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In Search of Pollution-Eating Bugs

Researcher Hunts For Bacteria That Can Fix Global Warming

By Lee Dye

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An innovative project that could lead to cleaner air for all of us proves once again that to find the answer to the really big questions, scientists sometimes have to think small. Very small.

The goal is to remove carbon dioxide, one of the key greenhouse gases, from smokestacks at fossil-fueled power plants. Lots of people have tried, with little success, but the cooperative efforts of three institutions, with support from the nation's oldest national park, just might provide the answer.

David Bayless, a mechanical engineer at Ohio University in Athens, initiated the project a few years ago when he reasoned that nature has its own way of dealing with carbon dioxide. It provides organisms that convert the gas through photosynthesis into useful byproducts, like oxygen.

So why not, Bayless asked, find some creature that could eat that junk as it comes out of the stack?

It turns out that the best candidate isn't some exotic, genetically engineered beast that loves to dine on carbon dioxide. It's just cyanobacteria, tiny micro-organisms commonly known as green slime. Cyanobacteria does, indeed, have a passion for CO2, and what's more important it can survive in the blistering temperatures of gases streaming out of a coal-fired furnace.

The technology has already proved itself on a demonstration scale, with some limitations. What remains to be seen is whether it will work on a fully operational power plant.

Looking For a Few Good Bacteria

But scientists need to find just the right kind of cyanobacteria, tiny green microbes that give the algae its name. To find it, Keith Cooksey, professor of microbiology at Montana State University at Bozeman, has turned to Yellowstone National Park, in hopes of finding a few stalwart microbes that he can grow and propagate in his lab.

These have to be hardy fellows, able to thrive in temperatures above 130 degrees Fahrenheit, with a strong appetite for carbon dioxide.

"I'm sure the ideal bug is out there somewhere," Cooksey says. "All we have to do is find it." The concept has earned a $1 million grant from the U.S. Department of Energy, all because Bayless asked a simple question several years ago.

He was working for American Electric Power, a Midwestern power supplier that generates 90 percent of its electricity from coal. One day Bayless found himself in a room full of company executives, and he

asked what they were most worried about.

"If a carbon tax ever comes, we're dead," he was told.

Coal produces a lot of carbon dioxide, and if officials imposed a "carbon tax" in an effort to force companies to clean up their stacks, it would drive many of them out of business, Bayless was told.

So he set out to find what kind of research was underway. Not much, he soon learned. The leading solution was to pump the gas deep into the ocean, and hope it doesn't come back up anytime soon.

"I'm just fundamentally opposed to that kind of solution," Bayless says. At some time, he adds, it would "come back and bite you."

"So I started thinking, nature deals with carbon dioxide by photosynthesis," the process by which plants and animals use sunlight to convert chemical compounds into energy. Why not find some kind of creature that could survive at high temperatures and absorb the CO2?

The logical choice, he thought, would be some sort of algae. A colleague put him in touch with Cooksey, an expert on cyanobacteria who had done some research in Yellowstone, famed for its blistering hot waters and geysers. That, surely, would be the place to find the perfect animal.

Cooksey turned to Steve Miller, a member of Yellowstone's own scientific team. Miller has compiled a huge database on the park, including topographical maps that show the temperature and chemical composition of thousands of potential sites for Cooksey to search for the perfect bug.

He plans to collect a few samples soon. His agreement with the park calls for a minimal impact on the environment, so he'll take just a few. Then he will feed them an enriched diet, and hope to grow enough for a full-blown demonstration project.

How to Brighten a Smokestack

That brings us back to a problem that confronted Bayless at the beginning of the project. Photosynthesis needs light, and how do you get sunlight down a smokestack?

"We considered artificial lighting, but that's just not practical," Bayless says. "It's just too energy intensive."

Bayless had almost given up on the project when an undergraduate student, Ben Cipiti, came up with an idea. Oak Ridge National Laboratory had developed a system of parabolic mirrors that track the sun and channel light down a series of fiber optic cables. The cables lead to boxes that "look like florescent lights," and they provide enough light to meet the needs of an entire building.

It was just what Bayless needed, and Oak Ridge joined the project to develop a system that will deliver sunlight directly to the "bioreactor" where Cooksey's bugs will be waiting.

The idea is to get the cyanobacteria to cling to membranes which are sort of like window screens. Fiber optic cables will focus light across the membranes, allowing the bugs to grow and feast on a diet of carbon dioxide as it flows through the membranes.

The bioreactor will be located just below the stacks, where the gas has already been cooled to about 130

degrees by liquid scrubbers that remove fly ash and sulfur from the exhaust. That temperature should be just fine for Cooksey's bugs.

Bayless hopes to have a full-scale demonstration project running in about four years. If it works as he expects, we could have cleaner skies in the years ahead, allowing the nation, and the world, to ease the burden we have placed on the planet.

If it fails, some scientists believe the only alternative is to figure out some way to pump all that carbon dioxide into the ocean, a significant problem since about 70 percent of the nation's power plants are inland.

"I don't think that will work, and I don't think it's something we should do," says Cooksey. "We have no idea what the consequences of injecting CO2 into the ocean would be. Many scientists are violently opposed to it."

So let's hear a rousing cheer for green slime. Maybe those little bugs can do it for us.

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