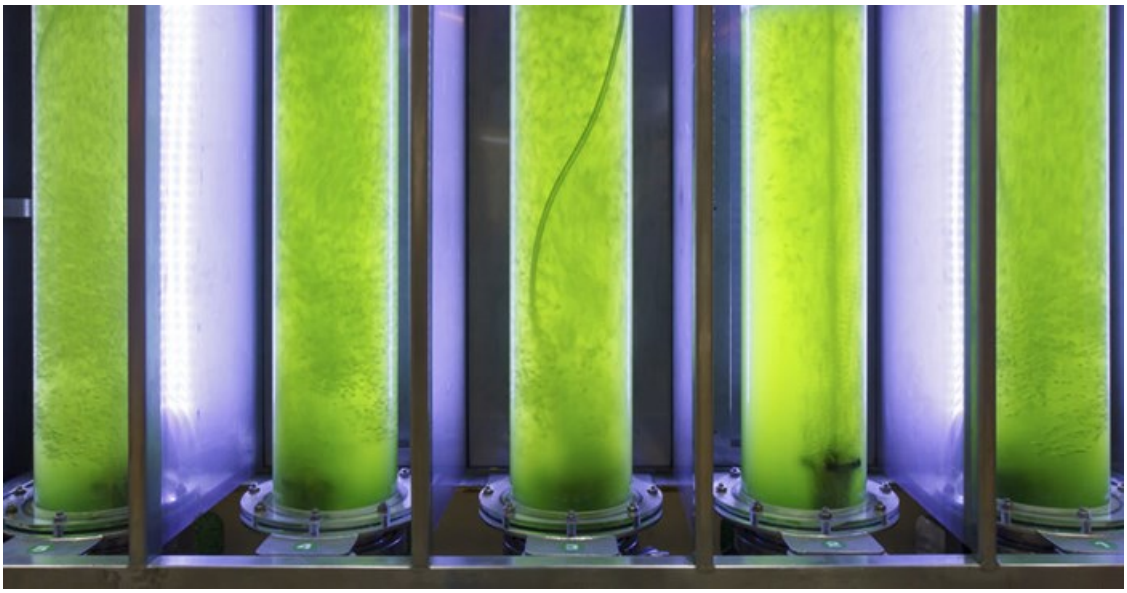
BIZCOMMUNITY

Can we save the algae biofuel industry?

By Christian Ridley

10 May 2016

Algal biofuels are in trouble. This alternative fuel source could help reduce overall carbon emissions without taking land from food production, like many crop-based biofuels do. But several major companies including Shell and ExxonMobil are seemingly abandoning their investments in this environmentally friendly fuel. So why has this promising technology failed to deliver, and what could be done to save it?



Algae are photosynthetic organisms related to plants that grow in water and produce energy from carbon dioxide and sunlight. Single-celled microalgae can be used to produce large amounts of fat, which can be converted into biodiesel, the most common form of biofuel. There are many possible ingredients for making biofuels, from corn to used cooking oil. But algae are particularly interesting because they can be grown rapidly and produce large amounts of fuel relative to the resources used to grow them (high productivity).

In the last decade or so, vast amounts of money have been invested in the development of algae for biofuel production. This made sense because, ten years ago, there was a need to find alternatives to fossil fuels due to the high oil price and the increasing recognition that carbon emissions were causing climate change. Algal biofuels were touted as the answer to these twin problems, and huge investment followed.

Unfortunately, things didn't go quite to plan. Companies making algal biofuels struggled to retain their high productivity at a larger scale and found predators often contaminated their farms. They also found that the economics just didn't make sense. Building the ponds in which to grow the algae and providing enough light and nutrients for them to grow proved too expensive, and to make matters worse the oil price has plummeted.

Beyond biofuels

But algae don't just produce biofuels. In fact, algae are like microscopic factories producing all sorts of useful compounds that can be used to make an amazingly diverse range of products.

For example, algae can produce large amounts of omega-3 fatty acids, an important dietary supplement. This means it could be a sustainable, vegetarian source of omega-3, which is otherwise only available from eating fish or unappetising cod liver tablets. More generally, algae are excellent sources of vitamins, minerals and proteins, with species such as Chlorella and Spirulina commonly being consumed for their health benefits.

Another useful product that can be made from algae is bioplastic. Regular plastic is a product of fossil fuels and takes an extremely long time to break down, which makes it very environmentally unfriendly. Bioplastic from algae can be produced with low carbon emissions, or even in a way that absorbs emissions. Their use could help prevent the build up of plastic in the environment.

The diversity of these products may be the key to finally developing algal biofuels. Many are high-value chemicals, selling for a much higher price than biofuels. So by combining them with biodiesel production, we could subsidise the price of the fuel and offset the high costs of algal cultivation.

This concept, known as a "biorefinery", is part of a new wave of algae research that aims to overcome the issues of the past decade or so. We already know that oil refineries produce plastics, fibres and lubricants as well as fuels. Now we are hoping to develop algal biorefineries in exactly the same way.

Producing an algal biorefinery

To make this model cost-effective and sustainable, we would need to use waste sources of heat, carbon dioxide and nutrients to grow the algae. These are widely available from power plants, factories and water treatment plants and so could reduce some of the costs of growing algae. After making algal fuel, you're left with lots of proteins, carbohydrates and other molecules. These can be converted into the kinds of products mentioned above, or used to produce biogas (another fuel source). This biogas can be sold or used at the biorefinery to produce heat for the algae, closing the loop and making the whole process more efficient.

It's easy to see how this process could be a way forward for sustainable, profitable biofuel from algae. In fact, there are companies already applying this concept to their work. In 2014 Sapphire Energy, one of the world's largest algal biotechnology companies, announced that they were diversifying their work to include nutritional supplements as well as biofuels. This move towards biorefinery is becoming more common and many firms diversifying their product lines.

Clearly, the algal biorefinery will not solve all the problems facing commercial algal cultivation today. There are still key issues facing the loss of yield at very large scales, and the contamination of algal cultures by predators that eat your crop of algae. These issues will only be solved by continued research efforts. However, biorefinery may well be the next step towards a future free from fossil fuels.

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