

**Ministry of Science & Technology**  
**Department of Biotechnology**

DBT/ International Centre For Genetic Engineering and Biotechnology

**Increasing sugar production in marine cyanobacteria through genetic engineering**

By Sunderarajan Padmanabhan

New Delhi, February 21: Most biotechnological processes, including biofuel production, are dependent on low-cost and a sustainable supply of sugars and a nitrogen source. The sugars typically come from plants. Plants convert carbon dioxide, a greenhouse gas, to biological components such as sugars, proteins and lipids through photosynthesis.

However, some bacteria, such as the cyanobacteria (also known as blue-green algae), can also perform photosynthesis and produce sugar by fixing carbon dioxide. Cyanobacteria are found in both fresh and marine waters. Marine cyanobacteria do not require freshwater, a resource that is getting scarce, for their growth and sugar production. Moreover, the yield of sugars from cyanobacteria could potentially be much higher than that of land-based crops. Also, unlike plant-based sugars, cyanobacterial biomass also provides a nitrogen source in the form of proteins. However, to improve the economic feasibility of marine cyanobacteria-based sugar production a significant improvement in the growth rates and sugar content is needed.

**In a recent work led by Dr. Shireesh Srivastava, Leader of the group for 'System Biology for Biofuel' at ICGEB and an investigator in the DBT-ICGEB Center for Advanced Bioenergy Research, and Jai Kumar Gupta, a Ph.D. student at ICGEB have successfully engineered a marine cyanobacterium to increase its growth and sugar (glycogen) production in a simple medium.**

The engineered cells produced more than double the amount of glycogen compared to normal cells at all the concentrations of carbon dioxide tested. Additionally, the engineered cells would not require bubbling of concentrated CO<sub>2</sub>. This work, therefore, is an important development in the direction of utilizing marine cyanobacteria for sugar production for biotechnological and biofuel applications. The work, sponsored by the Department of Biotechnology (DBT), was published in the journal *Biotechnology for Biofuels*.

Additionally, the proteins that are present in the cyanobacterial biomass could also provide the nitrogen source for biotechnological applications

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