

The Rise of AI in the Flavors & Fragrances Industry

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Industry Analysis · Artificial Intelligence · Sensory Science

The flavors and fragrances (F&F) industry, valued at over \$35 billion globally and growing steadily, has long relied on the artistry of human perfumers and flavorists. These experts blend ingredients based on intuition, experience, and sensory evaluation to create tastes for foods and beverages, as well as scents for perfumes, cosmetics, and household products. However, the integration of artificial intelligence (AI) is revolutionizing this field, accelerating innovation, reducing development time, and enabling unprecedented personalization.

AI tools analyze vast datasets of molecular structures, sensory profiles, and consumer preferences to predict outcomes, generate novel formulations, and digitize sensory experiences. This shift not only streamlines R&D but also addresses sustainability challenges by optimizing ingredient use and minimizing waste. From predictive modeling to generative AI, companies are deploying these technologies to stay competitive in a market driven by consumer demand for unique, eco-friendly, and tailored products.

AI-Driven Fragrance Formulation: From Concept to Creation

One of the most exciting applications of AI in fragrances is in formulation, where algorithms suggest ingredient combinations that might take humans months to discover. **Givaudan**, a Swiss leader in F&F, launched **Carto** in 2019 — an AI-powered tool that uses an "Odour Value Map" to maximize olfactory performance by intelligently blending ingredients. Carto has been used in high-profile launches, such as Tom Ford Beauty's Bois Pacifique, where it helped align ingredients with creative briefs for efficient prototyping. Similarly, Givaudan's VivaScentz technology curates fragrances across categories like personal care and fine perfumery, leveraging AI for rapid development.

Symrise, a German F&F producer, collaborated with IBM Research to create **Philyra**, an AI system that designs perfumes by analyzing thousands of formulas and raw materials. Philyra made history by contributing to two fragrances for Brazilian cosmetics company O Boticário in 2019, marking one of the first commercial AI-

designed scents. Symrise's Symvision AI further accelerates innovation by mitigating risks in lengthy product cycles, allowing for faster market entry.

dsm-firmenich (formed from the merger of DSM and Firmenich) offers *Scentmate*, an AI-driven platform that transforms client ideas into custom fragrances by mining data on preferences, age, location, and gender. This tool predicts consumer appeal with high accuracy, enabling small brands to compete with larger ones.

International Flavors & Fragrances (IFF) recently introduced *Scent Chat*, which employs semantic AI and natural language processing to guide scent development based on textual descriptions and insights.

In Latin America, food-tech company NotCo partnered with Cramer to launch a Generative AI Fragrance Formulator in 2024. Powered by NotCo's Giuseppe AI, it draws from tens of thousands of formulations to create premium scents in seconds, extending their earlier work in flavors to fragrances.

Revolutionizing Flavors with AI: Plant-Based and Beyond

AI's impact extends to flavors, particularly in the booming plant-based food sector. **dsm-firmenich** pioneered the world's first AI-created flavor in 2019 — a lightly grilled beef taste for meat alternatives — using algorithms to analyze and augment creativity. The company continues to test AI flavors in citrus and other categories, pushing boundaries in "Augmented Creativity."

NotCo, known for plant-based alternatives, developed a foundational generative AI model for flavors, optimizing products to mimic animal-based equivalents. Their Flavor Formulator, now complemented by the fragrance tool, helps bridge sensory gaps in vegan foods.

Bell Flavors and Fragrances uses AI for marketing and development in the food industry, creating custom tastes that enhance campaigns and products. These tools reduce trial-and-error, cutting costs and time while promoting sustainability through precise ingredient predictions.

Personalization and Sensory Digitization: The Human-AI Synergy

AI excels in personalization by linking scents and flavors to individual preferences. **L'Oréal** and **Estée Lauder** employ AI to analyze neurological responses (via EEG) to fragrances, recommending "neuroscents" that evoke similar emotional reactions. This neurotechnology interprets brain signals to match scents with moods, as seen in Yves Saint Laurent's AI-driven personalization.

Osmo's Generation platform uses "Olfactory Intelligence" (OI) to create fragrances for niche markets, drawing from AI-analyzed odor maps. **Scentronix's** Algorithmic Perfumery similarly crafts bespoke scents using machine learning.

SPOTLIGHT: MAMAY Technologies' Organoleptic Digitizer 1.0

A patent-pending tool that quantifies taste, odor, and feel sensations using AI algorithms. Based on compound concentrations, physical structures, and the proprietary Val® scale, it digitally maps organoleptic profiles for over 6,000 compounds. In analyzing a "Feminine Composition Fragrance for Toiletries" (inspired by a Givaudan patent), the tool generated a detailed breakdown of odor impacts: floral (2.22 val®), sweet (1.19 val®), green (0.77 val®), woody (0.76 val®), totaling 9.98 val® in overall impact. Ingredients like Hedione (21.66 µg/m³) and Bergamot oil (9.23 µg/m³) were evaluated for their contributions. Features include Ping for quick profile reports, a Simulator for predicting changes, and an APP for consumer personalization.

Challenges and Future Prospects

While AI enhances efficiency, it complements rather than replaces human expertise — perfumers still refine AI suggestions for artistic nuance. Ethical concerns include data privacy in personalization and ensuring AI doesn't homogenize creativity. Sustainability benefits, however, are clear: AI minimizes resource use by predicting viable formulas early.

Looking ahead, as generative AI evolves, we may see fully AI-orchestrated F&F lines tailored to real-time trends or individual biometrics. With startups like MAMAY and giants like Givaudan leading, the industry is poised for a sensory revolution where technology unlocks the "power of smell" in ways once unimaginable. By blending science, data, and artistry, AI is not just creating scents and tastes — it's redefining how we experience them.

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