An innovative technology is helping the biofuels industry to produce cellulosic ethanol from corn kernel fibre

Improving production efficiency

Since the beginning of its expansion period about 30 years ago, the global biofuels industry has been pursuing cellulosic solutions. While there are now a handful of large biomass-based cellulosic ethanol production facilities in operation around the world, many more companies have tried – and failed – to create an economic cellulosic ethanol process. Most failures have more to do with capital than technology – without a return on capital, even the most elegant technologies will eventually fail.

The leadership team at Edeniq recognised this problem and initially pursued a lower-capital, separate process train solution. After a few years, the California-based company's attention turned to a zero-capital solution: in situ processing of corn kernel fibre. The premise was simple, but innovative – apply years of R&D on cellulosic processes to co-produce cellulosic ethanol from a feedstock already available at every corn ethanol plant.

To achieve success, Edeniq needed to address two key problems: (1) how to adjust a plant's overall production process to get the most benefit from the addition of cellulase enzymes (supplied by a third party) and (2) how to quantify the gallons produced from corn kernel fibre, a challenging analytical exercise that requires obtaining an accurate mass balance for an ethanol plant's fermentation process. Solving these problems required that Edeniq's scientists and engineers work closely with ethanol plant managers and operators, enzyme companies, and representation from various US agencies.

Leading the way

In late 2016, Edeniq's customer Pacific Ethanol registered its Stockton, California ethanol plant for co-production of cellulosic ethanol, the first such submission of its kind. Today, the Stockton plant is one of five US ethanol plants registered by the United States Environmental Protection Agency (EPA) to generate cellulosic ethanol D3 RINs (Renewable Identification Numbers) using Edeniq's Pathway Technology. Historically, D3 RINs have been the most valuable RINs in the marketplace, but D3's – and in particular D3's from cellulosic ethanol – have been exceedingly scarce. As an increasing number of Edeniq's customers complete the EPA registration process, the number of cellulosic ethanol D3's in the market has been rising. Edeniq customers have already generated well over 3 million gallons of cellulosic ethanol. In 2018, Edeniq's existing customer plants have the potential to produce 30 to 40 million gallons of cellulosic ethanol, and new customers could bring that total to 80 million gallons next year alone.

Brian Thome, CEO of Edeniq

Edeniq Pathway continues the trend of innovation coming from within the ethanol industry that has dramatically improved production efficiency and asset value. In addition to process enhancements that have supported yield improvement from 2.70 gallons per bushel to 2.90 gallons per bushel in the last twenty years, the introduction of regenerative thermal oxidation, corn oil extraction, low-energy milling systems, and myriad other technologies have resulted in increased product diversity, lower energy requirements, and a lower carbon footprint by the plants. Like these technologies,

Denmark Antolin, head of Lab Services, and Bowya Lee, laboratory technician, working in the Edeniq lab in Visalia, California

Edeniq's vision is for corn kernel fibre conversion to be become the norm at ethanol plants, enabling every plant to produce more than 3.00 gallons per bushel of corn, a threshold that once seemed impossible. If every plant generated cellulosic ethanol D3 RINs from 2.50% of its production, the total value to the industry would be more than $1 billion (€850,000).

Today, the highest-performing customers using Edeniq Pathway are already generating D3 RINs on more than 2.50% of their production. Ethanol production is a biological process, and even plants with the same production hardware can vary in their results. But, as Edeniq synthesises data and feedback from customer plants, the technology is being tuned to improve performance. Average performance has doubled since 2015, and the current goal is to bring every customer up to at least 2.50% solely through process improvements. Meanwhile, Edeniq's R&D efforts are focused on achieving 3% to 4% from the cellulose in corn kernel fibre and double that when the hemi-cellulosic conversion is incorporated. A corn kernel contains enough cellulose and hemi-cellulose to enable more than 10% of an ethanol plant's production to come from cellulosic sources, but accessing and fermenting all this additional sugar without additional capital expenditures is a major challenge that Edeniq looks forward to solving.

Jim Kacmar, Pathway program director, with laboratory technicians David Zavaleta and Bowya Lee in the Edeniq lab in Visalia, California

After years of broken promises by others in the industry, with production being perpetually "five to ten years away," Edeniq's key innovation was to obviate the problem of capital so that cellulosic ethanol could fulfill its promise of supporting the environment, the consumer, and US national security. The results of using the $20 billion of steel and concrete that is already in the ground? Cellulosic ethanol could be in your tank today. ●

For more information:
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