



Biohydrogen: Chapter 9. Biohydrogen from Renewable Resources

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The world's energy markets rely heavily on fossil fuels (such as coal, petroleum, and natural gases). However, due to increasing energy demands, depleting reserves of fossil fuels, and increasing negative effects on the environment (e.g., global warming and climate changes), as well as growing political instability in oil-producing nations, the world is facing a major energy threat that needs to be solved by virtue of alternative energy sources utilizing renewable resources. The only natural, renewable carbon resource known with large enough capacity to substitute for fossil fuels is biomass. Thus, energy from biomass is considered to be one of the most promising alternatives to fossil fuels. Among the existing biomass energy/biofuels, biohydrogen has received considerable attention as it is clean, renewable, has a high energy content, and does not contribute to the greenhouse effect. Biomass is projected as a virtually eternal raw material for hydrogen (H₂) production; however, the main bottleneck is the low hydrogen yield arising from poor efficiency on direct microbial assimilation of biomass. Therefore, technologies leading to more efficient and commercially viable production of biohydrogen from biomass and other renewable resources are urgently demanded. This chapter sheds light on some of the practical approaches of fermentative H₂-generating processes utilizing a variety of biomass and renewable resources as substrate. This chapter also emphasizes biohydrogen production technology that could maximize hydrogen yield by designing efficient bioprocess integration and energy and waste minimization. Improving the hydrolysis of biomass has been recognized as a key step toward biohydrogen production. Considerable research efforts made on improving the pretreatment and hydrolysis of biomass materials are also addressed. Emphasis is given to discussion of the process based on important operating factors involved and to delineation of some of the process limitations. The aim of this chapter is to provide rapidly expanding information on biohydrogen production from renewable resources and to offer clues and possibilities for enhancing the performance of natural waste utilization and dark fermentative hydrogen production to resolve issues related to food security, climate change, energy security, and clean development in the future.

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