



New Genomatica Chemical Process Targets Ailing Ethanol Assets

First-ever bio-manufacturing process to produce methyl ethyl ketone from renewable feedstocks proven in rapid order

SAN DIEGO, Feb. 25, 2009 – Researchers at Genomatica Inc., a sustainable chemical company, have developed a bio-manufacturing process for methyl ethyl ketone (MEK), a commonly used industrial solvent with a global market valued at more than \$2 billion. The rapid development breakthrough demonstrates that Genomatica’s technology can repeatedly target specific chemicals that previously could only be produced from petroleum-based feedstocks. Genomatica’s research proves these chemicals can be manufactured inside organisms using renewable feedstocks.

In the second half of 2008, on the heels of its first breakthrough, 1,4-Butanediol ([BDO](#)), Genomatica targeted MEK and began development. By extensively leveraging unique capabilities of Genomatica’s technology platform, researchers have successfully created the first organism known to bio-manufacture MEK from sugar in the laboratory. The process converts sugar and water into this valuable chemical, most prominently used as a solvent in paints and coatings for furniture.

Genomatica executives selected MEK because it can be produced in existing ethanol manufacturing facilities left idle by a recent market contraction. Because of a recent downturn in demand for corn ethanol, many small- and mid-sized manufacturing facilities have been forced to cut production or shut down. These facilities are also facing serious concerns regarding the long-term competitive outlook for profitable ethanol production. To make better use of those investments, Genomatica developed a sustainable chemical process that would use the same equipment, temperatures and processes. With minimal additional investment, plants will be able to produce a chemical valued at significantly higher prices than ethanol.

“Shortly after our first chemical breakthrough, we envisioned the profile of an ideal chemical for the current economic environment. The Genomatica engineering team immediately determined that MEK fit the profile, and set to work,” said Christopher Gann, chief executive officer of Genomatica. “I am confident in our technology, but was still surprised and pleased when they produced the proof-of-concept so quickly.”

The Manufacturing Opportunity

Genomatica targeted MEK for development because it presented a unique opportunity to use existing facilities designed for corn ethanol manufacturing. The Renewable Fuels Association has estimated that 10 or more companies have shut down 24 ethanol plants



over the last three months. This represents about 15 percent of the country's ethanol production.

"We have invested in several commodity processing plants and clean energy development projects, but we are facing a difficult economic and regulatory environment," said David Kolsrud, ethanol producer and president of DAK Renewable Energy. "Many ethanol producers will be keenly interested in a process that would give new options for a strong return on investment and sustainable job growth for the community."

Small- to mid-sized ethanol producers are a particularly good fit for the manufacturing opportunity offered by Genomatica's breakthrough. As the industry adjusts to changes in demand, smaller farmer-owned or -operated plants will face unique challenges. While larger operations can restructure to lower costs or access capital for upgrades, smaller producers face a more uncertain future. As Genomatica refines the process for MEK and develops other chemicals to use existing ethanol infrastructure, it can offer additional product options to small producers.

MEK will offer existing plants the opportunity to transform their production from lower-value corn ethanol to higher-value chemical production.

"Using existing infrastructure like ethanol plants will allow the end-chemical customer to drive down the cost of their initial investment in sustainable chemical manufacturing," said Gann. "Most chemical producers and consumers are looking very closely at capital costs so they are eager to use existing manufacturing assets more fully."

The Genomatica Technology Advantage

Genomatica's technology portfolio consists of proprietary computational modeling, "wet lab" microbe modification and specialized process engineering. With computational modeling, Genomatica's researchers examine all possible biological pathways to create target chemicals from various low-cost, renewable feedstocks. In this case, they explored all plausible paths from glucose and sucrose to MEK, and selected the optimal version. Researchers then used the computer models to design the ideal microbe and made all the modifications necessary to turn this design into reality.

Armed with the "blueprint," researchers create microorganisms through traditional genetic modification. In the case of MEK, this resulted in a microbe able to produce significant amounts of MEK in a matter of only a few months. Combined with Genomatica's understanding of biological adaptation, they can develop organisms that thrive under adverse conditions while further increasing their production of the desired



chemical product. With deep experience from the traditional chemical industry, Genomatica then designs the complete process to produce the chemical and drives costly inefficiencies from every stage of the process, from raw material preparation and fermentation to separation and purification.

“With this second breakthrough, Genomatica has proven an important component of the technology: to predict and then rapidly build an organism that produces the target product,” said Jay Keasling, professor of chemical engineering and bioengineering at the University of California, Berkeley, and chief executive officer of the Joint BioEnergy Institute. “So much of what we do in biotechnology is trial and error, but this represents a unique step in the industry.”

The MEK Market

About 400 million pounds of MEK are bought and sold in the United States each year, and approximately 100 million pounds are imported from overseas. Worldwide installed capacity for manufacturing is just less than 3 billion pounds per year, and the market is broadly valued at \$2 billion per year. MEK is a solvent used in coatings and paint, also known as butanone. MEK also acts as a processing tool for synthetic rubber and polyester resin products.

Because it is expected to be cost-advantaged against traditional manufacturing techniques for MEK, with a low-capital outlay, Genomatica’s process could allow for additional domestic production capacity of MEK to reduce imports that are derived from fossil fuels. As with Genomatica’s previously announced BDO product, the company will continue to refine and develop the process to increase the cost advantage and efficiency. Genomatica will offer a licensing model to allow other manufacturers to directly produce MEK from the process.

Continued Progress with 1,4 Butanediol

In September 2008, Genomatica announced a novel bio-manufacturing process for the production of 1,4-butanediol (BDO) from renewable feedstocks – sugar and water. Since that announcement, the company has continued to improve the process, making it more cost effective and productive.

The current strain of microbe has been improved to tolerate and continue production in a 10 percent solution of BDO. In typical bio-manufacturing processes, microbes become less effective in higher concentration solutions. Because of Genomatica’s unique adaptive evolution method, the organism’s growth and survival has instead been linked to higher production of BDO. The company is now developing the process engineering plans for a demonstration plant to bio-manufacture BDO; Genomatica expects to initiate construction of the plant later this year.



About Genomatica

Genomatica is a sustainable chemicals company revolutionizing the chemical industry with groundbreaking technologies that sustainably transform chemical production processes through bio-manufacturing. Founded in 2000 by research scientists from the University of California at San Diego, Genomatica develops a broad range of biologically produced industrial chemicals from a variety of renewable feedstocks at a fraction of the cost.

A privately held company, Genomatica is backed by top Silicon Valley venture capital firms Mohr Davidow Ventures, Alloy Ventures and Draper Fisher Jurvetson. Genomatica is based in San Diego.

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