a series of data/analytics presentations, interactive educational talks and panel discussions featuring some of the industry's leading experts. Attendees will come away inspired with new tools and connections to create flavorful wins and products consumers love. p&f+



Riverside Food Tours co-owner Laura Noyes shares, "Our team of professional guides offer three-hour food and culture tours seven days a week."

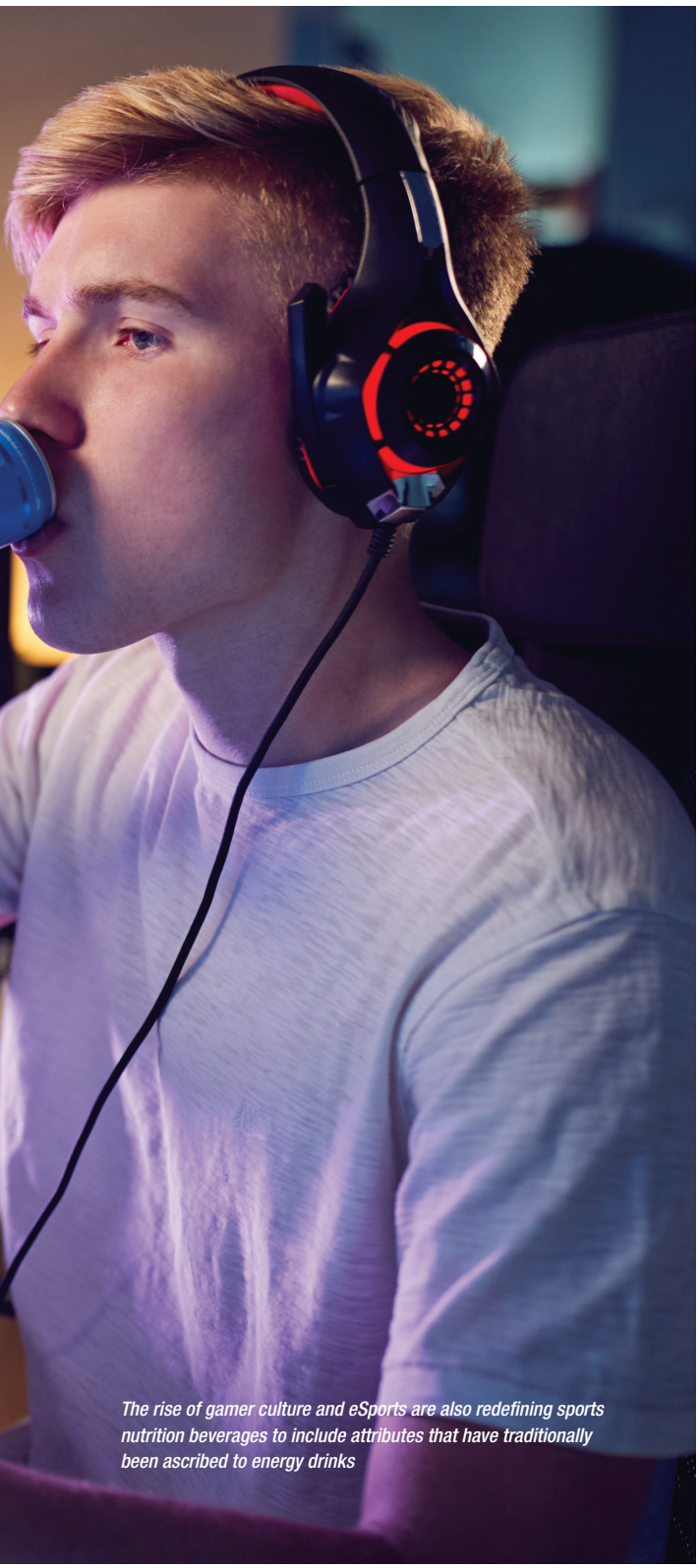
CHALLENGES AND WHITE SPACE IN ENERGY DRINK MARKET

The role of flavor in energy drinks is becoming a critical factor in new product trial and repeat purchase.

BY DOUG RESH, director, Commercial Marketing, T. Hasegawa USA



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The rise of gamer culture and eSports are also redefining sports nutrition beverages to include attributes that have traditionally been ascribed to energy drinks

The past few years have fundamentally shifted our relationship with food and beverages. While it's obvious that COVID-19 played a major role in changing consumer habits, its impact on the food and beverage market did not end when the pandemic concluded. As consumers return to active lifestyles and traditional work routines, they find themselves faced with economic uncertainty in the form of inflation, stagnant wage growth, and intermittent supply chain disruptions.

Consumers are trying to do more with less, and as a result, they are seeking more value from food and beverage products in the form of functional ingredients, health benefits and performance claims. No sector is experiencing this shift more than energy drinks, which has grown over the years from a niche category to a mainstream player in RTD beverages. With immense category growth and surging consumer demand for functional ingredients and BFY formulations, the role of flavor in energy drinks is becoming a critical factor in new product trial and repeat purchase.

Growing the Energy Drink Market by $10 Billion in 5 Years

The energy drink market has experienced remarkable growth in recent years. According to Mintel research[a], the U.S. market for energy drinks has surged by 71% since 2017, reaching a total of $23 billion in 2022 U.S. sales. Even more, the category is projected to grow extensively in the next five years[b], reaching $33.2 billion by 2028, growing at a CAGR of 7.63% during this period. This growth can be attributed to various factors, including the pandemic, generational changes, growth of the non-alcoholic beverage industry and more. As consumers seek new ways to power-up, they are venturing beyond traditional options like coffee and tea in order to explore a diverse array of energizing RTD beverages packed with functional ingredients that go beyond caffeine, taurine and guarana.

[a]Mintel, Energy Drinks, US, 2023.

[b]Mordor Intelligence, United States Energy Drink Market Size & Share Analysis – Growth Trends & Forecasts (2023-2028), US, 2023.



The growth of the energy drink market can be attributed to various factors, including the pandemic, generational changes, growth of the non-alcoholic beverage industry and more.

The Broadening Role of Energy Drinks

The biggest challenge for the energy drink category is showing that there is more to these RTD beverages than sugar and caffeine content – including unexpectedly healthy options. Today, the energy drink category includes a broad variety of beverages that offer new and exciting ways to keep energized – embracing innovation through unique flavors and targeted functionality, such as improved cognitive function, stress relief or boosted immunity. Unpredictably, the energy drink category is even challenging sports beverages and waters in enhancing hydration.

Energy drinks are no longer just a source of quick energy, they aim to address specific consumer needs and cater to a wider audience seeking holistic well-being.

A blossoming trend in recent years is energy drink products specifically targeted towards the gaming community. With the immense growth of online gaming and esports, beverage brands recognized an untapped opportunity to cater to the unique needs and demands of gamers. These specialized energy drinks include functional ingredients like ginseng, nootropics and ginkgo biloba to enhance focus, reaction time and stamina, while quickly gaining popularity among the gaming community. The gaming industry's notorious intensity is perfectly suited for energy drinks, plus the category relies on equally intense flavor formulations to gain market share and appeal to this consumer base. This segment of the energy drink category is poised for growth, due to the mass appeal of video games among younger consumers. More than 94% of U.S. teens aged 10-17 play video games, and playing video games is the top after-school leisure activity[c] among males aged 10-17.

Surprisingly, energy drinks have even found a place as an alcoholic beverage alternative, particularly for the "sober curious" consumer – a segment that grew dramatically during the pandemic. These consumers are a highly health-conscious group interested in premium, unique beverages – indicating an opportunity for BFY energy drinks with unique flavor profiles. Energy drinks have become an appealing option for this demographic, offering

[c]Mintel, Teen & Team Gaming, US, 2022.

a stimulating and enjoyable beverage without the effects of alcohol. The diversity of flavors, functional ingredients, and targeted benefits found in energy drinks allow the sober curious consumer to explore exciting and refreshing options that align with their desired lifestyle.

Formulating Flavors for Functionality

The energy drink market is fundamentally fueled by compelling and exciting flavors. The role of the flavor industry is growing to meet consumer demand for authentic, true-to-nature flavors, unexpected ingredient combinations and thrilling taste experiences. The importance of flavor in driving product trial and repeat purchase cannot be understated, it is a critical aspect of nearly every food and beverage category, and the complexity of balancing functional ingredients in energy drinks makes formulating flavors for this category even more challenging. To meet this challenge, the flavor industry has introduced innovative technologies like flavor modifiers and enhancers, aimed at amplifying taste characteristics as well as enhancing the mouthfeel, even improving the kokumi (Japanese for “rich taste”) sensation. These advancements enable the development of natural energy drinks that are both delicious and minimize sugar content. The energy drink category also leverages the positive perception associated with fruit flavors, capitalizing on the "health halo" of fruit ingredients. As demand rises for fruit flavors and natural ingredients, the flavor industry is leveraging technologies that produce authentic-tasting beverages that are true to nature’s essence. This strategy drives innovation that enhances and highlights the natural flavors in energy drinks, offering consumers refreshing and authentic taste profiles.

Evolving the Energy Drink Consumer

While consumer demand for more versatile, flavorful energy drinks continues to evolve, so do the consumers themselves. Energy drink demographics are shifting as Gen Z and even younger Gen Alpha consumers age into the market, and opportunities abound to serve-up what these consumers already want. According to Mintel, Gen Z’s high RTD coffee consumption indicates a need to aggressively target younger consumers and develop energy drinks that speak to their unique energy needs and interests. Aging millennials–once the prime demographic for traditional energy drinks–have distinct health and wellness goals. Millennials are now looking for BFY energy drink options made with natural ingredients, lower caffeine content or other health-minded formulations. The opportunity for organic growth of the energy drink market increases with younger consumers. Mintel research shows that only 17% of Gen X and older consumers consumed a traditional energy drink in the past three months, compared to over half of Gen Z consumers in the United States.

The market for energy drinks is also shifting between male and female consumers. In the past, energy drinks were primarily consumed by men, but now women are making up a larger share of the market. According to Mintel research 83% of women aged 18-34 have consumed an energy drink in the past three months and the market continues to grow, based on engagement from younger female consumers. There is also an overlap between the energy drink market and the ready-to-drink (RTD) coffee





According to Mintel, Gen Z's high RTD coffee consumption indicates a need to aggressively target younger consumers and develop energy drinks that speak to their unique energy needs and interests.

market. According to Mintel research, Gen Z's and millennials' love for energy drinks and RTD coffee creates the perfect positioning of an energy drink as a convenient, portable perk-up. Energy drinks that are marketed as "coffee alternatives" are becoming increasingly popular, and many energy drink companies are now offering RTD coffee formulations.

Energy Drink or Sports Nutrition Beverage?

As consumer need for a convenient, portable 'buzz' evolves, the lines are blurred between energy drinks and sports nutrition products. This is due to several factors, including the growing demand for healthier and more natural energy drinks, the increasing popularity of pre-workout and post-workout supplements, and the rise of gamer culture. According to Mintel research, nearly half of all U.S. energy drink consumers are interested in energy drinks that contain electrolytes. This represents a major shift in consumer perception about energy drinks as a source of hydration. Brands should explore flavors that are traditionally associated with hydration, such as fruit. These products can appeal to energy drink consumers but also represent a hybrid with sports nutrition beverages, tapping into a completely different market.

The aforementioned rise of gamer culture and eSports are also redefining sports nutrition beverages to include attributes that have traditionally been ascribed to energy drinks. The energy drink category's inherent focus on mental clarity, alertness and performance is ideal to position energy drinks as a sports nutrition option. Gamers are a large and growing demographic, and they are often looking for energy drinks that can help them stay focused during long sessions. While new product introductions are growing in this niche segment, major opportunities exist to formulate energy drink flavors that resonate with gamers and deliver functionality and great taste.

Fueling the Future

It's an exciting time for the energy drink market. Immense consumer interest in energy drink products and a willingness to try new flavors is proving that demand will continue growing for innovative energy drink products that deliver tangible benefits and value. But brands cannot overlook the importance of flavor in growing this market. The success of new energy drink products will hinge on leveraging the technical advancements of the flavor industry to keep the category interesting, encourage trial and drive sales.

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Some profiles mentioned for (E,Z)-3,6-nonadienol were lychee, nectarine, peach, plum, raspberry, strawberry, and lastly cooked asparagus and mushroom.



Flavor Materials Report

Flavorist panel evaluates rice bran infusion, cis-hexenyl isovaleratem, pistachio kiiNote and more.

BY CYNDIE LIPKA
Principal flavorist,
Bell Flavors and Fragrances



Organoleptic Evaluation Panelists

- **Bill Aslanides**, Senior Flavorist, Synergy Flavors, Inc.
- **Deborah Barber**, Senior Flavorist, FONA
- **Nicole Hernandez**, R&D Manager and Senior Flavorist, FlavorChem
- **Christina Hook**, Flavorist, Bell Flavors and Fragrances
- **Judith Michalski**, Senior Flavorist, abelei flavors
- **Andrew Petrou**, Flavorist, Savory, Bell Flavors and Fragrances

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cis-3-Hexenyl 2-methyl butyrate, Natural

Source: Avant Organics
FEMA#: 3497, CAS #: 53398-85-9
Naturally occurring in: Apricot, guava, plum, spearmint, tea.
Odor 1%: Fresh, green, light, fruity, juicy, sweet, slightly dry and fatty, melon and skin notes.
Taste @ 1 ppm: Mild, green, stemmy, crisp.
Taste @ 3 ppm: Green, fruity, slightly waxy, juicy pear, apple skin, peachy, melon, green and fragrant.
Possible applications: This would fit very nicely in all the stone fruits as the sweet juicy notes had the panel reflecting about peach and nectarine. Other fruits mentioned included apple, pear, pineapple watermelon, honeydew, green grape, kiwi, banana (green), strawberry and maybe orange. Other thoughts the panel had included both rhubarb and avocado.
➤**Avant Organics:** *https://www.crestoperations.com/avant-organics*

cis-3-Hexenyl isovalerate, Natural

Source: Avant Organics
FEMA#: 3498, CAS#: 35154-45-1
Naturally occurring in: Apple, cherimoya, cornmint, elderberry, nectarine, peppermint, spearmint, tabasco pepper, tea.
Odor @ 1%: Slightly cheesy, sweet, sweaty, green fruity, vegetative, dry, melon rind, fatty, cucumber, stemmy, grassy, and slightly candy-like.
Taste @ 1 ppm: Sweet, green, fresh, ripe, fruity, stemmy, slightly sweaty.
Taste @ 3 ppm: Sweaty, cheesy, green, heavy, waxy, green, slightly blueberry, slight floral.
Possible applications: The cheesy notes present in this ester had the panel thinking of cheddar cheese, Swiss, Parmesan, Romano, blue cheese, gorgonzola and gruyere. We also thought about green bell pepper and Anaheim pepper. On the sweet fruity side, we thought of berries like blueberry, blackberry, strawberry. But we also thought of some stone fruit such as peach, apricot, plum, and apple, pear, kiwi, watermelon, honeydew, banana and pineapple.
➤**Avant Organics:** *https://www.crestoperations.com/avant-organics*

Pistachio kiiNote

Source: Omega/Robertet
FEMA#: N/A, CAS#: N/A
Odor @ neat: Sweet, roasted, nutty, aldehydic, green, brown, bready, toasted, sunflower seed, dried nut skin, fatty, tea leaves.
Taste @ 0.25%: Dry, hay-like, aldehydic, brown, toasted, nutty, grain, cereal, seedy, fatty, oily, creamy, beany.



Possible applications for pistachio kiiNote include sesame, graham, cheesecake or other baked items like banana bread.

Taste @ 0.5%: Brown, nutty, toasted, graham cracker, praline, green nut, oily, cereal, earthy.
Possible applications: This allergen free pistachio would work in a plethora of profiles. It has cereal and bready notes that lend generic brown toasted character and yet also has an earthiness that would work in legume profiles and creamed corn. The panel also thought of sesame, graham and its wonderful partner…cheesecake or other baked items like banana bread. It might give an interesting twist to chocolate or cocoa.
➤**Robertet:** *https://www.robertet.com/*

(E,Z)-3,6-Nonadienol

Source: Bedoukian
FEMA#: 3884, CAS#: 76649-25-7
Naturally occurring in: Oysters, musk melon, prickly pear.
Odor @ 0.1%: Sweet, pulpy, green fleshy, waxy, floral, dry, melon rind, fatty, creamy, becomes earthy, mushroom on the dry out.



The panel came up with a slew of possible applications for rice bran infusion including horchata and rice pudding and oak barrel notes for whiskey and vanilla.

Taste @ 0.2 ppm: Pulpy, rindy, green, fatty, creamy, mouthcoating, vegetative, juicy, melon rind.
Taste @ 0.3 ppm: Fatty, slight citrus, rindy, green, waxy.
Possible uses: Because of the rindy notes, the panel thought of orange and tangerine and mandarin. But the overriding perceptions were more in line with melon profiles such as honeydew, cantaloupe and watermelon and included cucumber, avocado and apple for skin notes. Other profiles mentioned were lychee, nectarine, peach, plum, raspberry, strawberry, and lastly cooked asparagus and mushroom.
➤**Bedoukian:** *https://bedoukian.com/*

Ethyl isobutyate, Natural

Source: Penta
FEMA#: 2428, CAS#: 97-62-1
Naturally occurring in: Apple, apricot, Asian pear, banana, beer, brandy, mozzarella and parmesan cheese, Chinese quince, grapefruit, mandarin and orange juices, cocoa, durian, fig, fish, grape, guava, honey, hop, kiwi, litchee, musk melon, scotch spearmint, nectarine, olive, papaya, passionfruit, peach, pineapple, plum, rum, salami, sherry, starfruit, strawberry, tequila, vinegar, whiskey, wine.
Odor @ 1%: Sweet, dry, fruit seed, fruity, grape, berry, rummy, caramel, butterscotch, jammy.
Taste @ 1 ppm: Strawberry, fruity, sweet, alcoholic, rummy, purple grape, ripe pineapple, brown, caramelic, butterscotch, sugary, fig.
Taste @ 3 ppm: Slightly green, sweet, generic fruity, rummy, berry, grape, pineapple, butterscotch, rum, maple, sweet brown, slightly powdery finish.
Possible applications: The applications may be virtually endless for this one. The panel sees this fitting into all berry profiles, all grape profiles, apple, pear, cherry, apricot, nectarine, peach, plum, fig, pineapple, mango and all tropical fruits. Under the alcohol profile heading, we thought of cognac, sherry, rum, whiskey and wine. We also saw this fitting into sweet brown profiles like butterscotch, caramel, brown sugar, maple, chocolate, cocoa.
➤**Penta:** *https://www.robertet.com/*

Rice bran infusion, 60% volume

Source: Robertet
FEMA#: N/A, CAS#: 68553-81-1
Odor @ 100%: Cereal, dry, brown, sweet, grainy, corn meal, hay-like, popcorn, nutty, toasted.
Taste @ 0.5%: Dry, earthy, oily, roasted, meaty, brown, grain, nutty, sweet, toasted, starchy, rice water.
Taste @ 1%: High, rice, brown, cooked, nutty, sunflower, grainy, fatty, toasted.

Possible applications: If we exclude all the grains like wheat, corn, barley, oats, rice and generic cereal notes, do we still have ideas? You bet we do! How about graham cracker? Or horchata and rice pudding and oak barrel notes for whiskey and vanilla? There is a fermented note that might be interesting in beer, white wine or sake. I could see using this for meat crust in a barbeque profiles. It conveys that dryness as well for sesame and pumpkin seeds and almond flavors. Can we also mention Italian and Japanese rice balls? Thank you.

➤**Robertet:** *https://www.robertet.com/*

(E,E)-2,4-Octadienal

Source: Bedoukian

FEMA#: 3721, CAS#: 30361-28-5

Naturally occurring in: Beef, beer, cauliflower, blackberry, broccoli, wheat bread, caviar, fish, cheese, chicken, egg, grape, guava, olive, poppy seed, potato chip, lamb, peanut, rice, shrimp, tea.

Odor @ 1%: Fatty, oily, rancid, tallow, lard, schmaltz, green, nutty, and citrus on dry-out.

Taste @ 0.5 ppm: Chicken fat, oily, nutty, late orange, rancid, fried oil, creamy, vegetative, mouthcoating.

Taste @ 1 ppm: High level, animal fat, nut and seed oil.

Possible applications: Since this aldehyde was mentioned in association with meat so often, I think it would be excellent not only in meat profiles but also in flavors for meat analogs. This also conveys oiliness and as such would work well in nuts and seeds like walnut, hazelnut, macadamia, peanut, Brazil nut and sesame or poppy seed and wheat bread. Just a touch would add authenticity to olive oil, fried profiles and popcorn profiles. Much lower levels would need to be used in typical fatty waxy profiles like cucumber, melon and citrus.

➤**Bedoukian:** *https://bedoukian.com*

Basil oil, sweet linalool type, Organic

Source: Excellentia

FEMA#: 2119, CAS#: 8015-73-4

Odor @ 1%: Basil, licorice, floral, herbal, cooling, vegetative, dill, sweet, green, earthy, musty, pepper, incense, woody.

Taste @ 1 ppm: Dry, Earl Grey tea-like, basil, spearmint, green, fatty, herbal, anise, woody, cooling.

Taste @ 2 ppm: Herbal, green, fatty, earthy, woody.

Possible applications: This oil from Egypt is similar to fresh basil leaves. Suggestions regarding use ran from savory profiles for sausage, soups and sauces, Italian herbal blends, and certainly pesto. It could give a twist to spearmint, chai, blueberry, strawberry and peach and chamomile.

➤**Excellentia:** *https://excellentiainternational.com/*

Prenyl mercaptan

Source: Excellentia

FEMA#: 3896, CAS#: 5287-45-6

Naturally occurring in: Beer, coffee, curry, durian, hop, sake, shrimp, vanilla, wine.

Odor @ 0.01%: Coffee, rubber tire, burnt, skunky, roasted meat, burnt, dries out with alliaceous and mustard notes.

Taste @ 0.01 ppm: Coffee, brown, roasted, smokey, burnt, meaty, marijuana, sulfurous.

Taste @ 0.02 ppm: Coffee, espresso, roasted, oily, cooked, burnt, meaty, strong.

Possible uses: I'm sure it will come as no surprise that the panel alluded to all thing's coffee such as mocha, espresso, iced coffee, as well as chocolate and cocoa. The panel also thought of roasted meat especially beef and there were several mentions of cannabis and hops.

➤**Excellentia:** *https://excellentiainternational.com/*



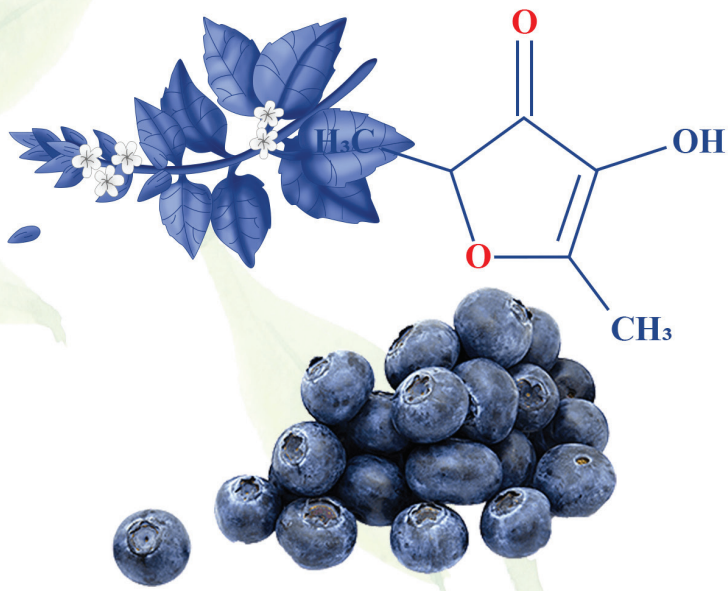
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FEMA2460 Ethyl Tiglate EU Natural (New)
FEMA3420 Beta-Damascenone EU Natural
FEMA3243 Beta-Damascone EU Natural (New)
FEMA3761 5-Methyl-2-hepten-4-one EU Natural, Chiral
FEMA2594 Alpha-Ionone EU Natural, Chiral (+100 degree)

FEMA3272 2,5-Dimethyl Pyrazine EU Natural
FEMA3273 2,6-Dimethyl Pyrazine EU Natural
FEMA3155 2-Ethyl-3-Methyl Pyrazine EU Natural
FEMA3919 2-Ethyl-6-Methyl Pyrazine EU Natural (New)
FEMA3149 2-Ethyl-3(5 or 6)-Dimethylpyrazine EU Natural

FEMA3204 Sulfurol EU Natural
FEMA3328 2-Acetyl Thiazole EU Natural
FEMA3134 2-Isobutyl Thiazole EU Natural
FEMA3555 2-Isopropyl-4-Methyl Thiazole EU Natural
FEMA3680 2-Ethyl-4-Methyl Thiazole EU Natural (New)

FEMA2361 Delta Decalactone EU Natural, Chiral
FEMA2401 Delta Dodecalactone EU Natural, Chiral
FEMA2796 Gamma Octalactone EU Natural, Chiral
FEMA2400 Gamma Dodecalactone EU Natural, Chiral
FEMA3590 Delta Tetradecanlactone EU Natural, Chiral (New)

FEMA3163 2-Acetyl Furan EU Natural
FEMA2702 5-Methyl Furfural EU Natural
FEMA3202 2-Acetyl Pyrrole EU Natural (New)
FEMA3251 2-Acetyl Pyridine EU Natural (New)
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