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Powering up with algae

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With the now urgent need to slow down climate change and find more sustainable ways of powering our cars, machines, and cities, the development of alternative sources of energy is more important than ever. Solar, wind, and hydroelectric energy sources are a few of the major renewable ones popular today. However, other forms are emerging.

One type of emerging alternative energy is biodiesel, which makes use of organic materials such as food or industrial waste, organic oils, and other plant and animal wastes and products. A chemical process called transesterification converts these materials into biodiesel that can power standard diesel engines.

The search for alternative sources of energy is a major global issue. Researchers from around the world are developing new techniques to create biodiesel and leveraging local natural resources as fuel sources.

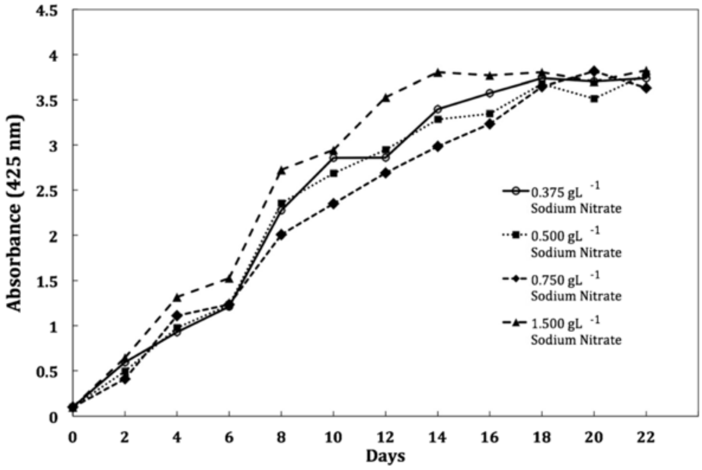
There have been many efforts by Filipinos to create biodiesel from local materials. Most efforts are focused on using coconut derivatives, which are then blended with regular diesel. However, other local fuel sources are also being studied.

A team of researchers from the University of the Philippines Los Baños is studying one potential biodiesel source: microscopic algae indigenous to the Philippines. The species is called *Desmodesmus* sp. (I-AU1), or simply *Desmodesmus*. Many types of green algae are being studied for their uses in the creation of biofuels because they are capable of photosynthesis, making cultivating them in large quantities much easier.

In a study published in the Journal of Applied Phycology, the researchers cultivated several batches of *Desmodesmus* under different conditions to determine which would yield the best algae for transesterification.

Like other organisms, microorganisms such as algae adapt to their surroundings to give themselves the best chance of survival. Similar to how humans sweat when it gets hot, many types of algae produce more fatty acids—or lipids—when there is less nitrogen in their surroundings. This is perfect for producing biodiesel, as lipids are essential to the conversion to biodiesel. Also, the properties of the lipids produced affect the quality of fuel produced, and these properties change depending on how the algae are grown.

The researchers cultivated four batches of *Desmodesmus* cells—originally sourced from the Institute of Plant Breeding, at UP Los Baños—each using different amounts of nitrogen (in the form of sodium nitrate). The researchers grew these cells for almost a month, and afterward they dried them and extracted the oils produced.



The researchers tracked the growth of the algae over 22 days by measuring minute differences in how much light was able to pass through water samples

The fatty acids making up these oils were then analyzed by using facilities at the Organic Chemistry Section of the Standards and Testing Division of the Department of Science and Technology Industrial Technology Development Institute. Aside from analyzing the lipid content of the extracted oils, the researchers converted the oils into biofuel and analyzed their potential for use as fuel.

The results from the study were extremely promising. Not only were the researchers able to extract fatty acids from the algae, but also the biofuel derived from the fatty acids showed great potential for further refinement and actual use as biodiesel, meeting a number of standards for different fuel properties.

For example, the biodiesel that the scientists created was high in saturated fatty acid methyl ethers, indicating that it would be stable biodiesel, good for actual use. The researchers also looked at the fuel's viscosity, which can affect how well it moves through an engine. A fuel that is too viscous is more resistant to combustion and is less efficient, but the *Desmodesmus*-derived fuel was within the accepted standards for viscosity. The calorific value of the biodiesel—basically referring to the amount of energy release when it is burned—was also adequate, slightly higher than the international standard.

These are very positive results, which tell us that biodiesel derived from *Desmodesmus* might just be a viable form of biodiesel. However, many challenges still lie in the way before it is truly adapted for widespread use.

Further testing needs to be done, for example, to determine *Desmodesmus*-derived biodiesel's safety and compatibility with different types of engines, as the fuel properties were derived from the analysis of the biodiesel, not yet in tests in real engines. If it is viable, work also needs to be done on creating ways to produce industrial quantities of this biodiesel, including cultivating enough algal cells and processing them.

Aside from these concerns, not all of the biodiesel's properties met standards. The biodiesel's cetane number—which measures how quickly the fuel ignites—for example, did not meet international standards. This means that refinements of the transesterification process or the cultivation process can still improve the fuel as a whole.

REFERENCE

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Luis Wilfrido Atienza graduated from the Ateneo de Manila University, with a BS in Biology, and a minor in poetry. He currently works as a writer for a medical communications agency, and spends some of his free time writing about science.