Advance Made in Turning Water, Sunlight Into Fuel

by Bend_Weekly_News_Sources

CORVALLIS, Ore. â€“ Simply split H_2O into H_2 and O. And just like that, the energy crisis is solved.

That may sound too easy to be true. Actually, itâ€™s not all that easy, but it could be true. According to engineers at Oregon State University, it should be possible to meet much of the worldâ€™s energy needs with nothing more than the combination of water, sunlight and cyanobacteria. And an important advance has just been made toward that goal.

OSU researchers successfully got one type of cyanobacteria â€“ more commonly known as blue-green algae â€“ to live, grow and produce hydrogen while the cells were â€œencapsulatedâ€• in a solid state system, an important preliminary step to controlling this interaction of water, light and bacteria for practical use.

Significant progress still needs to be made in making the process more efficient and using light energy more effectively, but the advance demonstrates the feasibility of using these biological processes to produce hydrogen â€“ which could be used directly as a fuel, or in hydrogen fuel cells to power the electric automobiles of the future.

In one context, this would become a different form of solar energy.

The recent findings were published in the International Journal of Hydrogen Energy. Based on this and other progress, the U.S. Air Force Office of Scientific Research also recently awarded a grant of $938,000 to OSU, the University of Oregon and Indiana University to continue research.

â€œCyanobacteria have been using water and sunlight to produce hydrogen and oxygen for billions of years, itâ€™s why we have oxygen in our atmosphere,â€• said Roger Ely, an associate professor of biological and ecological engineering at OSU. â€œThe process is natural and it isnâ€™t new.

â€œBut what we need to do is control and improve this process in a practical, efficient and inexpensive way to produce hydrogen that we could use for fuel,â€• Ely said. â€œBeing able to get cyanobacteria cells to produce hydrogen while they are encapsulated is an important step toward that.â€•

Existing fuel cell technology that produces electricity is already very efficient, scientists say â€“ more so than the internal combustion engines now fueled by gasoline. Such forms of power are also attractive because they would be environmentally benign, producing only water as a by-product. To use fuel cells to power automobiles, advances will need to be made in storage technology. And the hydrogen itself will have to be abundant and inexpensive, which is what many researchers are now working toward with differing approaches.

The biological approach, Ely said, is one of the most promising.

â€œCyanobacteria use water and light in the process of photosynthesis, and try to grow by producing carbohydrates,â€• Ely said. â€œThey also produce some hydrogen, though. We want them to use less energy making carbohydrates and channel more into hydrogen production, and do it in such a way that we can control the process and use it to our advantage.â€•

In recent research, the OSU engineers accomplished part of that with the encapsulation approach â€“ kind of like little cells being held in a glass sponge â€“ that keeps the bacteria isolated from the environment, resistant to contamination, and able to live longer and to produce larger amounts of hydrogen. The glass sponge material creates a solid framework that provides structural, thermal and chemical stability to encapsulated cells.

Such solid state devices could potentially be encased in treated glass or another suitable material and engineered as biocassettes in a variety of configurations, such as sheets, thin films, or designed layers that could be versatile, portable, contained, stable, efficient and inexpensive, Ely said.

In continuing research Ely said, scientists hope to find ways to make the bacteria use more of the sunlight that is available to them â€“ to â€œharvestâ€• the light energy more efficiently. And itâ€™s also necessary for them to continue their work with variable levels and lower intensities of light.

â€œWe believe all of these steps are possible,â€• Ely said. â€œIf adequate support is directed to research programs in this area, we think it is possible to have working technologies in five to seven years. Our ultimate goal is to be able to create simple, environmentally safe processes that make a great deal of hydrogen at very low cost.â€•

Such hydrogen production systems might be built as central facilities, he said, or even incorporated into homes â€“ a window could someday become a hydrogen production device, for example. And such decentralized energy production systems could help reduce the huge amounts of energy lost by transporting it long distances.

â€œWe have a nuclear fusion reactor conveniently located 93 million miles away, and it bathes us with a constant flow of light and energy,â€• Ely said.

â€œThe solar energy that strikes the Earth in just one hour is sufficient to meet global energy needs for an entire year,â€• he said. â€œAn hourâ€™s worth of that power, if it could be turned into $3 a gallon gasoline, would be worth $10.4 trillion. We just need to convert a small part of that free energy into a form we can use, and nature offers us examples of systems that do that every day.â€•

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