Metabolic pathway engineering to increase hydrogen production by *Chlamydomonas reinhardtii*

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Abstract

Biohydrogen as a sustainable and clean energy can be produced by microalgae during their photosynthetic activity. Among microalgae *Chlamydomonas Reinhardtii* has been investigated because of its high flexibility to acclimate to adverse environmental factors.
In this study effect of 4 parameter include light, Oxygen, Sulfur, Starch on the *C.reinhardtii* Hydrogen production has been examined.

Keywords: Metabolic Pathway, *C.reinhardtii*, Photosynthesis, Biohydrogen

Introduction

Hydrogen generation mechanisms by *c.reinhardtii*

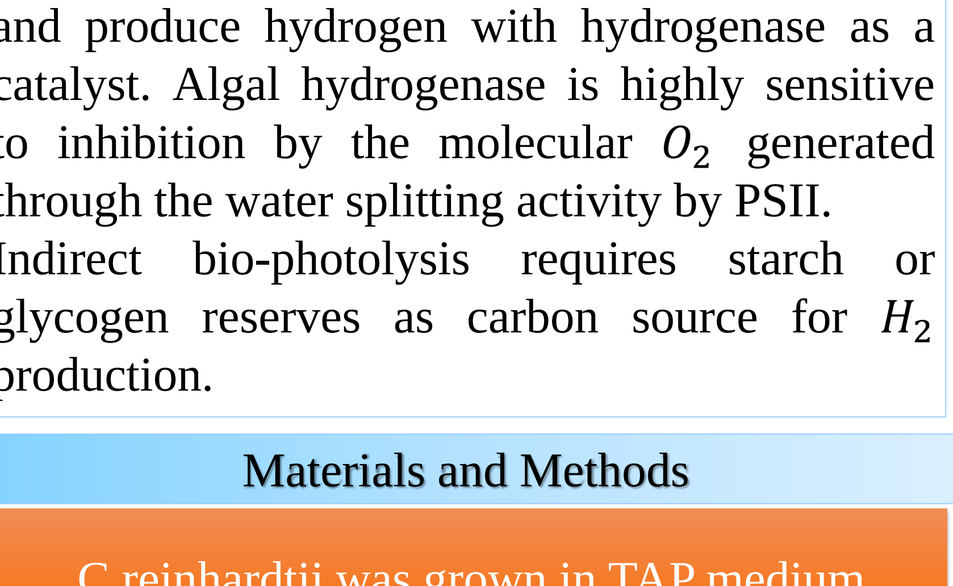
- The PSII dependent pathway (Direct)
- The PSII-independent pathway (Indirect)
- The light-independent pathway

In the direct pathway electron generated by PSII and water splitting, transfer into electron carriers and finally oxidized by hydrogen ions and produce hydrogen with hydrogenase as a catalyst. Algal hydrogenase is highly sensitive to inhibition by the molecular O_2 generated through the water splitting activity by PSII.
Indirect bio-photolysis requires starch or glycogen reserves as carbon source for H_2 production.

Materials and Methods

C.reinhardtii was grown in TAP medium

Starch metabolism has been proposed to contribute to both pathways by feeding respiration and maintaining anoxia during the direct pathway and by supplying reductants to the plastoquinone pool during the indirect pathway.



Results

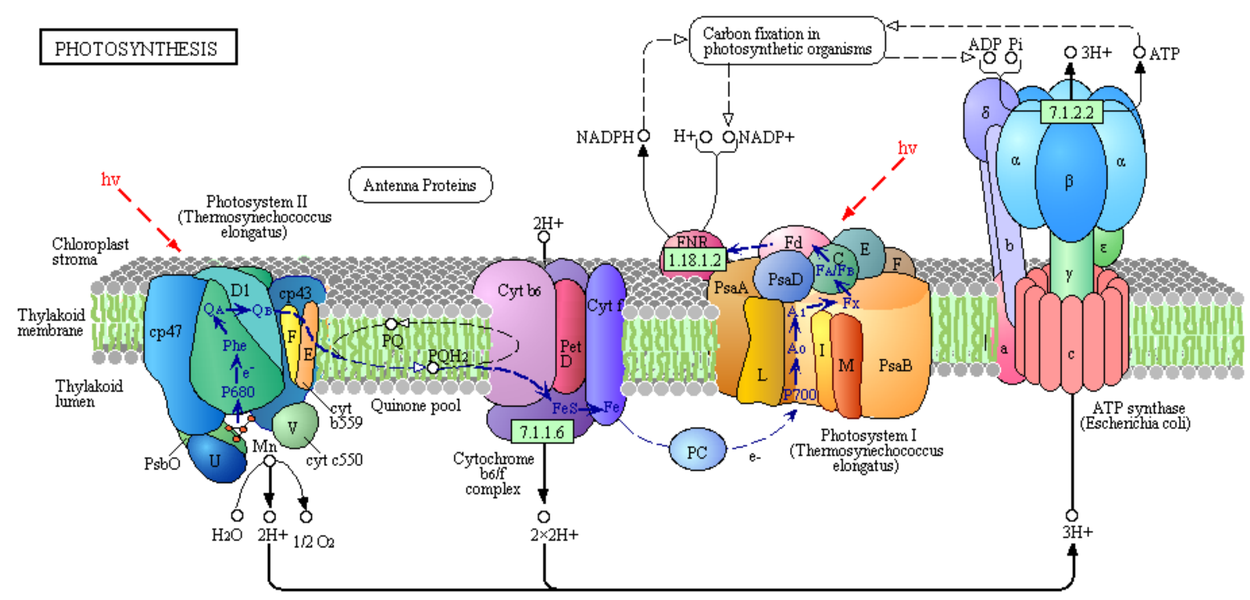
Factors \ pathways	Direct	Indirect
Dark anaerobic fermentation	Decrease in hydrogen evolution rate due to the increase in O_2 production	Higher rate of Hydrogen generation, using carbohydrate as a substrate
Sulfur deprivation	A decrease in PSII activity leads to anaerobic condition and higher evolution of H_2	starch and protein degradation provide the photosynthetic ETC with electrons that contribute to H2 photoproduction
Starch metabolism	Sustains anaerobic condition. acetate could be superseded	Act as substrate and supply electrons

Discussion, Conclusion and Suggestions

The PSII, which is the critical protein in microalgae photosynthesis, is active in anaerobic conditions.

Hydrogenase which is the critical enzyme in H_2 production is inhibited by oxygen

Hydrogen production by sulfur-deprived culture depends on light intensity.



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