E.coli a future source of energy?

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For most people, the name “E. coli” is synonymous with food poisoning and product recalls, but a professor in Texas A&M University’s chemical engineering department envisions the bacteria as a future source of energy, helping to power our cars, homes and more.

By genetically modifying the bacteria, Thomas Wood, a professor in the Artie McFerrin Department of Chemical Engineering, has “tweaked” a strain of E. coli so that it produces substantial amounts of hydrogen. Specifically, Wood’s strain produces 140 times more hydrogen than is created in a naturally occurring process, according to an article in *Microbial Biotechnology,* detailing his research.

Though Wood acknowledges that there is still much work to be done before his research translates into any kind of commercial application, his initial success could prove to be a significant stepping stone on the path to the hydrogen-based economy that many believe is in this country’s future.

Renewable, clean and efficient, hydrogen is the key ingredient in fuel-cell technology, which has the potential to power everything from portable electronics to automobiles and even entire power plants. Today, most of the hydrogen produced globally is created by a process known as “cracking water” through which hydrogen is separated from the oxygen. But the process is expensive and requires vast amounts of energy – one of the chief reasons why the technology has yet to catch on.

Wood’s work with E. coli could change that.

While the public may be used to hearing about the very specific strain that can cause food poisoning in humans, most strains are common and harmless, even helping their hosts by preventing other harmful bacteria from taking root in the human intestinal tract.

And the use of E. coli in science is nothing new, having been used in the production of human insulin and in the development of vaccines.

But as a potential energy source?

That's new territory, and it's being pioneered by Wood and his colleagues.

By selectively deleting six specific genes in E. coli's DNA, Wood has basically transformed the bacterium into a mini hydrogen-producing factory that's powered by sugar. Scientifically speaking, Wood has enhanced the bacteria's naturally occurring glucose-conversion process on a massive scale.

"These bacteria have 5,000 genes that enable them to survive environmental changes," Wood explained. "When we knock things out, the bacteria become less competitive. We haven't given them an ability to do something. They don't gain anything here; they lose. The bacteria that we're making are less competitive and less harmful because of what's been removed."

With sugar as its main power source, this strain of E. coli can now take advantage of existing and ever-expanding scientific processes aimed at producing sugar from certain crops, such as corn, Wood said.

"A lot of people are working on converting something that you grow into some kind of sugar," Wood explained. "We want to take that sugar and make it into hydrogen. We're going to get sugar from some crop

somewhere. We're going to get some form of sugar-like molecule and use the bacteria to convert that into hydrogen."

Biological methods such as this (E. coli produce hydrogen through a fermentative process) are likely to reduce energy costs since these processes don't require extensive heating or electricity," Wood said.

"One of the most difficult things about chemical engineering is how you get the product," Wood explained. "In this case, it's very easy because the hydrogen is a gas, and it just bubbles out of the solution. You just catch the gas as it comes out of the glass. That's it. You have pure hydrogen."

There also are other benefits.

As might be expected, the cost of building an entirely new pipeline to transport hydrogen is a significant deterrent in the utilization of hydrogen-based fuel cell technology. In addition, there is also increased risk when transporting hydrogen.

The solution, Wood believes, is converting hydrogen on site.

"The main thing we think is you can transport things like sugar, and if you spill the sugar there is not a huge catastrophe," Wood said. "The idea is to make the hydrogen where you need it."

Of course, all of this is down the road. Right now, Wood remains busy in the lab, working on refining a process that's already hinted at its incredible potential. The goal, he said, is to continue to get more out of less.

"Take your house, for example," Wood said. "The size of the reactor that we'd need today if we implemented this technology would be less than

the size of a 250-gallon fuel tank found in the typical east-coast home. I'm not finished with this yet, but at this point if we implemented the technology right now, you or a machine would have to shovel in about the weight of a man every day so that the reactor could provide enough hydrogen to take care of the average American home for a 24-hour period.

"We're trying to make bacteria so it's doesn't require 80 kilograms; it will be closer to 8 kilograms."

Source: Texas A&M University