DBT/ Institute Name: International Centre For Genetic Engineering and Biotechnology

Producing biofuel from microorganisms

By Sunderarajan Padmanabhan

New Delhi, February 27: The biofuel sector could get a boost, with researchers at the International Centre for Genetic Engineering and Biotechnology (ICGEB) here developing a method to improve the growth rate and sugar content of a marine microorganism called *Synechococcus* sp. PCC 7002.

Most biotechnological processes, including biofuel production, are dependent on the availability of low-cost and sustainable supply of sugars and a nitrogen source. The sugars typically come from plants. Plants utilize light energy through the process of photosynthesis to convert carbon dioxide in the atmosphere into biological components such as sugars, proteins and lipids.

However, some bacteria, such as the cyanobacteria (also known as blue-green algae), too can perform photosynthesis and produce sugar by fixing the carbon dioxide in the atmosphere. The yield of sugars from cyanobacteria could potentially be much higher than that of land-based crops. Further, unlike plant-based sugars, cyanobacterial biomass provides a nitrogen source in the form of proteins.

Cyanobacteria are found in both fresh and marine waters. Using marine cyanobacteria could be better as freshwater is increasingly getting scarce. However, there is a need to significantly improve their growth rates and sugar content in order to improve the economic feasibility of marine cyanobacteria-based sugar production.

In a new study, a team of researchers led by Dr. Shireesh Srivastava, Group Leader of the System Biology for Biofuel group of International Centre for Genetic Engineering and Biotechnology and an investigator in the DBT-ICGEB Centre for Advanced Bioenergy Research, and Jai Kumar Gupta, a Ph.D. student at ICGEB have achieved this.

They have successfully engineered a marine cyanobacterium called *Synechococcus* sp. PCC 7002 which showed a higher growth rate and sugar (glycogen) content. When grown on air, the growth was doubled and the glycogen content of the cells increased by about 50%.

The leader of the study team, Dr. Srivastava, noted that Synechococcus sp. PCC 7002 is a model marine cyanobacterium and there were other Synechococcus species or related organisms where this work can be extended right away.

“We are conducting several follow-up studies related to this work. This includes scaling up the cultures to larger volumes, growing cells on urea (the primary nitrogenous compound in human and animal urine so that the “waste” could be converted to something of “value”), optimizing the extraction of sugars and proteins from the cyanobacterial biomass, and a proof-of-concept production of a biotechnological product such as bioethanol from the processed biomass”, he added.

Department of Biotechnology sponsored the research. The scientists have published a report on their work in journal `Biotechnology for Biofuels'.

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