

# **The Complete Book on Biomass Based Products (Biochemicals, Biofuels, Activated Carbon)**

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Biomass use is growing globally. Biomass is biological material derived from living, or recently living organisms. It most often refers to plants or plant-based materials which are specifically called lignocellulosic biomass. Biomass (organic matter that can be converted into energy) may include food crops, crops for energy, crop residues, wood waste and byproducts, and animal manure. It is one of the most plentiful and well-utilized sources of renewable energy in the world. Broadly speaking, it is organic material produced by the photosynthesis of light. The chemical materials (organic compounds of carbons) are stored and can then be used to generate energy. The most common biomass used for energy is wood from trees. Wood has been used by humans for producing energy for heating and cooking for a very long time.

As an energy source, biomass can either be used directly via combustion to produce heat, or indirectly after converting it to various forms of biofuel. Conversion of biomass to biofuel can be achieved by different methods which are broadly classified into: thermal, chemical, and biochemical methods. Biomass gasification is the conversion of solid fuels like wood and agricultural residues into a combustible gas mixture. The gasification system basically consists of a gasifier unit, a purification system and energy converters- burner or engine.

This book offers comprehensive coverage of the design and analysis of biomass gasification, the key technology enabling the production of biofuels from all viable sources like sugar beet and sweet sorghum. It aims at creating an understanding of the nature of biomass resources for energy and fuels, the variety of processes that are available for conversion of the wastes into energy or fuels. The book discusses the overview of the Biomass Energy along with their Properties, Composition, Benefits, Characteristics and Manufacturing Process of Biomass based products. Also it contains suppliers contact details of plant & machinery with their photographs.

The content includes biomass renewable energy, prospective renewable resources for bio-based processes, biochemical from biomass, biomass based chemicals, biofuel production from biomass crops, biomass gasification, reuse of bio-genic iron oxides and woody biomass fly ash in cement based materials and agricultural areas, biofuel briquettes from biomass, biomass based activated carbon, environmental aspects.

It will be a standard reference book for Professionals, Decision-makers, Engineers, those studying and researching in this important area and others interested in the field of biomass

based products. Professionals in academia and industry will appreciate this comprehensive and practical reference book, due to its multidisciplinary nature.

## 1. BIOMASS RENEWABLE ENERGY

Introduction

Types of Biomass

Lignocellulosic Biomass

Crops and Vegetables

Waste Biomass

Properties of Biomass

Physical Properties

Densities

True Density

Apparent Density

Bulk Density

Thermodynamic Properties

(a) Thermal Conductivity

(b) Specific Heat

(c) Heat of Formation

(d) Heat of Combustion (Reaction)

(e) Heating Value

(f) Ignition Temperature

Important Constituents of Lignocellulosic Feedstocks

Benefits of Biomass

Disadvantages of Biomass

Biomass Pyramids

Compaction Characteristics of Biomass and Their Significance

Effect of Particle Size

Effect of Moisture

Effect of Temperature of Biomass

Effect of Temperature of the Die

Effect of External Additives

Unit Operations

Anaerobic Digestion

Biomass Energy in India

## 2. PROSPECTIVE RENEWABLE RESOURCE FOR BIO-BASED PROCESSES

Waste Biomass

Types of Waste Biomass

Lignocellulose

Lignocellulose Composition

Cellulose

Hemicellulose

Lignin

Residual Biomasses and the Biorefinery Associated Concept

Bio-Based Processes

Value Addition of Waste Biomass

Biotransformation of Biomass

Transformation of Marine Process Wastes

Biotransformation of Biotechnological Process Wastes

Biochemical Extraction from Biomass

## 3. BIOCHEMICAL FROM BIOMASS

Biomass Conversion

Thermo Chemical Conversion  
(a) Combustion  
Gasification  
Pyrolysis  
Biochemical Conversion  
Fermentation  
Anaerobic Digestion  
Mechanical Extraction  
Biochemical from Biomass  
Biomethanation  
Feature of Biomethanation  
Mechanism of Biomethanation  
Current Status  
Ethanol Fermentation  
Ethanol Fermentation of Saccharine Materials  
Ethanol Fermentation of Starch  
Ethanol Fermentation of Lignocellulosics  
(a) Concentrated Sulfuric Acid Process  
(b) Dilute Sulfuric Acid Process  
Acetone-Butanol Fermentation  
Characteristics of Acetone-Butanol Fermentation  
Reactions of Acetone-Butanol Fermentation  
Energy Efficiency of Acetone-Butanol Fermentation  
Products of Acetone-Butanol Fermentation  
Hydrogen Fermentation  
Characteristics of Hydrogen Fermentation  
Reactions of Hydrogen Fermentation  
Energy Efficiency of Hydrogen Fermentation  
Products of Hydrogen Fermentation  
Lactic Acid Fermentation  
Lactic Acid Bacteria  
Biomass Resources for Lactic Acid Fermentation  
Utilization of Unused Biomass from Palm Oil Industry  
Lactic Acid Fermentation from Kitchen Garbage  
Purification of Lactic Acid  
Silage  
Silage Making  
Silage Fermentation  
Roll Bale Silage  
Composting  
Basic Principles of Composting  
Basic Elements of Composting  
(a) Preprocessing  
(b) Fermentation  
(c) Product Forming Process  
Current Composting Technology  
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Chemicals from Biomass as Feedstock  
Biomass Conversion Chemicals  
Methane  
Methanol  
Production of Methanol from Biomass  
Uses and Applications of Methanol

Waste Water Treatment  
Environmentally Friendly  
Chemical Intermediate and Fuel  
Safety in Automotive Fuels  
Government Policy  
Other Applications  
Ethanol  
Properties of Ethanol  
Ethanol Production Process from Sugarcane  
Cleaning of Sugarcane, Extraction of Sugars and Juice Treatment  
Juice Concentration and Sterilization  
Fermentation  
Distillation and Dehydration  
Acetic Acid  
Ethylene  
Glycerol  
Production of Glycerol  
Applications of Glycerol  
Lactic Acid  
Propylene Glycol  
1,3-Propanediol  
Acetone  
Uses of Acetone  
Production of Acetone  
Butanol  
Butanol Fermentation Process  
Advantages of Biobutanol  
Succinic Acid  
Aspartic Acid  
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Xylitol  
2,5-furandicarboxylic Acid  
Sorbitol  
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The Holistic Approach  
Pretreatment of Lignocellulosic Biomass to Biofuel  
Bioethanol from Sugar Beet  
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Bajra  
Banana  
Barley  
Coconut  
Coffee  
Coriander  
Cotton  
Dry Chilly  
Dry Ginger

Green Gram  
Ground Nut  
Jowar  
Maize  
Mango  
Masoor  
Moong  
Moth  
Mustard  
Potato  
Soyabean  
Sugarcane  
Tea

## 6. BIOMASS GASIFICATION

Gasification Reactor Types  
Moving Bed (Fixed Bed)  
Down-draft Gasifiers  
Up-draft Gasifier  
Fluidized Bed Gasifier  
Bubbling Fluidized Bed  
Circulating Fluidized Bed Gasifier  
Entrained-Flow Reactor  
Gasification Reactions and Steps  
Gasifying Medium  
Chemical Reactions  
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2. Reactions with Carbon Dioxide  
3. Reactions with Steam  
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Advantages  
Limitations  
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Characterization of WBFA  
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Lab-scale Activation  
Activation Results  
Pore Size Distribution  
Generation of Granular Activated Carbon  
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Composition and Application  
Basic Principles of Biological Activated Carbon Technology  
Application Fields and the Typical Process Flow of Biological Activated Carbon Technology  
Basic Operational Parameters of BAC Process  
O3-BAC Process and the Evaluation of Ozonation  
Mechanism and Characteristics of O3-BAC Process  
Effect of Ozonation on Molecule Weight Distribution and the Molecule Structure of Organic Matters  
Effect of Ozonation on Molecule Weight Distribution of Organic Matters  
Effect of Ozonation on the Structure of Organic Matters  
Improvement of Biochemical Properties of Organics by Ozonation  
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Soil Resources  
Forest Health  
Wildlife  
Water Quality and Fisheries  
Environmental Impacts of Biofuels  
Ethanol  
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