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# Cannell Finds Fuel by the Bushel

## Faculty

Kevin Cannell, JCCC associate professor, chemistry, has helped contribute to the field of renewable energy.

**W**hen Renew Energy, Jefferson, Wis., opened one of the biggest ethanol plants in the country this October, it had basic

scientists like Kevin Cannell, JCCC associate professor, chemistry, to thank. Renew Energy is estimated to generate 130 million gallons of ethanol each year and is home to the world's largest dry fractionation mill.

For those of us who are not analytical chemists, the short story is this: the starch in corn, a renewable energy source, can be fermented into alcohol and used in place of fossil fuels for gasoline. Fractionating the corn into its components so that there is a pure stream of starch makes the production of ethanol more efficient, generates valuable co-products and reduces the overall cost of operations for ethanol production.

Cereal Process Technologies, St. Louis, is the license holder of the patented dry-fractionation process now in place at Renew Energy. Dry fractionation, a way to separate the kernel's starch from the germ and the bran, has been used for 100 years for food products, but Renew Energy is the first facility to use CPT's fractionation process for ethanol.

Cannell's contribution, under the direction of CPT, was to use NIRS (near-infrared spectrophotometry, an analytical method that uses wavelengths in the near infrared region) to analyze corn taken from the dry-fractionation process. What CPT needed from Cannell was a set of calibration curves to determine the corn's components using NIRS.

During his sabbatical in fall 2006, Cannell analyzed 1,800 samples of corn in room 209 of the Science Building. He was sent duplicates of samples analyzed at an independent lab by the traditional wet-lab techniques. Both processes measure the same components within corn – protein, moisture, fat, fiber and starch – but NIRS is simple and quick, while wet chemistry is more time-consuming with beakers and reagents.

Cannell's work resulted in several "robust" calibration curves, meaning the curves were determined by a large number of samples and that the curves sufficiently predict their respective components.



“The advantage of the NIRS is that the information comes back in six seconds, as opposed to wet chemistry that takes several days,” Cannell said. “There is a huge time interest in being able to incorporate NIRS into a fractionation mill and ethanol production.

“My task was to collect the data and validate that one can, in fact, correlate NIRS data to wet chemistry so that eventually the amount of wet chemistry one has to do is minimal.”

The quicker NIRS results means that millers can make adjustments in the milling process, maximizing starch purity.

“So all this begs the question: Why go to the trouble to build a big expensive dry-fractionation facility in conjunction with an ethanol plant?” Cannell asks.

He answers his own rhetorical question. Although there is more cost up front in adding the milling process, it takes less energy to turn the corn starch into alcohol and results in a higher ethanol yield. Another big selling point for CPT is that co-products also can be put to good use – the protein and bran streams are valuable in other agricultural fields. Dairy farmers will be particularly interested in these co-products.

Was the tedious work of analyzing corn samples for three months in the Science department’s stock room gratifying?

“Science is science, and you have to collect data. Not all science is discovering the structure of DNA and winning a Nobel Prize. That’s not the point. You appreciate the science, you appreciate your contribution to the science and you have fun doing it. Now I have a photo of an ethanol plant and know I had a small part in it. I take a lot of pride in that.”

Cannell says that his sabbatical taught him about the business of science.

“I teach from an academic and research side of science; this experience taught me more about the business side of science,” the analytical chemist said.

As for ethanol, Cannell doesn’t see it as the silver bullet.

“The ethanol industry is aiming to dent gasoline usage by 10 percent, so it’s important, but the United States is a long way from energy independence.”

Renew Energy’s ethanol plant opened October 2007 in Jefferson, Wis. The blue storage tanks indicate the milling part of the facility.