Bio-based routes to C4s move ahead

Genomatica has signed technology deals for bio-based butanediol and butadiene with BASF and Versalis in recent months, progressing the commercialisation of its offering

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Development of alternative routes to C4-based chemicals continues to progress at US-based technology specialist Genomatica, which focuses on delivering new bio-based manufacturing processes based on renewable feedstocks. It has targeted 1,4-butanediol (BDO) and butadiene (BD) as its two lead products, both of which are being impacted by the shift to cracking lighter feedstocks in the US and around the world.

Last month, its BDO development received a resounding endorsement, with chemical major BASF signing a licence with Genomatica to use its technology in a new worldscale plant of around 50,000 tonnes/year capacity. This represents a considerable scale up from even the current 5m lb (2,000 tonnes) in five weeks level achieved by Genomatica in late 2012, and the planned capacity for Novamont’s converted facility in Italy of 20,000 tonnes/year.

The BASF deal, says Genomatica CEO Christophe Schilling, “highlights Genomatica’s commitment to delivering innovative process technologies to the global chemical industry.” BASF will license the one-step fermentation process based on crop-derived sugars and build a production facility at an as-yet undisclosed location. Material will be ready for sampling and trials in the second half of this year, says BASF.

BDO EXPANSIONS

The German major will offer the renewable BDO “to create additional value for its customers” in the plastics, textile and automotive industries. It currently produces BDO at sites in Germany, the US, Japan and Malaysia, and has an overall capacity of 535,000 tonnes/ year. It is also planning to build a conventional BDO unit in China, to add a further 100,000 tonnes/year capacity.

Schilling sees the latest development as another step on the BDO journey and an indication that renewable chemicals are being taken up through the chemical industry value chain. That journey began five years ago, he explains, and is now reaching commercial scale. In late 2012, Genomatica used its process to perform 50 consecutive fermentation runs along with continuous downstream processing at the DuPont Tate & Lyle facility in Loudon, Tennessee. All the product was sold and shipped to licensees.

It has also been used successfully to make downstream products by multiple companies. The first to publicly announce specific results and plans was Japanese company Toray which stated that the material can be used successfully to make bio-based polybutylene terephthalate (PBT), a large volume derivative of BDO. Parts moulded in bio-PBT have proved to have the same processing characteristics and performance as those made from conventional BDO.

The first licensor of the technology, Schilling continues, was Novamont, with which Genomatica has formed a joint venture for European bio-BDO production. Novamont is retrofitting a 20,000 tonnes/year plant in Adria, Italy, to make bio-BDO, which it will use for its own internal use for Mater-Bi biopolymer production. Initial production is expected this year. Novamont also has an option to build a second, purpose-built facility at some point.

Schilling says the arrangement, first outlined in mid-2011, is a “good early opportunity to work with a company that will be backward integrating with bio-based feedstocks”.

In a parallel development, Genomatica is also pursuing the manufacture of BD from non-food biomass, and earlier this year signed an agreement with Italy’s Versalis for joint development and licensing of the technology. The two companies, says Schilling, “will work together to develop a complete end-to-end process for on-purpose production of butadiene from non-food biomass.”

The actual feedstocks used, he adds, can vary across geographies and have not yet been disclosed. “The feedstocks will be plant-specific and even vary from region to region”, depending on crop availability and climate. He points out that corn stover waste might be used in the US, energy cane in Brazil and perhaps rice or wheat straw in Italy.

The resulting process will be licensed across Europe, Asia and Africa by a joint venture set up under the agreement. Versalis will itself be the first licensee and will build commercial plants. In an early sign of its commitment, it is providing $20m to fund development work by investing in Genomatica. Schilling says he is very excited by this opportunity. “Butadiene is an exciting space to be in. The industry needs alternative sources of the material and if these are renewable it is even better.”

ROBUST TECHNOLOGY PLATFORM

Genomatica’s basic technology and intellectual property, says Schilling, will also enable other chemical products to be made, using a range of renewable resources. Besides sugar-based fermentation processes, it is developing ways of using biomass and also syngas made from municipal solid wastes.

Schilling is reluctant to specify which chemicals might be the next priorities for Genomatica. There is little doubt, however, that he feels the company’s technology base is a robust one, and one that can compete commercially as well. In fact, he says, with today’s shift to shale gas, there will be even greater reason to develop alternative sources of the higher carbon building blocks. In general, he argues, shale gas will alter the dynamics in the market place and create long-term shortages of C4 chemicals, including BD and BDO.

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