



Biohydrogen: Chapter 4. Insurmountable Hurdles for Fermentative H₂ Production?

Patrik R. Jones, M. Kalim Akhtar

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The production of H₂ by fermentative conversion of photosynthetic glucose into H₂, CO₂, and residual hydrocarbons is one potential method for renewable fuel production. One of the main theoretical issues with fermentative H₂ production is the low stoichiometric yield of H₂ per glucose. Numerous studies on the engineering of microorganisms for H₂ synthesis have been reported, although none have, as yet, successfully demonstrated H₂ 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 H₂ as a final electron sink. The second hurdle is incomplete oxidation of glucose in the absence of O₂. In light of these issues, natural and potential engineering solutions for H₂ 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 H₂ is to become an important method of fuel production in the future.

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