Waste to Renewable Biohydrogen
Volume 2

Numerical Modelling and Sustainability Assessment

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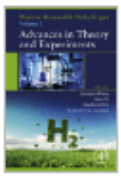

Chapter 1 - Sustainable waste management: valorization of waste for biohydrogen production

Sheng Yang, Kebo Ma, Zhiqiang Liu

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Abstract

The energy dilemma and environmental pollution have become the two most significant problems. Because the development of city life is usually accompanied by much waste that is generated and discarded, it greatly influences the city's appearance and human health. This chapter introduces the concepts of waste, its harm, its conversion, and its main approach to recycling (in Sections 1.2 and 1.3). Meanwhile, as an important component of waste, biomass and its related concepts are introduced (in Section 1.4). As a promising practice of biomass, biohydrogen is introduced in the fifth part of this chapter (in Section 1.5). Hydrogen production organisms (in Section 1.5.1), organic anaerobic biodegradation (in Section 1.5.2), and hydrogen fermentation (in Sections 1.5.3–1.5.5) are introduced. Finally, two methods to evaluate the efficiency of biohydrogen technologies are explained in Section 1.6.

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Chapter 2 - Waste to biohydrogen: potential and feasibility

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Abstract

With the acceleration of the process of human modernization, the prominent problems of resources and the environment make the renewable transformation of waste increasingly important. Agricultural production waste, industrial production waste, and municipal waste can be used to produce hydrogen through microbial fermentation, achieve energy recycling, and reduce environmental pollution and the greenhouse effect caused by fossil fuel energy consumption. This chapter reviews research on the conversion of these types of waste into biohydrogen and evaluates the feasibility of biohydrogen production in terms of the energy recovery potential and environmental benefits. The results reveal that solid waste with a high organic matter content can quickly obtain biogas with a high hydrogen content through biomass gasification technology. For organic wastewater, food waste, and other microbial fermentation technology, the hydrogen production rate is further improved. The optimization of fermentation conditions and the reactor design are the key to reducing the cost of hydrogen production.

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Chapter 3 - Waste to biohydrogen: progress, challenges, and prospects

Quanguo Zhang

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Abstract

Waste is produced in the process of people's lives and production that pollutes the environment. Some of the waste contains a lot of organic matter. Through some treatment methods, this organic matter can be extracted to produce clean renewable energy, such as hydrogen energy. Biohydrogen production technology is a promising method of hydrogen production. The effective treatment of organic waste is the premise of the industrialization of hydrogen production, and optimization of the process and technology of hydrogen production is the basis of the industrialization of hydrogen production. Therefore, it is necessary to have a solid grasp of progress in the research of waste to biohydrogen, a clear understanding of its challenges, and a clear direction of its prospects. This chapter aims to introduce progress in the research, challenges, and the development prospects for biohydrogen production from waste. According to the results, it may be concluded that research in biohydrogen production from waste is still in the primary stages of exploration and faces various problems and challenges. Nevertheless, biohydrogen production technology is one of the best methods for the rational use of waste.