Contents

Anaerobic Digestion ................................................................. 1
Sevcen Aydin

Using Pretreatment and Enzymatic Saccharification Technologies to Produce Fermentable Sugars from Agricultural Wastes .................. 15
Caoxing Huang, Ben Jeuck, and Qiang Yong

Various Sludge Pretreatments: Their Impact on Biogas Generation .... 39
J. Rajesh Banu and S. Kavitha

Hydrolysis of Lignocellulosic Biomass for Recovering Hemicellulose:
State of the Art ............................................................... 73
I.S.M. Rafiql, A.M.M. Saknah, and A.W. Zularisam

Latent Potential of Microalgal Biomass: Research Efforts and Challenges .................................................. 107
Pau Loke Show, Arumugasamy Senthil Kumar, Sue Wen Siow,
Siti Sabariah Din, Vidya Sundaram, and Kulandai Arockia Rajesh Packiam

Treatment of Dye Wastewater for Water Reuse Using Membrane
Bioreactor and Biofouling Control ........................................ 121
Muhammad Faisal Siddiqui, Lakhveer Singh, and Zularisam Ab Wahid

Economic and Market Value of Biogas Technology ....................... 137
Abu Yousuf, Maksudur Rahman Khan, Domenico Pirozzi,
Zularisam Ab Wahid, and Samson Mekbib Atinaw

Biomass Gasification ............................................................... 159
Samson Mekbib Atinaw, Shaharin Anwar Sulaiman, and Suzana Yusup

Activated Carbon from Renewable Sources: Thermochemical
Conversion and Activation of Biomass and Carbon Residues
from Biomass Gasification .................................................. 187
Davide Bergna, Henrik Romar, Sari Tuomikoski, Hanna Runtti,
Teija Kangas, Pekka Tynjälä, and Ulla Lassi
Pyrolysis of Biomass ............................................. 215
Dooshyantsingh Oochit, Anurita Selvarajoo,
and Senthil Kumar Arumugasamy

Liquefaction of Biomass for Bio-oil Products .......... 231
Hua-jun Huang, Xing-zhong Yuan, and Guo-qiang Wu

Intensified Synthesis of Bioethanol from Sustainable Biomass ..... 251
Saurabh M. Joshi and Parag R. Gogate

Current Approaches in Producing Oil and Biodiesel from Microalgal Biomass ........................................... 289
Marcondes M. Pacheco, Michele Hoeltz, Diego de Souza,
Lisianne B. Benitez, Rosana C.S. Schneider, and Maria V.G. Müller

Intensified Synthesis of Biodiesel from Sustainable Raw Materials Using Enzymatic Approach ......................... 311
Preeti B. Subhedar and Parag R. Gogate

Sandra Silva, Ana Cristina Rodrigues, Ana Ferraz, and Joaquim Alonso

Microbial Fuel Cells: Types and Applications ............... 367
Ravinder Kumar, Lakhveer Singh, and A.W. Zularisam

Index ........................................................................... 385
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Microbial Fuel Cells: Types and Applications

Ravinder Kumar, Lakhveer Singh, and A.W. Zularisam

Abstract Microbial fuel cells (MFCs) are bioelectrochemical devices that convert the chemical energy present in organic or inorganic compounds into electric current by using microorganisms as the catalysts. MFCs are of different types; however, the basic designs used in the laboratories for its applications include double-chamber MFC, single-chamber MFC, upflow MFC and stacked MFC. Moreover, some other designs have also been used for the studies. The type of electrode materials and proton exchange membrane (PEM) used in MFCs has most significant role for its outcomes for different applications such as bioelectricity generation, wastewater treatment, bioremediation of toxic compounds, biohydrogen production and biosensors. Furthermore, MFCs are operated at the optimized parameters such as thermophilic temperatures, neutral pH, etc. to obtain more significant results for respective application. This chapter explores the various types of MFCs, the operational parameters to improve its performance and the most studied applications of the MFCs.

Keywords Microbial fuel cells • Catalysts • Wastewater treatment • Bioelectricity generation • Biosensors • Proton exchange membrane

1 Introduction

The microbial fuel cell (MFC) technology is one of the most attractive technologies at present for renewable energy production and simultaneous wastewater treatment. MFCs are the bioelectrochemical devices that utilize microorganisms as the biocatalysts to convert the chemical energy present in organic or inorganic compounds into electric current (Aelterman et al. 2006; Bermek et al. 2014; Kumar et al. 2016). A typical double-chamber MFC is made up of two chambers, i.e. the anode and the cathode. Usually a proton exchange membrane (PEM) is placed between these two chambers that allows the protons produced at the anode to pass...