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Biological Hydrogen Production

The Hawaii Natural Energy Institute (HNEI) has carried out research and development (R&D) on biological hydrogen production since the early 1990s. Initially, this project investigated the genetics of cyanobacterial (blue green algae) hydrogenases. A new R&D phase was initiated in 1996 to develop a microalgal indirect biophotolysis process, in which water is converted in separate stages into oxygen and hydrogen (H_2). The organism chosen for initial work on this project was a strain of Spirulina (Arthrospira platensis) already being commercially grown in Hawaii and used in the prior biohydrogen research at HNEI. Laboratory work confirmed that Spirulina produces H_2 by dark fermentations, but not in the light.

The major part of the research carried out under this project from 1996 to 2000 was the operation and engineering studies of the photobioreactors. While this initial work demonstrated the ability to produce Spirulina in the reactors, an indirect biophotolysis process using cyanobacteria in the photobioreactors was not demonstrated.

Proposals for future biohydrogen research at HNEI aim to maximize the yield of H_2 from endogenous substrates by dark fermentations in microalgae or by bacteria using exogenous waste substrates. Such processes could produce H_2 fuel in small-scale amounts at acceptable costs in the near term, and larger quantities in the long term.

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