Algal Biofuels

Our world is currently reliant on fossil fuels for everything from heating our homes to fueling our vehicles. However, fossil fuels are non-renewable and are a leading cause of climate change. And, although more sustainable energy sources like wind and nuclear power are being explored, researchers are also exploring using microbes, such as algae and cyanobacteria, to produce biofuels. I interviewed Dr. Bill Henley at Oklahoma State University’s Plant Biology Department to find out more.

Dr. Henley was recently investigating continuous growth algal cultures for biodiesel production. Typically, he says, cells are grown in batch cultures, where you give them all of their nutrients at once. Dr. Henley was investigating using a continuous culture instead. “For algae to accumulate lipids (the feedstock for biodiesel), you need them to be limited by nutrients, typically nitrogen... If they were growing exponentially, you could get elevated lipid content if you keep them growing exponentially by feeding them little bits of nitrogen at a time.” This way, you can keep them behaving as though they were starved for nitrogen and encourage them to divert their photosynthetic products to biofuel production. They found that by keeping the continuous cultures starved for nitrogen, they produced more lipids than the non-nitrogen starved control.

He went on to explain that doing research in algal biofuels can be difficult—funding can be sporadic. He said that “when oil prices go up, everybody gets concerned, but eventually as oil prices come back down, everybody loses interest.” This has happened several times—in the 1980s, again in the 1990s, and more recently, around 2008, when gas prices in Oklahoma hit $4.00 a gallon.

Not many companies have gotten in on the biofuel game, and many of the ones that did have either gone bankrupt or changed their business model to producing other compounds. For commodities like fuel, increasing your production decreases the price. Additionally, fuel is cheap. Dr. Henley explained that many companies have transitioned their business models to produce pharmaceuticals that “sell for $1,000 a gram instead of $1,000 a ton” like fuels. He continued “it’s possible [to make algal biofuels] at the moment, the problem is that you can’t make any money doing it.”

Many of these expenses come from how difficult it can be to successfully grow algae in large quantities. Over the course of the interview, we discussed many of the problems. The cells must be grown outside to utilize sunlight, and due to the large quantity of cells required at an industrial scale, they will inevitably be exposed to contaminants. Additionally, the media the algae are grown in would have to be periodically replaced to prevent inhibitory amounts of toxin buildup. Fertilizing the media adds further complexity: where can you dispose of thousands of gallons of toxin and fertilizer laden water?

Although there are currently many issues with the economical production of algal biofuels, they remain a promising alternative to fossil fuels. Continued research into these issues will help us achieve a cleaner, and hopefully much greener future.

Henley, William. Personal interview. 31 March 2021.