BIG energy seminar series

Addressing the scale and complexity of the global energy challenge.

Basic process, barriers, and optimization of algal hydrogen production

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NREL and RASEI Fellow

Date: Thursday, February 20, 2014 at 12:00 pm
Location: Duane Physics D142

Abstract:

The use of microalgae for production of hydrogen gas from water photolysis has been studied for many years, but its commercialization is still limited by multiple challenges. Most of the barriers to commercialization are attributed to the existence of biological regulatory mechanisms that, under anaerobic conditions, quench the absorbed light energy, down-regulate linear electron transfer, inactivate the H2-producing enzyme, and compete for electrons with the hydrogenase. Consequently, the conversion efficiency of absorbed photons into H2 is significantly lower than its estimated potential value of 12–13 % of sunlight. However, extensive research continues towards addressing these barriers by either trying to understand and circumvent intracellular regulatory mechanisms at the enzyme and metabolic level, or by developing biological systems that achieve prolonged H2 production albeit under lower than 12–13 % solar conversion efficiency. I will describe the metabolic pathways involved in biological H2 photoproduction from water photolysis, the attributes of the algal [FeFe]-hydrogenases, and highlight NREL research related to addressing some of these barriers, including: (a) the discovery of a new mechanism for regulation of H2 production; (b) recent advances in expressing in green algae a hydrogenase that is more tolerant to O2; (c) understanding the redox mediator responsible for linking photosynthetic electron transport to hydrogenases; (d) the development of a high-throughput assay to detect H2 production on plates.

Bio:

Dr. Maria L. Ghirardi is an NREL and RASEI Research Fellow, Manager of NREL's Photobiology Group, and a Research Associate Professor at the Colorado School of Mines. She has a B.S., an M.S. and a Ph.D degree in Comparative Biochemistry from the University of California at Berkeley and extensive experience working with photosynthetic organisms. Her research at NREL involves photobiological H2 production and basic photosynthesis. Her group's expertise covers metabolic, biochemical and genetic aspects of algal H2 metabolism. Maria has over 100 publications to date and has been featured as an invited speaker in many national and international conferences. . She was the recipient of NREL's 2003 Outstanding Performance Staff Award, DOE's 2003 Office of Sciences Outstanding Mentor Award, the Hispanic Engineer National Achievement Award in 2005 and the Kavli Frontiers Fellowship. She is the recipient of 3 U.S. patents and has 3 new patent applications filed.

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