Microdiesel from *E. coli* – an alternative to fossil fuels?

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Practical alternatives to fossil fuels are a challenge for the 21st century. Not only are the number of exploitable oil reserves around the world decreasing as demand increases, but using this non-renewable resource also contributes to global warming. Among the solutions is biodiesel, an alternative to petroleum-based diesel made from plant oils. Its major drawback is that the acreage of oil crops like oilseed rape, soybeans and oil palm needed to meet the world's current demands would leave little space for food crops. However, most of the carbon in plants is within structural materials like cellulose and starch rather than the seed oils. Biodiesel would be much more practical if it could be made from these chemicals. A second problem is that biodiesel is currently produced by converting the plant oils to fatty acid methyl esters (FAMEs) using methanol, which is both toxic and derived from non-renewable natural gas. Fatty acid ethyl esters (FAEEs), synthesized using ethanol that can be produced biologically, have similar fuel properties to FAMEs, but are more expensive to make by chemical synthesis.

Researchers at the Westfälische Wilhelms-University in Germany have taken a lateral approach to these problems to see whether bacteria can help. Their solution has demonstrated that bacteria can be designed to make 'Microdiesel', resembling biodiesel. The researchers brought together genes from three different bacteria. They had been working with the species *Acinetobacter baylyi* that makes fats to store within its cells. The key enzyme (WS/DGAT) in this biosynthesis turns out to work well with a remarkably broad range of substrates, including many never encountered in nature. This enzyme therefore might make Microdiesel if it was supplied with suitable materials. Unfortunately, *A. baylyi* cannot synthesize suitable amounts of ethanol. The solution was to add two genes from another bacterium, *Zymomonas mobilis*, to the microbiological workhorse *Escherichia coli*, giving it the capacity to synthesize enough ethanol. Adding the gene for WS/DGAT from *A. baylyi* as well created genetically modified bacteria that could churn out up to 26 % of their dry weight as FAEEs, once supplied with sugars and fatty acids.

Higher efficiency and yields would be needed in a practical industrial process, as well as the ability to use crude plant materials as substrates. However, the versatility within bacterial metabolism means that this may well be possible using the right combination of genes and bacteria. The German researchers have shown that the concept works and have opened up the way for further developments.