World Academy of Science, Engineering and Technology
International Journal of Biotechnology and Bioengineering
Vol:17, No:04, 2023

The Effects of Varying Nutrient Conditions on Hydrogen Production in PGR5 Deficient C. Reinhardtii Mutants

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Abstract : C. Reinahrdtii serves as one of the most promising organisms from which to obtain biological hydrogen. However, its production catalyst, [FeFe]-hydrogenase, is largely inhibited by the presence of oxygen. In recent years, researchers have identified a Proton Gradient Regulation 5 (PGR5) deficient mutant, which shows enhanced respiration and lower accumulations of oxygen within the system. In this research, we investigated the effects of varying nutrient conditions on PGR5 mutants' ability to produce hydrogen. After growing PGR5 mutants in varying nutrient conditions under 55W fluorescent lamps at 30℃ with constant stirring at 200 rpm, a common water displacement method was utilized to obtain a definitive volumetric reading of hydrogen produced by these mutants over a period of 12 days. After the trials, statistical t-tests and ANOVAs were performed to better determine the effect which nutrient conditions have on PGR5 mutants' ability to produce hydrogen. In this, we report that conditions of sulfur deprivation most optimally enhanced hydrogen production within these mutants, with groups grown under these conditions demonstrating the highest production capacity over the entire 12-day period. Similarly, it was found that when grown under conditions of nitrogen deprivation, a favorable shift towards carbon fixation and overall lipid/starch metabolism was observed. Overall, these results demonstrate that PGR5-deficient mutants stand as a promising source of biohydrogen when grown under conditions of sulfur deprivation. To date, photochemical characteristics of [FeFe]-hydrogenase in these mutants have yet to be investigated under conditions of sulfur deprivation.

Keywords : biofuel, biohydrogen, [FeFe]-hydrogenase, algal biofuel
Conference Title : ICETB 2023 : International Conference on Enzyme Technology and Bioprocesses
Conference Location : Boston, United States
Conference Dates : April 17-18, 2023