
Versalis and Genomatica produce bio-rubber with bio-butadiene from

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Versalis and Genomatica Produce Bio-Rubber With Bio-Butadiene From Sugars

Breakthrough accomplishments continue progress toward commercial plants

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Versalis (Eni), a European producer in the polymers and elastomers industry, and Genomatica, a leader in bioengineering solutions, announced today that they have successfully advanced to pilot-scale production of bio-butadiene (bio-BDE) from fully renewable feedstock. Versalis used this bio-BDE to make bio-rubber, specifically, bio-polybutadiene (bio-BR). These accomplishments represent a remarkable milestone for the rubber industry, by enabling an improved technological and sustainability footprint; and to the broader industry for butadiene, one of the most widely-used chemicals in the world, with over ten million tons produced per year.



**Versalis has produced bio-based rubber
using bio-butadiene from its joint venture with Genomatica**

The success of this innovative undertaking results from a newly-developed process for the on-purpose production of butadiene which uses various types of sugars as feedstock, rather than the traditional use of hydrocarbon feedstocks. The project started with the establishment of a technology joint venture between Versalis and Genomatica in early 2013. The joint venture – with Versalis having the majority stake – has developed a complete process to make bio-BDE and plans to license the resulting technology.

The joint venture uses the proven and complementary strengths of

both companies. Versalis and Genomatica together determined that 1,3-butanediol (1,3-BDO) was the most suitable intermediate to produce bio-BDE. Genomatica applied its 'whole-process' systems approach to bioengineering to develop a microorganism that produces 1,3-BDO in a way that enables cost-efficient, scalable fermentation, recovery and subsequent process operations. Versalis leverages its industrial process engineering and catalysis capabilities, plus expertise in overall polymer production, to purify the 1,3-BDO, dehydrate it and then purify the resulting butadiene. Versalis has produced several kilograms of butadiene from 1,3-BDO made in 200 liter fermenters at their research centers at Novara and Mantova, and then made bio-polybutadiene, at the Ravenna R&D centre, using both anionic and Ziegler-Natta catalysis.

Initial testing of the bio-BDE and bio-BR demonstrates good compatibility with industry standards. Versalis is continuing to test the bio-BDE within its other proprietary rubber and plastics downstream technologies such as SBR (Styrene-Butadiene Rubber), SBS (Styrene-Butadiene-Styrene Rubber) and ABS (Acrylonitrile Butadiene-Styrene).

The accomplishments demonstrate the common vision of the partners on the potential of this project: access to on-purpose butadiene from renewables will establish a competitive advantage and will ensure a strategic raw material from alternative feedstock, contributing at the same time to drive a greater sustainability profile for downstream applications in the plastics and rubber businesses.

About Versalis

Versalis (Eni) is interfacing with markets through globally-oriented strategies and a market-driven product portfolio. It leads the industry in manufacturing intermediates, polyethylene, styrenics and elastomers and has entered the green chemicals and polymers industry partnering also with worldwide biotech companies. Versalis prides itself on its wide range of proprietary technologies, wide-reaching distribution network and after-sales assistance. As part of its new strategy, the company aims to gain a significant position in fast-growing markets by leveraging its technological and industrial expertise. In Asia, Versalis has entered into partnerships with global petrochemical producers for development of its elastomer division. To learn more, visit www.versalis.eni.com.

About Genomatica

Genomatica is a widely-recognized leader in bioengineering. It develops bio-based process technologies and solutions that enable its partners to produce chemicals a 'better way,' from alternative feedstocks, with better economics and greater sustainability than using conventional feedstocks and processes. Partners include ENI Versalis, Braskem, BASF, Novamont and Cargill.

Genomatica is distinctive in its 'total-solutions' and systems

engineering approach. Its bioengineering platform intimately intertwines and co-optimizes microorganism design, process design and economics. This approach has consistently delivered reliable timelines for bioprocess design and scaleup, high product quality, and economic competitiveness.

Genomatica has earned widespread acclaim for its scientific, engineering and commercialization achievements. Awards include the Kirkpatrick Award, for 'the most noteworthy chemical engineering technology commercialized in the world,' and the 2015 World Economic Forum Technology Pioneer award.

For more info, see www.genomatica.com.

Genomatica Press Office

Rob Adler

415.984.1970 x0104

radler@vantagepr.com

Versalis Company Contacts:

Eni Press Office: Tel. +39.0252031875 – +39.0659822030

Freephone for shareholders (from Italy): 800940924

Freephone for shareholders (from abroad): +39.800 11 22 34 56

Switchboard: +39-0659821

ufficio.stampa@eni.com

segreteriasocietaria.azionisti@eni.com

investor.relations@eni.com

websites: eni.com and versalis.eni.com

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