Biodiesel from algae may not be as green as it seems

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BUBBLING green tubes filled with algae gobbling up carbon dioxide and producing biodiesel may sound like the perfect way to make clean fuel, but it could generate nearly four times the greenhouse emissions from regular diesel.

How we farm algae is crucial to making algal biodiesel environmentally viable, says Anna Stephenson [1] at the University of Cambridge. She has developed a computer model that calculates the carbon footprint of producing, refining and burning algal biodiesel.

Making algal biodiesel in clear tubes has a carbon footprint nearly four times that of producing diesel

When algae are farmed in perspex tubes, she says, the energy needed to pump the algae around to ensure adequate exposure to sunlight results in a carbon footprint of 320 grams per megajoule equivalent of fuel. This compares with 86 g/MJ to extract, refine and burn regular diesel (*Energy and Fuels*, DOI: 10.1021/ef1003123 [2]).

"If you use tubular bioreactors, frictional losses mean the energy required to pump the culture around is so high that the biodiesel would have a much greater greenhouse gas emission than fossil diesel," she says.

Her model shows that growing algae in open ponds offers "a lot more potential to produce an environmentally sustainable fuel" - the footprint of biodiesel produced this way is only 19 g/MJ. But open ponds have one major drawback, namely that the water tends to evaporate, making them potentially more water-hungry than biofuel crops. What's more, the yield of diesel from open ponds tends to be lower than from growing tubes, where the algae have better exposure to sunlight.

Renewed interest in algal biofuels [3] has seen the likes of oil giant Exxon Mobil and Synthetic Genomics, based in La Jolla, California, jointly invest $600 million in researching algae cultivation. Such firms hope to pioneer technology that could see the cost of producing algal biodiesel dip below that of diesel within a few years (see graph) .

The solution may lie in closed reactors designed to circulate algae for little energy outlay, says Benjamin Taylor [4], a chemical engineer at the University of Cambridge. He is developing a system of tubes containing baffles that restrict the flow of the water and algae in such a way as to create a swirling motion. This ensures the algal culture is constantly mixed and uses just 4 per cent of the energy consumed by conventional tubular reactors, he says.

[5]

SOURCE [6]

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