Galyna Kufryk, Appli Micro Open Access 2016, 2:3(Suppl)
http://dx.doi.org/10.4172/2471-9315.C1.001

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Exploring the hydrogen-producing potential of *cyanobacteria* by genetic engineering

Since 1970s, the continuous interest to the production and application of biofuels was maintained by the need to reduce the use of non-renewable energy sources. While the majority of the research was focused on the carbon-based biofuels, such as bioethanol, biodiesel, jet fuel, etc., such types of biofuels had the same problem as their fossil counterparts: They were producing atmospheric pollutants and creating a green house effect. The cleaner alternative was biohydrogen. Hydrogen can be produced by multiple groups of microorganisms. Among the least expensive producers are cyanobacteria that utilize the solar energy for the accumulation of biomass and biohydrogen. *Cyanobacteria* can be grown in open systems as well as in bioreactors and their nutritional needs as photoautotrophic microorganisms are extremely simple. The production facilities can be placed in the areas that are not competing with agricultural and recreational land and maintained at a reasonably low cost. This makes *cyanobacteria* a very attractive system for the production of biohydrogen and other biofuels. About 40 strains of *cyanobacteria* are naturally capable of hydrogen production by the way of direct and indirect biophotolysis. Diazotrophic *cyanobacteria* have an additional hydrogen-producing mechanism via nitrogenase. Genetic engineering of cyanobacterial strains offers an opportunity to increase the hydrogen production level. Current efforts in the field include metabolic engineering, expression of heterologous hydrogenases, mutagenesis of uptake hydrogenases and bidirectional hydrogenase, etc. While many obstacles remain, the increase in the hydrogen-producing capacity of bioengineered cyanobacteria is encouraging the further research and potential applications of cyanobacteria as biofuel producers.

Biography

Galyna Kufryk holds a MS in Microbiology and a PhD in Biology and completed her Postdoctoral studies at Arizona State University, USA. She is a Professor of Biology at Grand Canyon University in Phoenix, AZ. Her research and publications are focused on genetics and biochemistry of cyanobacteria.

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