Microbes help in making hydrocarbons

Engineered metabolism: Shriessh Srivastava (from left), Syed Shams Yazdani, Zia Fatma and Tabinda Shakeel studied the phospholipid pathway of E. coli .

Scientists at the International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi, have succeeded in engineering the metabolic pathway of *Escherichia coli* in such way that it would synthesise hydrocarbons of carbon chain length 15 and 17, which are the fundamental components of diesel. The results were recently published in *Journal of Metabolic Engineering.*

They first added two genes from Cyanobacteria into *E. coli.* “Few cyanobacteria are known to produce a low quantity of alkane. So we put the genes responsible for this production into the laboratory bacteria. But then the production was very minimal. So we took the approach of in-silico metabolic pathway, and finally over-expressed a gene (zwf gene) and removed few genes from *E. coli* which resulted in significantly high hydrocarbon production,” explains Zia Fatma, Postdoc researcher and first author of the paper.

The researchers also studied the phospholipid pathway of *E. coli* and made some gene deletions.

A total of three gene additions and eight gene deletions were carried out to increase the hydrocarbon production rate and concentration.

The added genes included those which code for cyanobacterial alkane producing enzymes and a host gene which can lead to availability of higher electrons needed for alkane production. The deletions helped in saving the substrate (glucose) from going to other competing products, and also helped in limiting the cell growth so that more carbon is available for alkane formation.

This pathway engineering also led to higher production of fatty alcohol, which has a role in cosmetic industries.

Fed-batch cultivation of *E.coli* (culturing the bacteria in a bioreactor with continuous nutrition supply) was done - 3 litre of the substrate supplemented with glucose and other nutrient sources were used. The engineered bacteria were able to produce 2.54 g/L of alka(e)ne and 12.5 g/L of fatty acid in 72 hours.

The report says that this is the highest production levels achieved so far by any microbial source.

“Currently, most of our need for fuels is met by non-renewable crude petroleum. Few countries have commercialised biodiesel made via transesterification of vegetable oil, but they can only be blended in the proportion of 5-20% with diesel and are not compatible with the supply chain,” says Dr Syed Shams Yazdani, from Microbial Engineering group and corresponding author of the paper. “The production is currently only at the lab level. We have to integrate the engineered plasmid into the genome and go for mass production. We are working to bring about a ten-fold increase in the production and at the same time bring down the cost of the new product.”

Perkin discovered the first synthetic dye, known as mauveine.

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