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Delta BioFuels, Inc.

Industry: Chemical

Delta BioFuels, Inc.
Natchez, Mississippi, USA

deltafuel.com

Foxboro Conductivity Sensing Sparks Automated, Efficient Biodiesel Fuel Processing

"There are a number of ways to detect phase changes, but conductivity sensing is really ideal for this application. A conductivity measurement system is relatively inexpensive, very clean, and maintenance free. Delta BioFuels brought in Schneider Electric to discuss its Foxboro products and we decided these were the solutions we needed."

- Scott Nisula, Chief Technical Officer, Delta BioFuels, Inc.

Natchez, Mississippi — Little did the scientists in the mid-1800s know that their pioneering work in developing biofuels and diesel engines using vegetable and peanut oils would serve as the foundation for today's efforts to combat the world's growing energy demands. By spearheading alternatives to fossil fuels, these 19th century researchers paved the way for the options that we enjoy today to help balance the need for additional energy resources with choices that are sustainable and reduce the impact on the fragile global environment.

Goals

- BioFuels required technology that would improve the delicate process of separating byproducts from the final product at various stages
- Improve technology that would enable frequent and accurate monitoring without interrupting production or jeopardizing worker safety

Challenges

- A solution was required to ensure that the production process of Delta BioFuel's biodiesel would not be interrupted during the fuel separation process
- Sustainable alternative energy sources demand an immediate technology solution that would produce a very pure biodiesel product quickly and efficiently

Solutions

- Foxboro 871 EC Series Electrodeless Conductivity Sensors

Results

- The 871EC sensor enables Delta BioFuels to produce between 80-100 million gallons of biodiesel per year, making it one of the largest biodiesel plants in the country
- Using the 871EC sensor, Delta BioFuels achieved the production goals of its four 20,000-gallon reactors and controls the delicate separation process through accurate conductivity measurements
- By implementing a reliable and accurate process automation system, Delta BioFuels has been able to eliminate human error and enhance overall product quality

The Energy Policy Act of 2005 passed by the U.S. Congress significantly changed the nation's energy strategies by providing tax incentives and loan guarantees for energy production of various types, including the production of biofuels. Biofuel products are made from a variety of feedstocks, primarily soybean oil, vegetable oil and animal fat derivatives. Delta BioFuels, Inc. is a leading private alternative energy company dedicated to producing only the highest-quality biodiesel, meeting or exceeding all industry standards.

The company has achieved best-in-class operations with state-of-the-art equipment coupled with a highly experienced management and technical staff. To complement its state-of-the-art production facility, the company selected Foxboro® technology to monitor the delicate biodiesel production process. Using the Foxboro 871 EC Series Electrodeless Conductivity Sensor enables Delta BioFuels to monitor the critical ongoing viability and purity of biodiesel during production process.

Located directly on the Mississippi River, the company's 60-acre facility can receive its soybean and vegetable oil feedstocks quickly and directly at the production facility. Delta BioFuels can then easily distribute its final biodiesel products by barge, rail or truck, positioning the company to serve any market on a global scale. The Delta BioFuels facility has the capacity to produce between 80-100 million gallons per year, making it one of the largest biodiesel plants in the country.

Demanding Flow Rates

Biodiesel is a safe alternative fuel replacement for traditional petroleum diesel. However, producing biodiesel fuel is a difficult task that requires precise separation at various stages. As an innovative producer of biodiesel fuel, Delta BioFuels overcame this "separation" anxiety by applying conductivity sensing technology.

The Delta Biodiesel plant has four 20,000-gallon reactors and approximately 15 process vessels of various sizes, as well as large field storage tanks used in the delicate separation process. Biodiesel production process is done through a chemical reaction that combines vegetable oil or animal fat as a raw stock, methanol and a catalyst of sodium methylate in proper proportions.

The process, called transesterification, involves chemically converting triglycerides to smaller methyl esters that resemble diesel fuel with extra oxygen atoms that make it oxygenated diesel fuel enabling it to burn cleaner.

“Effective separation is critical to the success of our process and the quality of our product, which we take very seriously,” said Scott Nisula, Chief Technical Officer at Delta BioFuels. “When emptying the reactors we need to know exactly where the interface is between the biodiesel and byproducts. If we leave byproducts in the fuel, we won’t meet product quality standards and have to reprocess the material. If we pour out biodiesel, we’re throwing money down the drain.”

Leading-Edge Technology Solution

Based on more than 20 years of petroleum and refinery experience, Delta BioFuels selected the Foxboro 871EC sensor as the preferred instrument for measuring conductivity.

“There are a number of ways to detect phase changes, but conductivity sensing is really ideal for this application,” said Nisula. “A conductivity measurement system is relatively inexpensive, very clean and maintenance free, since there are no moving parts. I brought Schneider Electric in when discussing the process and the company provided the solution we needed.”

Delta BioFuels is using the Foxboro conductivity probes in three applications. The initial application is in a batch plant mode where the company has a pump on the bottom of the reactor. Directly downstream of that pump is a “T” configuration that houses the Foxboro conductivity sensor. At this stage, the company needs to separate glycerin, which has a relatively high conductivity, approximately 4,000 to 5,000 microsiemen/cm.

The Foxboro probe monitors the conductivity of the fluid passing by and, as the interface occurs, it immediately detects a dramatic drop in conductivity because the methyl ester phase has a conductivity of less than 20 microsiemen/cm.

The conductivity sensor then triggers a signal to stop the pump and close the valve. The remainder of what is in the reactor is methyl ester that contains contaminants including excess methanol, glycerin, soaps, catalyst and other impurities.

The second application involves removing these components from the biodiesel fuel before it can be released as a final product. The crude biodiesel is mixed with water to scrub out the impurities, and then the water is allowed to settle to the bottom of the reactor.

Because wash water has a high conductivity of about 2,500 microsiemen/cm, the Foxboro sensors can immediately detect the interface between methyl ester and wash water.

After the washing, the biodiesel goes to the final phase where a vacuum dehydrator warms the wet biodiesel and draws out any residual water. In this third application the Foxboro conductivity sensing probe is used to determine when the appropriate amount of water is removed. At that point what remains is finished biodiesel fuel.

Expectations Exceeded

Delta BioFuels' innovative application of Foxboro conductivity sensing technology has resulted in improved production efficiency, reduced material and maintenance costs, and most importantly, ensured product quality.

By automating the phase separation process through Foxboro conductivity sensing technology, Delta BioFuels has eliminated the possibility of human error. Now, the interface between end-product biodiesel and waste byproducts is accurately and consistently detected to ensure product quality. Accurate, automated phase detection also eliminates loss of valuable biodiesel that might otherwise be disposed of with byproducts.

"Conductivity sensing technology has proven to be the cornerstone of successfully automating our critical phase separation process," said Nisula. "This will promote additional and ongoing process improvements such as automated, continuous processing, which will further improve production efficiencies and consistent product quality."

The early developers of biodiesel fuel probably would be pleased with the evolution of their pioneering chemical experiments and today's implementation of biofuel technology, albeit more than 150 years later.

The ongoing development of biofuels as a viable alternative energy source will surely play an important role as the world transitions from its dependence on petroleum to cleaner, sustainable energy options.

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