Growing algae could clean the Chesapeake Bay and create biofuel

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Maryland's Eastern Shore is known for vast soybean and corn farms, but if Patrick Kangas had his way it would be covered in slime.

Kangas, a researcher at the University of Maryland, helped create a system that uses fields of slimy algae to clean up the Chesapeake Bay by removing pollutants from agricultural wastewater.

Typically, algae hurt the bay because they contribute to dead zones, oxygen depleted areas harmful to aquatic life. But by growing fields of algae in a controlled system, the tiny plants can clean water while creating a feedstock for biofuel.

"We're really just taking what happens in nature and controlling it and channeling into the kinds of ways that we want to use the algae essentially to work for us," Kangas said.

Kangas, who is the founder of a new center at the University of Maryland that aims to scale up this technology, has two small experimental algae cleaning systems in place in Maryland now.

But he hopes to eventually create systems that span hundreds or thousands of acres of land that would mimic his operation at a farm in Henderson, a small town in Caroline County on the Eastern Shore.

At the Henderson farm, the smell of muck and the sound of dribbling water surround the "algal turf scrubber" system. A solar-powered pump

moves the wastewater from a nearby canal into 50-meter troughs where the algae grow.

Thin screens catch the algae. The organisms use sunlight to grow as they filter phosphorus and nitrogen out of the wastewater and add oxygen before the water trickles to the bay.

Once a week during the growing season, Kangas dons galoshes to harvest the algae. Using an old broom, he pushes the dark green globs down the to the end of the troughs. Here the algae marinates in the farm breeze, drying out until Kangas returns a week later to collect it and take it back to the lab.

Harvesting rejuvenates the system, allowing for new algae to grow and continue to clean the water. Then the process repeats.

Much like the surrounding fields of corn after the seeds are planted, the algal turf scrubber system is mostly self-sufficient. The strands of algae grow like stalks until it's time to harvest.

"The idea is that if we have remote locations we can operate the system in areas where people aren't hanging around," said Tim Goertemiller of Living Ecosystems, an environmental consulting company, who worked on the design and production of the algal turf scrubber system.

The algal turf scrubber system is modeled after the way algae grows near coral reefs. The flow of water in the algal turf scrubber system mimics the pulse of the waves near a coral reef, which helps maximize growth.

Increased growth would mean more algae to use for biofuels, if Kangas's plans pan out.

"At that scale we'll produce a lot of biomass. So we'll need something to

do with that biomass. We're most interested in algal biofuels," Kangas said.

Kangas is working with chemical engineers from the University of Arkansas and Western Michigan University that are designing a process to turn his algae into butanol and ethanol.

Different types of algae yield different types of biofuel. The algae growing in Kangas's system are filamentous algae, which can be used to produce ethanol or butanol. But, Kangas said, very few types of algae produce enough oil to be economically viable options for biodiesel production.

Other groups are trying to produce biodiesel using genetically engineered algae, Kangas said.

"I hope those kinds of technologies work, but they're very expensive, and I just am skeptical of them," he said.

In addition to the algal turf scrubber system in Henderson, Kangas grows algae at a Constellation power plant near Baltimore.

He also has a working system at a sewage treatment plan on the New York City harbor, one at a nuclear power plant in Pennsylvania, and several systems that are temporarily shut down in Virginia.

Another system is scheduled to start operating at the Baltimore Inner Harbor soon, Kangas said.

"We are really anxious to scale up the technology and realistically hope to operate at the acre scale next summer, hopefully with hundreds of acres within 10 years," he wrote in an email.