Ancient diatoms could make biofuels, electronics and health food—at the same time

September 17 2012

Diatoms, tiny marine life forms that have been around since the dinosaurs, could finally make biofuel production from algae truly cost-effective – because they can simultaneously produce other valuable products such as semiconductors, biomedical products and even health foods.

Engineers at Oregon State University concede that such technology is pushing the envelope a bit. But it's not science fiction – many of the needed advances have already been made, and the National Science Foundation just provided a four-year, $2 million grant to help make it a working reality.

In theory, and possibly soon in practice, these amazing microscopic algae will be able to take some of the cheapest, most abundant materials on Earth - like silicon and nitrates - and add nothing much more than sunshine, almost any type of water, and carbon dioxide to produce a steady stream of affordable products.

The concept is called a "photosynthetic biorefinery." Sand, fertilizer, a little sun and saltwater, in other words, might some day power the world's automobiles and provide materials for electronics, with the help of a tiny, single-celled microstructure that already helps form the basis for much of the marine food chain and cycles carbon dioxide from the Earth's atmosphere.

"This NSF program is intended to support long-range concepts for a

sustainable future, but in fact we're demonstrating much of the science behind these technologies right now," said Greg Rorrer, an OSU professor and head of the School of Chemical, Biological and Environmental Engineering. Rorrer has studied the remarkable power of diatoms for more than a decade.

"We have shown how diatoms can be used to produce semiconductor materials, chitin fibers for biomedical applications, or the lipids needed to make biofuels," he said. "We believe that we can produce all of these products in one facility at the same time and move easily from one product to the other."

Biofuels can be made from algae, scientists have shown, but the fuels are a comparatively low-value product and existing technologies have so far been held back by cost. If this program can help produce products with much higher value at the same time – like glucosamine, a food product commonly sold as a health food supplement – then the entire process could make more economic sense.

Much of the cost in this approach, in fact, is not the raw materials involved but the facilities needed for production. As part of the work at OSU, researchers plan to develop mathematical models so that various options can be tested and computers used to perfect the technology before actually building it.

The key to all of this is the diatom itself, a natural nanotechnology factory that has been found in the fossil record for more than 100 million years. Diatoms evolved sometime around the Jurassic Period when dinosaurs flourished. A major component of phytoplankton, diatoms have rigid microscopic shell walls made out of silica, and the capability to biosynthesize various compounds of commercial value.

"Regular algae don't make everything that diatoms can make," Rorrer

said. "This is the only organism we know of that can create organized structures at the nano-level and naturally produce such high-value products. With the right components, they will make what you want them to make."

Provided by Oregon State University

Citation: Ancient diatoms could make biofuels, electronics and health food—at the same time (2012, September 17) retrieved 22 June 2024 from https://phys.org/news/2012-09-ancient-diatoms-biofuels-electronics-health.html