



## Biohydrogen: Chapter 4. Insurmountable Hurdles for Fermentative H<sub>2</sub> Production?

*Patrik R. Jones, M. Kalim Akhtar*

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The production of H<sub>2</sub> by fermentative conversion of photosynthetic glucose into H<sub>2</sub>, CO<sub>2</sub>, and residual hydrocarbons is one potential method for renewable fuel production. One of the main theoretical issues with fermentative H<sub>2</sub> production is the low stoichiometric yield of H<sub>2</sub> per glucose. Numerous studies on the engineering of microorganisms for H<sub>2</sub> synthesis have been reported, although none have, as yet, successfully demonstrated H<sub>2</sub> yields beyond 33% of the maximum stoichiometric potential. The low yields are due principally to two main reasons, described herein as potentially insurmountable hurdles. The first hurdle is the thermodynamic limitation attributed to the energetically unfavorable link among fermentative metabolism, the maintenance of reduced to oxidized ratios of central electron acceptor/donors, and the use of H<sub>2</sub> as a final electron sink. The second hurdle is incomplete oxidation of glucose in the absence of O<sub>2</sub>. In light of these issues, natural and potential engineering solutions for H<sub>2</sub> synthesis are discussed. The main conclusion that can be drawn from this is that these hurdles will be exceedingly difficult, if not impossible, to overcome and will therefore require alternative approaches if fermentative H<sub>2</sub> is to become an important method of fuel production in the future.



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