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Researchers at ICGEB genetically engineered marine cyanobacterium with huge growth and sugar producing potential

By Dr Bilqeesa Bhat

In a recent work led by Dr. Shireesh Srivastava, Group Leader of the System Biology for Biofuel group and an investigator in the DBT-ICGEB Center for Advanced Bioenergy Research, and Jai Kumar Gupta, a Ph.D. student at International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi 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 CO_2 tested. Additionally, the engineered cells would not require bubbling of concentrated CO_2.

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), Government of India was published in the journal *Biotechnology for Biofuels.*

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 utilize a process called photosynthesis that uses light energy to convert CO_2, a greenhouse gas, to synthesize biological components such as sugars, proteins and lipids etc.

However, some bacteria, such as the Cyanobacteria (also known as blue-green algae), can also perform photosynthesis and sugar production by fixing CO_2. 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 with huge biotechnological applications. However, to improve the economic feasibility of marine Cyanobacteria-based sugar production a significant improvement in the growth rates and sugar content is needed.

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