Algae species explored for both biofuel source and pollution control

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Kathryn Coyne, assistant professor of marine biosciences, is studying algae as a source of biofuel and pollution control. Credit: Lisa Tossey

(PhysOrg.com) -- The tiny, plant-like Heterosigma akashiwo is too small to see with the naked eye, but the microscopic algae may pack a big environmental punch. University of Delaware researchers are studying whether the species can neutralize harmful smokestack emissions – and also serve as a source of eco-friendly biofuel.

The project is an outgrowth of biochemist Kathryn Coyne's study into the ecology of H. akashiwo, which thrives in Delaware and worldwide. Coyne and her postdoctoral fellow, Jennifer Stewart, found that the algae contain a special enzyme with the unusual ability to detoxify nitric oxide, one of multiple contaminants released through industrial chimneys as flue gas.

Based on the discovery of that enzyme, Coyne and Stewart decided to explore the possibility of recruiting the algae for pollution control. They knew that other scientists were trying to use different types of algae to reduce emissions of another flue gas component, carbon dioxide, since algae need carbon dioxide to grow.

“The problem with those attempts was that the nitric oxide also present in flue gas usually killed the algae,” said Coyne, assistant professor of marine biosciences. “It’s very harmful.”

That’s where H. akashiwo’s special enzyme may come in handy. The protein may enable the algae to convert harmful nitric oxide into innocuous nitrate, while the algae are also metabolizing carbon dioxide.

In addition to having pollution-fighting potential, H. akashiwo is a proven source of biofuel. Rising petroleum prices and finite quantities of fossil fuels are prompting demand for renewable energy sources, and algae-derived biofuel is already powering some trains, jets and other machines.

Adding nitrogen is an important but costly step in the process of making biofuel. H. akashiwo’s ability to use nitric oxide from flue gas essentially eliminates that step.

Coyne’s project is still in the early stages, having only recently received funding from Delaware Sea Grant. Before investigating commercial applications, Coyne will need to examine the long-term effects of flue gas on the algae’s physiology. She will also evaluate how well H. akashiwo uses nitric oxide as a nitrogen source and how light intensities affect its production of the lipids and fatty acids used to make biofuel.

Yet the potential upsides could be great. Existing methods of cleaning factory gas before it is released into the air are labor-intensive and

costly, so algae pose a natural and potentially cheaper alternative. They also contain a high proportion of the fats needed to make biofuel.

“Algal biofuels are great values,” Coyne said. “Compared to crops like corn and soybeans, the same mass of algae can produce greater quantities of biofuel.”

Provided by University of Delaware