



SYMRISE

Challenge

Improve the complex fermentation process for product development in fragrance, flavor, natural nutrition and cosmetic ingredients solutions.

A scientist's guide to taste-testing

Fermentation specialists at Symrise use statistically driven experimentation methods to perfect product development in the fragrance and flavor industry

The world of scents and tastes is a huge, invisible part of modern-day life. Globally, consumers interact with flavors and fragrances between 20 and 30 times a day, from the familiar mint of toothpaste in the morning to a favorite soft drink in the breakroom to the chicken-and-rice flavored pet food in the dog's bowl at night. As taste perceptions change, the race is on to develop new, more sophisticated product flavor profiles combined with additional advantages for the consumer.

Since 1874, Holzminden, Germany-based Symrise AG has been manufacturing taste and smell. The original founders of Haarman & Reimer (later Symrise following a 2003 merger with Dragoco), were the first to discover a means to synthesize the aromatic flavoring vanillin. In 1973, they were the first to develop and manufacture a synthetic menthol. Today, Symrise commands 11% of the global taste and smell market with its creations appearing in over 30,000 products and more than 100 countries.

Since the early days of vanillin and menthol, a lot has changed. There is a constant pressure to keep innovating, not only by creating new flavors and smells, but also by perfecting formulas to make products more sustainable. Symrise products start their life from a palette of 10,000 raw materials in a range of ever-changing formulations. In 2017, the company filed 42 new patent applications and invested €196 million in research and development.

Making the world taste good

Fragrance and flavor development can be challenging because of the complex nature of the manufacturing process. For each product, there might be several natural ingredients with a plethora of variables all acting together – and interacting – at any given time. Moreover, each ingredient and resulting product will need to be tested and measured for efficacy, safety and other factors.

Product developers often use a design of experiments approach to test products and properly uncover how factors jointly affect responses. "In fermentation, there are several different probes and measurements online and at-line over time which are important, because [the process] reflects more or less the behavior of the organism interacting with its environment," explains Egon Gross, a Master Technologist with Symrise. "It's a complicated issue, because a certain application of flavors or combination of flavors applied to different carriers may evolve [differently] over time."

In a world of constant creation, it's important for new scents and flavors to be developed and tested quickly to ensure they reach the market swiftly. It's equally important for experiments to be easily replicable, both in scale and in formulation. Using a design of experiments approach means Gross and his team can tweak and rework formulas easily, replicating what is good and changing what needs to evolve.

For design of experiments, a superior software

Design of experiments (DOE) is a ubiquitous, practical approach for exploring multifactor opportunity spaces. For Gross, JMP® was the only software offering the statistical solutions and visualization tools that suited the demands of this method. "Even if you use design of experiments and stick to all the parameter settings, sometimes the chain can be broken," he says. "It can be due to a lack of intendancy or even because, for example, something during the path of analyzing the samples goes

JMP is absolutely invaluable if you want to see what's going on within the data. We can learn from the data already available to visualize an outcome that works both in theory and in practice.

Egon Gross, Master Technologist



wrong." A software like JMP that presents every conceivable tool for DOE – and excels at creating interactive visualizations – is a requirement in this field, Gross says.

The ability to manipulate visuals in real time is especially important in formulation work where ingredients must be tweaked on a very small scale. The DOE functionality in JMP allows Gross to visualize the design space. "If I raise the concentration of one ingredient, I'll have to lower the other ones," he says. "If you measure it out from a development standpoint, you are sometimes able to eliminate the confounding nature of components in a formulation – you can increase or decrease the ingredients independently. I tend to look at [my ingredients] independently, having different advantages; working in a model, changing the number of experiments.

"With JMP, you are able to look at the same variables, not only as a category, but also as a continuous variable. You have a complete view of the design space available. It means even less work."

Another advantage to this approach is the flexibility to manipulate the settings and react to outcomes that diverge from expectations. "It's sometimes not possible to use all the settings you thought would be necessary in an experiment," Gross says. "But still the outcome might be valuable. I don't throw these experiments away; I just get the information about what went wrong and look at the curves in JMP. If something goes wrong [with the production process], I have to ask whether it affects the outcome. It's critical to know when to draw the line and move on."

Efficiencies lead to shorter production cycles

For Symrise, Gross contends, JMP has been something of a revelation. The software, he says, enables research and development experts to make decisions based on data that might not otherwise have been possible. This efficiency has helped the company optimize production overall by extracting more impactful information from the data in far less time.

"JMP is absolutely invaluable if you want to see what's going on within the data," he adds. "We can learn from the data already available to visualize an outcome that works both in theory and in practice."

Using JMP means Gross and his team are able to shorten the product development cycle, arriving at the right product formulation earlier and taking finalized products to market faster. Furthermore, the time saved has allowed his team to expand their projects and the remit of the work that they do. "The output within the department increased while the headcount stayed constant," he says.

Taking JMP® further

Once he upgraded to JMP Pro, Gross says he found all new potential in features like the Functional Data Explorer. "I have this kind of spectral data – there are curves containing some meaningful information, but you have to find that information before you can use it. I can speed up analytical times, processes and development times [now thanks to JMP Pro]. My plan is to soon dig deeper into the Functional Data Explorer to really use it as an additional information source to distinguish which direction is the best to continue exploring."

JMP has become such a vital part of Gross' work that he has been instrumental in rolling out training so that other scientists in the company might take full advantage. "I was only the second person at Symrise to use JMP, but now I clearly know the benefits of it. That's why I'm trying to push JMP further within the company," he says. "It's really nice to see how others approach problems, even problems in other fields of interest, with more or less the same optimization strategy: reducing time to market or boosting the speed of experiments. And it's really inspiring to see that you can always dig deeper yet into JMP."

Solution

Use design of experiments in JMP® Pro to develop a system that records results in a complex chain to identify potential breaks and failures and to account for them in future formulations.

Results

A more efficient and reliable fermentation process means the development cycle for new products can be shortened, enabling Symrise to bring new flavors and fragrances to market faster.

To contact your local JMP office, please visit: jmp.com/offices



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