



Unlocking the potential of biomass through high-performance, heterogeneous catalysts – an introduction to **Alternative Fuel Technologies**

 ALBEMARLE®



Albemarle® develops, manufactures and markets speciality chemicals and services that benefit many of the largest and most respected companies in the world. Our products are essential ingredients in brands that millions of people use every day to make their lives healthier, safer, cleaner and more enjoyable.





With corporate roots that date back to 1887, the Albemarle of today is a progressive global operation, driven by a company-wide commitment to three universal themes:

Solutions: Using our creativity, teamwork, flexibility and enthusiasm to add real business value to our customer relationships

Sustainability: Doing the right things – in every community in which we operate with regard to our employees, the environment and society in general

Chemistry: Continuing to push for innovation in the laboratory, which is essential for developing leading market positions and creating long-lasting customer value



Albemarle alternative fuel technologies

With over 50 years of experience in developing catalysts, Albemarle is leveraging its extensive knowledge of catalysis, catalyst preparation and production in the biofuels arena. With its state-of-the-art equipment for high-throughput experimentation and analysis, Albemarle is poised to develop and commercialize catalytic routes to renewable fuels from non-fossil carbon sources quickly and efficiently.

The heterogeneous catalytic technologies Albemarle and its partners are developing focus on the production of fungible fuels. This means that the products are suitable for mixing at any percentage with traditional fuel types. Albemarle's researchers are aiming to derive all types of fuel from renewable sources, for example, gasoline, diesel, aviation fuel and fuel for stationary power units are being developed. As this work is ongoing, we are also studying current processes for producing fatty acid methyl esters (FAME) and ethanol.





FROM THE EARLIEST CONCEPT IN A CATALYST'S DEVELOPMENT, ITS PRODUCTION, USE, RECYCLING AND DISPOSAL ARE TAKEN INTO CONSIDERATION.

Working with partners or in consortia, we are developing heterogeneous catalysts that are essential for converting biomass into usable transportation fuels. Once a catalyst has proven its suitability for a particular process, we manufacture it for our partners.

During the development of our catalysts, we closely adhere to the principles of green chemistry. The products we develop are based on relatively benign chemistry and chemicals. Most catalytic materials are inorganic and easily recyclable. From the earliest stages of catalyst development, the production, use, recycling and disposal of a product are all considered.



Our new biofuels catalyst portfolio

We offer a wide portfolio of commercial and developmental catalysts that transform different feedstocks into valuable products. A schematic representation of the role of our catalysts is shown in Figure 1.

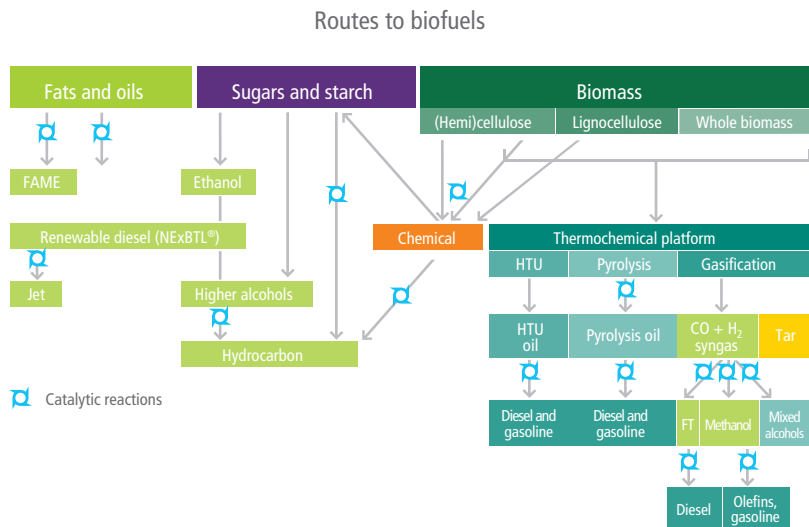


Figure 1. **Routes to biofuels:** The conversion of fats, oils, sugars and starches is well established and has provided the first generation of biofuels. We need, however, to get into a position to process agricultural waste products, loosely described as biomass, which have tougher cellulosic and lignocellulosic structures. Heterogeneous catalysis has an important role to play, not only in opening up the second generation of biofuels but also in improving the first-generation routes.

ALBEMARLE HAS MUCH TO OFFER IN TERMS OF ITS KNOWLEDGE AND UNDERSTANDING OF HETEROGENEOUS CATALYSIS AND, IN PARTICULAR, ITS ABILITY TO RESEARCH, SCREEN, DEVELOP AND RAISE TO COMMERCIAL SCALE THE MANUFACTURE OF NEW CATALYSTS QUICKLY AND EFFICIENTLY.

As Albemarle can customize catalyst grades to your specific needs and requirements, please contact your Albemarle product manager to discuss your particular custom catalyst situation.

Technology platform	Catalyst	Year
NExBTL®	Custom	2007
Transesterification biodiesel	GoBio™ TS-15	2010
Syngas to methanol	GoBio ME-10	2010
Dimethylether catalyst	GoBio DME-1	2007
Fischer–Tropsch	GoBio FT-10, FT-20	2008
Fischer–Tropsch wax upgrading	GoBio DX-20	2008
Pyrolysis oil upgrading	GoBio PO-10	2010
Catalytic flash pyrolysis	Developmental	2010

ALBEMARLE IS INTERESTED IN PURSUING NEW PRODUCT OPPORTUNITIES WITH YOUR COMPANY.

You are welcome to contact your nearest product manager. Please include additional contact details if you would like us to contact you by post or fax.

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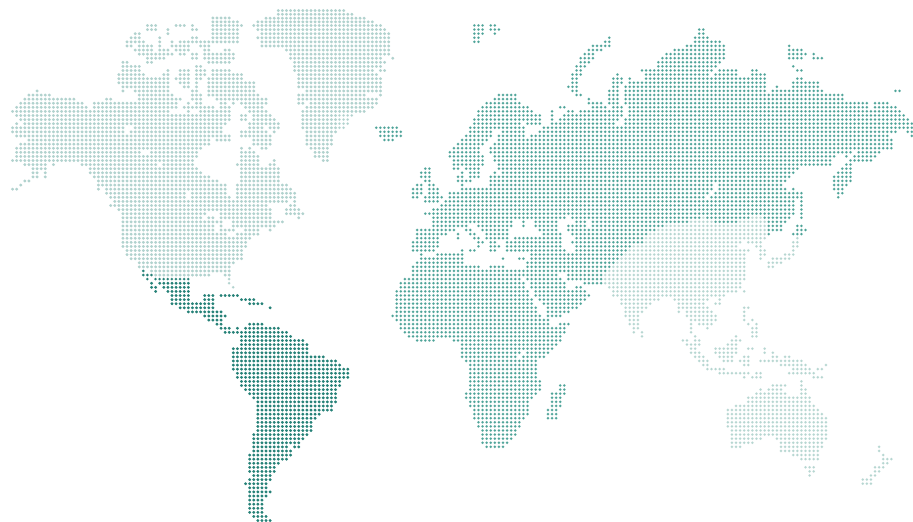
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