Advanced Research Projects Agency • ENERGY

ELECTROFUELS PROJECT

MIT

NATURAL OIL PRODUCTION FROM MICROORGANISMS

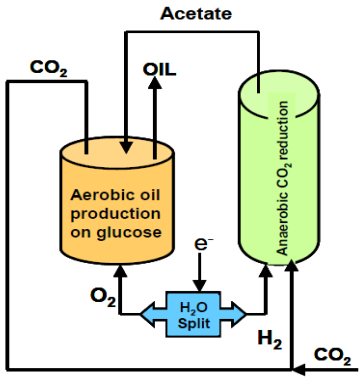
PROJECT TITLE:	Bioprocess and Microbe Engineering for Total Carbon Utilization in Biofuel Production		
ORGANIZATION:	Massachusetts Institute of Technology (MIT)	LOCATION:	Boston, MA
PROGRAM:	Electrofuels	ARPA-E AWARD:	$3,863,564
TECH TOPIC:	Advanced Fuels	PROJECT TERM:	7/15/10 – 7/14/13
WEBSITE:	bamel.scripts.mit.edu/gns		

CRITICAL NEED

Domestic biofuels are an attractive alternative to petroleum-based transportation fuels. Biofuels are produced from plant matter, such as sugars, oils, and biomass. This plant matter is created by photosynthesis, a process that converts solar energy into stored chemical energy in plants. However, photosynthesis is an inefficient way to transfer energy from the sun to a plant and then to biofuel. Electrofuels—which bypass photosynthesis by using self-reliant microorganisms that can directly use the energy from electricity and chemical compounds to produce liquid fuels—are an innovative step forward.

PROJECT INNOVATION + ADVANTAGES

MIT is using carbon dioxide (CO_2) and hydrogen generated from electricity to produce natural oils that can be upgraded to hydrocarbon fuels. MIT has designed a 2-stage biofuel production system. In the first stage, hydrogen and CO_2 are fed to a microorganism capable of converting these feedstocks to a 2-carbon compound called acetate. In the second stage, acetate is delivered to a different microorganism that can use the acetate to grow and produce oil. The oil can be removed from the reactor tank and chemically converted to various hydrocarbons. The electricity for the process could be supplied from novel means currently in development, or more proven methods such as the combustion of municipal waste, which would also generate the required CO_2 and enhance the overall efficiency of MIT's biofuel-production system.



IMPACT

If successful, MIT would create a liquid transportation fuel that is cost competitive with traditional gasoline-based fuels and 10 times more efficient than existing biofuels.

- SECURITY: Cost-competitive Electrofuels would help reduce U.S. dependence on imported oil and increase the nation's energy security.
- ENVIRONMENT: Widespread use of Electrofuels would help limit greenhouse gas emissions and reduce demands for land, water, and fertilizer traditionally required to produce biofuels.
- ECONOMY: A domestic Electrofuels industry could contribute tens of billions of dollars to the nation's economy. Widespread use of Electrofuels could also help stabilize gasoline prices—saving drivers money at the pump.
- JOBS: Electrofuels could create jobs in fuel production, distribution, and sales.

CONTACTS

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