Environmentally friendly process offers intriguing alternative to fossil-fuel-based ethylene for chemicals and transportation fuels.

Scientists at the National Renewable Energy Laboratory (NREL) have demonstrated a new way to use photosynthesis to produce ethylene. NREL scientists introduced a gene for ethylene forming enzyme (EFE) into a cyanobacterium and demonstrated that the organism remained stable through at least four generations, producing ethylene gas that could be easily captured.

Ethylene is the most widely produced petrochemical feedstock in the world. It is currently produced exclusively from fossil fuels, and its production is the largest carbon dioxide (CO₂)-emitting process in the chemical industry. Steam cracking of long-chain hydrocarbons from petroleum produces 1.5 to 3 tons of CO₂ for every ton of ethylene produced.

The NREL process, by contrast, does not release CO₂ into the atmosphere. Conversely, the process recycles CO₂, as the organism — *Synechocystis* sp. PCC 6803 — utilizes the gas as the carbon source for making ethylene. This could mean a savings of six tons of CO₂ emissions for every ton of ethylene produced — the three tons that would be emitted using fossil fuels and another three tons absorbed by the bacteria.

*Synechocystis* produced ethylene at a sustained rate and is still being improved. The laboratory-demonstrated rate of 170 milligrams of ethylene per liter per day is greater than the rates reported for the photosynthetic production of other algal biofuels.

NREL is initiating discussions with potential industry partners to help move the process to commercial scale. Interested companies include those in the business of producing ethylene or transportation fuels, as well as firms that build photobioreactors.

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