



Genomatica Produces Pure BDO From Natural Sugars

*With downstream processing techniques proven cost-effective,
Genomatica looks to develop demonstration plant*

SAN DIEGO, June 2, 2009 – Genomatica, a sustainable chemicals company, announced today that the company's engineering team has achieved an important milestone toward the production of commercial grade 1,4-butanediol (BDO) from renewable feedstocks using Genomatica's novel bioprocess. The company has demonstrated that it can process BDO produced from sugar to greater than 99 percent purity using a proprietary and cost-effective recovery process. The achievement clears the way for development of a demonstration facility to begin operating next year.

The new process begins with producing BDO in fermentation broths generated by microbes engineered to directly produce BDO from sugars, and uses process designs and equipment compatible with large-scale chemical production. The purification achievement proves the feasibility of critical downstream process engineering elements of Genomatica's manufacturing method for renewable BDO. Fully integrated, the process will offer Genomatica's partners a competitive advantage relative to producers that today generate BDO entirely from fossil fuels.

"The first 100-percent renewably sourced and purified BDO – it's a powerful sight that symbolizes the transformation that is possible for our industry," said Christophe Schilling, chief executive officer of Genomatica. "With a cost advantage over traditional manufacturing processes, our bio-manufacturing method for BDO will release chemical producers from the fluctuations of the hydrocarbon markets and lower their overall carbon footprint, while meeting the growing demand for sustainably manufactured products,"

When Genomatica began development of this breakthrough bio-manufacturing process, the company set three key laboratory-scale development milestones to commercialize the process: first, to show that its organisms can directly produce BDO in a fermentation broth from sugars; next, to show that the yield and rate of BDO production and concentration can reach levels consistent with commercial goals; and finally, to show that BDO can be purified from the fermentation broth using a cost-effective and scalable process. Since the successful production of BDO was first announced [last September](#), the company has been consistently executing against all three milestones.

Genomatica first produced BDO from glucose in February 2008, and has since demonstrated the ability to produce BDO at high levels from sucrose as well as from xylose, a five-carbon sugar. Development is primarily focused on sucrose because it is a readily available feedstock with a tradable forward market and with less pricing volatility compared to hydrocarbon



feedstocks currently in use to make BDO. The ability to produce BDO from both six- and five-carbon sugars now opens the way to possible second-generation BDO processes that use carbohydrates derived from lignocellulosic biomass, such as wood residue, municipal paper waste, agricultural waste or energy crops like switchgrass.

At the same time, company researchers have demonstrated 20,000-fold increases in the concentrations of BDO that microbes can produce, approaching the commercial levels needed to manufacture large volumes of BDO at reduced cost. Concurrently, the company created strains of the bacteria that are tolerant of the commercial target concentrations.

With today's announcement, the company has shown the ability to produce purified BDO from various sugars, now validating the feasibility of all of the major unit operations in the lab, and setting the stage for a demonstration plant facility. The company will now focus on scaling up to begin operations at a demonstration plant in 2010.

"By proving the process engineering operations, Genomatica now offers the complete package," said Matt Tirrell, dean of engineering at the University of California, Santa Barbara, and a member of Genomatica's Engineering Advisory Council. "The integration of fermentation and purification processes is vital to chemical manufacturers and an important step in Genomatica's development."

The generation of purified BDO will allow Genomatica's bio-manufacturing process to compete against petroleum-based equivalents and offer a cost advantage to producers. Many chemical producers are facing unprecedented business challenges as the global economic slowdown depresses demand, and the credit crisis hampers their ability to finance large-scale projects. Fluctuating natural gas prices and possible changes in environmental and climate regulation have added to the uncertainty for petrochemical producers.

The Genomatica Technology Advantage

Genomatica researchers were able to delicately refine the design of the process because of the integrated components that the company has developed. Genomatica's technology portfolio consists of proprietary best-in-class computational modeling, "wet lab" microbe modification and specialized chemical process engineering. The unique combination of all three elements allows for the creation of breakthrough bioprocesses to produce chemicals through faster and more integrated product development.

With proprietary computational modeling, Genomatica's researchers examine all possible biological pathways to create target chemicals from various low-cost, renewable feedstocks. In this case, they also used modeling and simulation to examine the by-products produced in earlier versions of the BDO manufacturing process, and determined exactly how to eliminate



those by-products. This channels more sugar to make BDO. Armed with the “blueprint,” Genomatica researchers then updated the microorganisms using a range of different state-of-the-art genetic techniques to increase titers and reduce by-products. With significantly reduced by-products and using expertise from the traditional chemical industry, Genomatica’s process engineers designed a novel combination of steps to separate and purify the BDO, obtaining high-purity samples. With this, Genomatica now has validated the entire sustainable BDO process from start to finish.

Genomatica is now refining the complete process to improve the cost-efficiency of every step of the process, from raw material preparation and fermentation to separation and purification. When the demonstration plant validation is complete, Genomatica will then commercialize the process with partners through licensing or other means. This allows the company to advance other sustainable chemical products in its growing pipeline.

About Genomatica

Genomatica is a sustainable chemicals company enabling transformation of the chemical industry together with its commercial partners. The company develops groundbreaking biomanufacturing processes to sustainably produce a variety of industrial chemicals that impact all major industries and provide the materials that comprise the world we live in. The company enables the production of sustainable chemicals through a compelling proprietary platform that fundamentally transforms the way in which natural processes can be used to convert low cost, renewable feedstocks into higher-value chemicals. Founded in 2000 by research scientists and engineers from the University of California, 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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