Customer Story

Challenge

To produce everyday products that are cost-effective, meet industry standards and are easy on the environment.

A green process grows more efficient

Design of experiments in JMP® provides Novomer with a structure for optimization

Novomer, a Massachusetts-based sustainable chemistry company, is pioneering a family of high-performance, environmentally responsible polymers and chemical intermediates. The company takes carbon dioxide – a primary source of the greenhouse effect – and incorporates it into a variety of products, including plastic bottles and packages and coatings for metals used in storm windows, storm doors, garage doors, metal roofs – any sort of coating that requires good weathering properties. And Novomer is doing this cost-effectively.

Developing applications that are both sustainable and competitively priced

In many cases, Novomer's products contain large amounts of carbon dioxide, meaning that significantly less petroleum is required in their manufacture than for traditional polymers. "Some of the materials that we make are more than 40 percent carbon dioxide," says Scott Allen, Novomer's co-founder and Vice President of Catalyst Development.

Novomer is commercializing a catalyst technology that makes it possible to manufacture products with less petroleum and put CO_2 to good use, rather than emitting it into the atmosphere or storing it underground. And JMP has played an important role in this effort.

"With the limited resources that we have – we have only about a dozen chemists, and we're trying to push forward multiple product efforts – JMP has helped us screen different reaction conditions in a very logical way to give us a starting point for optimization," Allen says. "If we didn't have a very deliberate, structured way of doing that, these new application-development efforts would really suffer." Instead, Novomer continues to make significant strides in developing environmentally friendly applications that meet or surpass industry standards, and that are competitively priced.

As Novomer CEO Jim Mahoney told The Boston Globe, "When we talk to customers, environmental aspects are very important. But it has to come in at a competitive price." An efficient design process is essential to realizing that objective.

Design of experiments helps guide research priorities

The catalyst technology that Novomer employs was developed at Cornell University. "The original thesis was that carbon dioxide and carbon monoxide were both very inexpensive," Allen says.

Allen's job is to determine the optimal use of the catalyst technology for each application, overseeing the process development required to generate useful materials. "The partners we work with have certain materials that must go into their existing processes or formulations," Allen says, "and generally we don't know if our system can accommodate those types of materials. So it's my responsibility to

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>
> Scott Allen
> Co-Founder and Vice President of Catalyst Development at Novomer

fine-tune our technology to make it useful to them – whether it's a different molecular weight, a different composition or formulation. I translate our capabilities into what their requirements are."

Allen has been using JMP for only about a year and a half, but quickly became a devotee after he heard about it from Ron Valente, Vice President of R&D. "I suggested running some design of experiments with JMP to speed up the way we were examining the critical factors in our reaction," says Valente, who has extensive JMP experience and was heading up process development at the time. During his 20 years working at another company, Valente saw that JMP was key to success in chemical process development there.

"It was clear that the Novomer team would also benefit from the power that JMP software offered. Design of experiments methodology would streamline our process understanding, increase our ability to reproduce our process and help to guide our research priorities. Plus, the technical support was exceptional and was a factor in the decision to select JMP," Valente explains.

An objective look at second-generation designs

Novomer was introducing a second-generation catalyst that was fundamentally different from the previous one, and Allen and his team wanted to understand it without bias from that first-gen iteration. "We knew what the optimal conditions were for the first-generation system, and we didn't want to carry those over into our second generation. We wanted to look at about 12 different factors. Using traditional screening designs, that would be a lot of experiments," he says.

Allen's team was able to see a number of interactions that they subsequently validated. "We saw some responses that if we had gone in with a bias from our first-generation catalyst, we probably wouldn't have considered, and that was really nice. That's the baseline for all of our future work."

Allen now uses JMP for other data analysis – using control charts, for example, to determine whether a reaction is statistically within a range of responses. But, he acknowledges, "I'm sure we're only using about 2 percent of the power of JMP."

Allen recognizes the role JMP has played in moving Novomer's technology forward: "With JMP, you're able to see interactions or effects that you might not have anticipated were significant early on." In general, Allen appreciates the confidence JMP instills in the experimental process – and the ability to explore reaction conditions that wouldn't be considered if it were necessary to vary one factor at a time.

Solution

Novomer uses JMP for design of experiments to streamline the development of its proprietary catalyst technology.

Results

Novomer is making significant strides in putting carbon emissions to productive use, preventing them from escaping into the atmosphere and saving on the expense of storing them underground.

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