



SUSTAINABILITY

Genomatica Partnership Spree Accrues Chemical Industry Heavyweights

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Genomatica, a San Diego-based developer of sustainable chemicals, including a biobased 1,4-butanediol, has gained tremendous momentum in 2011, having announced partnerships with major chemical producers [Mitsubishi Chemical](#), [Tate & Lyle](#) (T&L), and [Mossi & Ghisolfi Group](#) (M&G; Tortona, Italy), plus an agreement with Waste Management.

“In Mitsubishi Chemical we’ve got one of the largest BDO producers in the world, and M&G has best-in-class cellulosic biomass treatment technology to develop a biomass-to-BDO process,” says Genomatica CEO and founder Christophe Schilling. “And in Tate & Lyle we have proven scale-up success, given their experience moving to a 100 million pound bio-propanediol plant, directly from demonstration scale, in a joint venture with DuPont”. “The quality and scope of our partnerships validates our BDO technology and the potential to have a broad impact in a very large market,” Schilling adds.

The memorandum of understanding with Mitsubishi, signed in April, includes a joint venture and a commercial-scale biobased BDO plant “significantly larger” than those being announced in recent months for other biobased chemicals such as succinic acid, Schilling says.

The partnership is a landmark deal in the biochemicals market, given Mitsubishi’s position in the BDO market and commitment to biochemicals, Schilling says. It is among the top five BDO producers globally, using much of its output internally to produce products such as polybutylene terephthalate (PBT) and polytetramethylene ether glycol (PTMEG). The company has also established a JV with PTT (Bangkok) for the production of polybutylene succinate (PBS), a 100% biodegradable plastic made from succinic acid and BDO.

“Mitsubishi has been forward-looking for many years, and recently been more public about their activities in sustainable chemicals,” Schilling says. “There’s a segment of Mitsubishi focused on biobased

polymers they are developing. At the same time they are very focused on replacing a significant portion of their feedstock with renewables.”

Mitsubishi was among the investors in Genomatica’s [recent \\$45 million funding round](#), and has expressed interest in other technologies within its portfolio. Genomatica’s IP covers 25 or more large-volume intermediate and basic chemicals, and the company has been doing work to advance a couple of key processes in the pipeline. The company is not disclosing any target chemicals beyond BDO, but Schilling says they will be revealed in the near future. The common thread, according to Schilling, is that Genomatica targets high-volume, intermediate and basic chemicals – all of which have existing markets in the billions to scores of billions of pounds. By making these same chemicals more sustainably, Genomatica’s drop-in replacements can green entire material and product value chains at the source.

Meanwhile, biobased succinic acid has been getting a [good deal of attention](#) in recent months given commercial-scale project announcements from BioAmber, DSM, and Myriant. But Schilling sees biobased BDO as a more attractive market opportunity. “One of the biggest differences between succinic acid and BDO is the size of the market,” he says. “Succinic acid is one-tenth the size of the BDO market, at best.”

Though it can be used to make BDO and polymers, or as a replacement for adipic acid and phthalates, succinic acid is a modest 25,000-35,000 m.t./year market. The high cost of petroleum-based routes has precluded many large volume applications, and the existing merchant market consists of certain pigments, solvents, and detergents. Biobased routes have pushed down the cost of making succinic acid, and recently announced projects will more than double global capacity over the next two-three years.

The global market for BDO, which is used to make products such as spandex and automotive plastics, is enormous by comparison, at about \$4 billion and 1.4 million m.t./year. “[Bio-BDO] is a whole other world,” Schilling says. “We’re talking about a large volume commodity chemical, as opposed to a new chemical that goes into a new polymer where you have to build a market over time. And anyone in the chemical industry knows that’s a long road to travel.”

Genomatica will also move forward on commercial-scale units in North America and Europe. It recently signed a joint development deal with biochemical scale-up veteran T&L to upgrade a fermentation and downstream processing unit at T&L’s Decatur, IL facility. The demonstration-scale facility will use 13,000-liter fermentation tanks and use feedstock from T&L’s adjacent corn wet mill. Genomatica has said it plans to have a North American commercial-scale plant in operation by 2014, and Schilling expects that project and the plant with Mitsubishi will be built, to a certain extent, in parallel. Discussions are also moving forward on a potential plant in Europe.

All projects will be built with a partner, Schilling adds. “Companies are engaging us because they know that this technology is going to deliver the best economics,” he says. “Big chemical companies want ways to make the same product they make now. In some cases they will take a risk on a new polymer, but they understand that it’s going to take decades to build those markets.”

NatureWorks, for example, brought a 140,000 m.t./year polylactic acid (PLA)-based polymer plant online in 2002, and recently told CW it expects to sell out in 2013-2014. Genomatica, however, avoids the long market development timeline by focusing exclusively on developing lower-cost, biobased routes to chemicals with established, large-volume markets.

Genomatica is also working with M&G to develop a process for BDO production from second generation cellulosic feedstocks. The agreement gives Genomatica exclusive rights to M&G's Proesa technology for cellulosic biomass conversion to fermentable sugars for BDO production. Genomatica will produce Bio-BDO from biomass-derived sugars in a demonstration-scale unit set to come online in the first half of 2012 at M&G's Rivalta, Italy facility. M&G's Chemtex engineering unit will then design and construct Genomatica's commercial bio-based chemical plants, both for first- and second-generation feedstocks.

M&G, a leader in second-generation technology, is currently building the world's first commercial-scale cellulosic ethanol plant at Crescentino, Italy.

Genomatica is looking even further than second-generation sources to producing chemicals from landfill-derived syngas. The company [partnered with Waste Management](#) (Houston) in February and agreed to engineer organisms and manufacturing processes to efficiently convert syngas into chemicals. Waste Management, which produces syngas through anaerobic digestion, gasification, and landfill gas, says the deal will help it maximize the value of its materials.

While several companies are looking for opportunities to convert waste gases into value-added materials—notably [LanzaTech's](#) (Auckland, New Zealand) efforts to commercialize a 2,3-butanediol process that uses steel mill flue gas—Genomatica may be unique in its efforts to develop syngas conversion technology in addition to first- and second-generation processes.