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Recovering Fatty Acids from Cyanobacteria: a novel method based on controlled cell death from CO_2 limitation

AzTE Case # M11-015

Inventors

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Invention Description

Cyanobacteria are a promising source of biofuels. They have higher growth rates and greater solar energy capture efficiency than multi-cellular plants. Traditional downstream recovery of the cell membrane lipids from cyanobacteria, however, typically requires cell lysis followed by solvent extraction. This can account for 70-80% of the cost of biofuel production. If these operations could be eliminated, it would substantially reduce the cost of producing biofuels from cyanobacteria.

Researchers at the Biodesign Institute of Arizona State University have engineered a strain of the cyanobacterium, *Synechocystis* sp. PCC6803, so as to die in a controlled fashion when CO_2 is removed from the growth environment. Under low CO_2 conditions, in as little as 30 minutes, inducible promoters up-regulate the synthesis of lipolytic enzymes. These convert membrane lipids into free fatty acids, which are more readily processed into biofuel than the membrane lipids and can easily be collected as they are released when the membranes disintegrate and the cells collapse.

This technology has the potential to significantly reduce the cost of algal biofuel production, both by eliminating physical cell lysis and solvent extraction, and by producing free fatty acids rather than the diacylglycerols present in membrane lipids.

This technology can be paired with other cyanobacterial genetic engineering technologies, and has produced yields of nearly $4x10^{-11}$ mg/cell.

Potential Applications

- Algal biofuel production
- Pairing with other genetic engineered cyanobacterial technologies, such as producing and excreting biodiesel-chain length neutral lipids in lieu of increasing biomass (AzTE Cases # M9-017 and M10-180)

Benefits and Advantages

- Less expensive than physical cell lysis and solvent extraction of membrane lipids
- Produces free fatty acids, which are more readily processed into biofuel than diacylglycerols present in membrane lipids
- Amenable to combination with other genetic engineered cyanobacterial technologies for even greater productivity

Intellectual Property Status:

Patent Pending

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