

Logo

106-E, Kamla Nagar, New Delhi-110007, India.  
Tel: 91-11-23843955, 23845654, 23845886, +918800733955  
Mobile: +91-9811043595  
Email: npcs.ei@gmail.com, info@entrepreneurindia.co  
Website: www.entrepreneurIndia.co

## Handbook on Biofuel, Ethanol and Bioenergy Based Products

<b>Code:</b> NI328	<b>Format:</b> paperback
<b>Indian Price:</b> ₹1875	<b>US Price:</b> \$150
<b>Pages:</b> 456	<b>ISBN:</b> 9788195370184
<b>Publisher:</b> Asia Pacific Business Press Inc.	

## Description

Handbook on Biofuel, Ethanol and Bioenergy Based Products

(Ethanol as Biofuel, Methane Gas, Biodiesel, Biogas, Biomass Gasification, Bio-Chemical, Renewable Energy, Clean-Energy, Activated Carbon, Agricultural Residues, Forestry Residues, Animal Waste, Wood Wastes, Industrial Wastes, Municipal Solid Wastes and Sewage with Machinery, Manufacturing Process, Equipment Details and Plant Layout)

Bioenergy is biofuel-derived energy. Biofuel is any fuel made from biomass, such as plant or algal matter or animal waste. Biofuel is considered a renewable energy source since the feedstock material can be easily renewed, unlike fossil fuels such as petroleum, coal, and natural gas.

Ethanol is a naturally occurring result of plant fermentation that may also be made by hydrating ethylene. Ethanol is a widely used industrial chemical that is employed as a solvent, in the production of other organic compounds, and as a fuel additive (forming a mixture known as a gasohol). Many alcoholic beverages, such as beer, wine, and distilled spirits, include ethanol as a psychoactive element.

Transportation fuels generated from biomass resources, such as ethanol and biomass-based diesel, are known as biofuels. Using ethanol or biodiesel reduces the use of crude oil-based gasoline and diesel, potentially lowering the amount of crude oil imported from other nations. The global biofuels market is expected to reach growth at 7.3% CAGR. Increasing demand for biofuels as automobile fuel owing to their environment friendly characteristic to mitigate greenhouse gas emission is expected to propel industry growth.

The global ethanol fuel market is expected to reach growing at a CAGR of 6.7%. The demand for the product is driven by growing usage of the product as a biofuel. The

bioenergy market is expected to register a CAGR of over 6% during the forecast period. Bioenergy is one of the renewable energy sources globally. Increasing demand for energy, advancements in bioenergy conversion technologies, and increasing investment in bioenergy, and declining electricity generation costs from bioenergy facilities are expected to drive the market during the forecast period.

The book covers a wide range of topics connected to Biofuel, Ethanol and Bioenergy Based Products, as well as their manufacturing processes. It also includes contact information for machinery suppliers, as well as images of equipment and plant layout. A complete guide on Biofuel, Ethanol and Bioenergy Based Products manufacture and entrepreneurship. This book serves as a one-stop shop for everything you need to know about the Biofuel, Ethanol and Bioenergy Based Products manufacturing industry, which is ripe with opportunity for manufacturers, merchants, and entrepreneurs. This is the only book that covers commercial Biofuel, Ethanol and Bioenergy Based Products in depth. From concept through equipment procurement, it is a veritable feast of how-to information.

## **Content**

### **INTRODUCTION**

#### **1.1. Types**

##### **1.1.1. Wood**

##### **1.1.2. Biogas**

##### **1.1.3. Biodiesel**

##### **1.1.4. Ethanol**

##### **1.1.5. Methanol**

##### **1.1.6. Butanol**

#### **1.2. Benefits**

##### **1.2.1. They are Renewable Sources of Energy**

##### **1.2.2. Sovereignty**

##### **1.2.3. Ensure Sustainable Economy**

##### **1.2.4. Low Costs**

##### **1.2.5. Cleanest Fuel**

##### **1.2.6. Production of Less Smoke**

##### **1.2.7. They Help to Reduce Monopoly**

##### **1.2.8. Lower Toxicity in the Atmosphere**

##### **1.2.9. They are a Source of Employment for Locals**

##### **1.2.10. They do not Produce Sulfur**

##### **1.2.11. Promotion of Agriculture**

### **2. ETHANOL**

## 2.1. Production Process

### 2.1.1. Hydrolysis of Starch and Cellulose followed by Fermentation of Glucose to Ethanol

## 2.2. Applications

## 2.3. Uses

### 2.3.1. Medical

### 2.3.2. Recreational

### 2.3.3. Fuel

## 2.4. Chemistry

### 2.4.1. Chemical Formula

### 2.4.2. Physical Properties

### 2.4.3. Solvent Properties

### 2.4.4. Flammability

## 2.5. Technology

## 3. ETHANOL PRODUCTION

### 3.1. History of Ethanol

### 3.2. Most Motor Gasoline Now Contains Fuel Ethanol

#### 3.2.1. Sugar-to-Ethanol Process

#### 3.2.2. Starch-to-Ethanol Process

#### 3.2.3. Cellulose-to-Ethanol Process

#### 3.2.4. Distillation and Dehydration Process

### 3.3. Technology Applications for Bioethanol

### 3.4. Ethanol and The Environment

## 4. ETHANOL PRODUCTION PROCESS FROM SUGARCANE

### 4.1. Cleaning of Sugarcane, Extraction of Sugars and Juice Treatment

### 4.2. Juice Concentration and Sterilization

### 4.3. Distillation and Dehydration

## 5. ETHANOL PRODUCTION PROCESS FROM SUGARCANE BAGASSE

### 5.1. Pre-Hydrolysis of Hemicellulose

### 5.2. Cellulose Hydrolysis and Solvent Recovery

## 6. ETHANOL PRODUCTION PROCESS FROM CELLULOSIC

### 6.1. Cellulosic Production Process

#### 6.1.1. Pretreatment

#### 6.1.2. Enzyme Hydrolysis

#### 6.1.3. Fermentation

#### 6.1.4. Distillation

#### 6.1.5. Fuel Ethanol

## 7. BIOFUEL

### 7.1. How Biofuel is Made

#### 7.1.1. Biofuel Conversion Processes Deconstruction

- High-Temperature Deconstruction
- Low-Temperature Deconstruction

## 7.2. Production of Common Biofuels

### 7.3. Biofuels are Classified in the following four Categories:

- First-Generation Biofuels.
- Second-Generation Biofuels
- Third-Generation Biofuels
- Fourth-Generation Biofuels

## 7.4. Types

### 7.4.1. Gaseous Biofuel

### 7.4.2. Liquid Biofuel

## 8. BIOFUEL PRODUCTION FROM BIOMASS CROPS

### 8.1. Biomass Production

#### 8.1.1. Introduction

#### 8.1.2. The Holistic Approach

### 8.2. Pretreatment of Lignocellulosic Biomass to Biofuel

#### 8.2.1. Bioethanol from Sugar Beet

#### 8.2.2. Biological Hydrogen from Sweet Sorghum

### 8.3. Few Crops and their Residues

#### 8.3.1. Arhar

#### 8.3.2. Bajra

#### 8.3.3. Banana

#### 8.3.4. Barley

#### 8.3.5. Coconut

#### 8.3.6. Coffee

#### 8.3.7. Coriander

#### 8.3.8. Cotton

#### 8.3.9. Dry Chilly

#### 8.3.10. Dry Ginger

#### 8.3.11. Green Gram

#### 8.3.12. Ground Nut

#### 8.3.13. Jowar

#### 8.3.14. Maize

#### 8.3.15. Mango

#### 8.3.16. Masoor

#### 8.3.17. Moong

#### 8.3.18. Moth

#### 8.3.19. Mustard

#### 8.3.20. Potato

#### 8.3.21. Soyabean

8.3.22. Sugarcane

8.3.23. Tea

## 9. BIOFUEL BRIQUETTES FROM BIOMASS

9.1. Properties of Biomass Briquettes

9.2. Uses and Applications of Briquette

9.3. Feedstock

9.4. Market

9.5. Pre-processing of Biomass Residues

9.6. Bio-briquette Manufacturing Process

9.6.1. Advantages of Biomass Briquetting

9.7. Comparative Characteristics of Bio Briquettes

9.8. Briquetting Plant

## 10. BIOMASS RENEWABLE ENERGY

10.1. Introduction

10.2. Types of Biomass

10.3. Lignocellulosic Biomass

10.4. Crops and Vegetables

10.5. Waste Biomass

10.6. Properties of Biomass

10.6.1. Physical Properties

Densities

True Density

Apparent Density

Bulk Density

10.6.2. Thermodynamic Properties

(a) Thermal Conductivity

(b) Specific Heat

(c) Heat of Formation

(d) Heat of Combustion (Reaction)

(e) Heating Value

(f) Ignition Temperature

10.7. Important Constituents of Lignocellulosic Feedstocks

10.7.1. Benefits of Biomass

10.7.2. Disadvantages of Biomass

10.8. Biomass Pyramids

10.8.1. Compaction Characteristics of Biomass and Their Significance

10.8.2. Effect of Particle Size

10.8.3. Effect of Moisture

10.8.4. Effect of Temperature of Biomass

10.8.5. Effect of Temperature of the Die

10.8.6. Effect of External Additives

10.8.7. Unit Operations

10.8.8. Anaerobic Digestion

10.9. Biomass Energy in India

11. PROSPECTIVE RENEWABLE RESOURCE FOR BIO-BASED PROCESSES

11.1. Waste Biomass

11.2. Types of Waste Biomass

11.2.1. Lignocellulose

11.2.2. Lignocellulose Composition

11.2.3. Cellulose

11.2.4. Hemicellulose

11.2.5. Lignin

11.3. Residual Biomasses and the Biorefinery Associated Concept

11.3.1. Bio-Based Processes

11.3.2. Value Addition of Waste Biomass

11.3.3. Biotransformation of Biomass

11.3.4. Transformation of Marine Process Wastes

11.3.5. Biotransformation of Biotechnological Process Wastes

11.3.6. Biochemical Extraction from Biomass

12. BIOMASS BASED ACTIVATED CARBON

12.1. Introduction

12.2. Biomass Pyrolysis and Char Activation

12.3. Biomass Properties

12.3.1. Lab-Scale Pyrolysis

12.3.2. Lab-scale Activation

12.3.3. Activation Results

12.3.4. Pore Size Distribution

12.3.5. Generation of Granular Activated Carbon

12.3.6. Rotary Kiln Reactor for Char Activation

12.4. Composition of Biological Activated Carbon Process

12.4.1. 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

12.5. O<sub>3</sub>-BAC Process and the Evaluation of Ozonation

12.5.1. Mechanism and Characteristics of O<sub>3</sub>-BAC Process

12.6. Effect of Ozonation on Molecule Weight Distribution and the Molecule Structure of Organic Matters

12.6.1. Effect of Ozonation on Molecule Weight Distribution of Organic Matters

- 12.6.2. Effect of Ozonation on the Structure of Organic Matters
- 12.6.3. Improvement of Biochemical Properties of Organics by Ozonation
- 12.6.4. Improvement of Ozonation on Biodegradability of Organic Matters

### 13. BIOMASS BASED CHEMICALS

- 13.1. Chemicals from Biomass as Feedstock
  - 13.2. Biomass Conversion Chemicals
    - 13.2.1. Methane
    - 13.2.2. Methanol
  - 13.3. Production of Methanol from Biomass
  - 13.4. Uses and Applications of Methanol
    - 13.4.1. Waste Water Treatment
    - 13.4.2. Environmentally Friendly
    - 13.4.3. Chemical Intermediate and Fuel
    - 13.4.4. Safety in Automotive Fuels
    - 13.4.5. Government Policy
    - 13.4.6. Other Applications
  - 13.5. Ethanol
    - 13.5.1. Properties of Ethanol
    - 13.5.2. Ethanol Production Process from Sugarcane
  - 13.6. Cleaning of Sugarcane, Extraction of Sugars and Juice Treatment
    - 13.6.1. Juice Concentration and Sterilization
    - 13.6.2. Fermentation
    - 13.6.3. Distillation and Dehydration
    - 13.6.4. Acetic Acid
    - 13.6.5. Ethylene
    - 13.6.6. Glycerol
    - 13.6.7. Lactic Acid
    - 13.6.8. Acetone
  - 13.7. Butanol
    - 13.7.1. Sorbitol
- ### 14. BIOMASS GASIFICATION
- 14.1. Gasification Reactor Types
    - 14.1.1. Moving Bed (Fixed Bed)
    - 14.1.2. Down-draft Gasifiers
    - 14.1.3. Up-draft Gasifier
    - 14.1.4. Fluidized Bed Gasifier
    - 14.1.5. Bubbling Fluidized Bed
    - 14.1.6. Circulating Fluidized Bed Gasifier
    - 14.1.7. Entrained-Flow Reactor
  - 14.2. Gasification Reactions and Steps

- 14.2.1. Gasifying Medium
- 14.2.2. Chemical Reactions
  - 1. Reactions with Molecular Oxygen
  - 2. Reactions with Carbon Dioxide
  - 3. Reactions with Steam
  - 4. Reactions with Hydrogen
- 14.3. Fuel-Gas Production and Utilization
  - 14.3.1. Synthesis Gas Production
- 14.4. The Gasification Process
  - 14.4.1. Drying
  - 14.4.2. Pyrolysis
- 14.5. Char Gasification Reactions
  - 14.5.1. Speed of Char Reactions
  - 14.5.2. Boudouard Reaction
  - 14.5.3. Water-Gas Reaction
  - 14.5.4. Shift Reaction
  - 14.5.5. Hydrogasification Reaction
  - 14.5.6. Char Combustion Reactions
- 14.6. Catalytic Gasification
- 14.7. Catalyst Selection Criteria
  - 14.7.1. Advantages and Limitations
- 14.8. Generation of Thermal Energy from Wood through Biomass Gasification System
- 14.9. Scope of Supply
- 14.10. Equipment Description
- 14.11. Appendix & Annexure
- 15. BIOCHEMICAL FROM BIOMASS
  - 15.1. Biomass Conversion
    - 15.1.1. Thermo Chemical Conversion
    - 15.1.2. Combustion
    - 15.1.3. Gasification
    - 15.1.4. Pyrolysis
    - 15.1.5. Biochemical Conversion
    - 15.1.6. Fermentation
    - 15.1.7. Anaerobic Digestion
    - 15.1.8. Mechanical Extraction
  - 15.2. Biochemical from Biomass
    - 15.2.1. Biomethanation
    - 15.2.2. Feature of Biomethanation
    - 15.2.3. Mechanism of Biomethanation
    - 15.2.4. Current Status



- 15.2.5. Ethanol Fermentation
- 15.2.6. Ethanol Fermentation of Saccharine Materials
- 15.2.7. Ethanol Fermentation of Starch
- 15.2.8. Ethanol Fermentation of Lignocellulosics
  - (a) Concentrated Sulfuric Acid Process
  - (b) Dilute Sulfuric Acid Process
- 15.2.9. Acetone-Butanol Fermentation
- 15.2.10. Characteristics of Acetone-Butanol Fermentation
- 15.2.11. Reactions of Acetone-Butanol Fermentation
- 15.2.12. Energy Efficiency of Acetone-Butanol Fermentation
- 15.2.13. Products of Acetone-Butanol Fermentation
- 15.2.14. Hydrogen Fermentation
- 15.2.15. Characteristics of Hydrogen Fermentation
- 15.2.16. Reactions of Hydrogen Fermentation
- 15.2.17. Energy Efficiency of Hydrogen Fermentation
- 15.2.18. Products of Hydrogen Fermentation
- 15.2.19. Lactic Acid Fermentation
- 15.2.20. Lactic Acid Bacteria
- 15.2.21. Biomass Resources for Lactic Acid Fermentation
- 15.2.22. Utilization of Unused Biomass from Palm Oil Industry
- 15.2.23. Lactic Acid Fermentation from Kitchen Garbage
- 15.2.24. Purification of Lactic Acid
- 15.2.25. Silage
- 15.2.26. Silage Making
- 15.2.27. Silage Fermentation
- 15.2.28. Roll Bale Silage
- 15.3. Composting
  - 15.3.1. Basic Principles of Composting
  - 15.3.2. Basic Elements of Composting
    - (a) Preprocessing
    - (b) Fermentation
    - (c) Product Forming Process
- 15.4. Current Composting Technology
- 16. REUSE OF BIO-GENIC IRON OXIDES AND WOODY BIOMASS FLY ASH IN CEMENT BASED MATERIALS AND AGRICULTURAL AREAS
  - 16.1. Introduction
  - 16.2. Materials and Methods
    - 16.2.1. Preparation of Hardened Cement Paste Specimens
    - 16.2.2. Monolith Leaching Test
  - 16.3. Characterization of WBFA

16.4. Leaching Behavior of Blended Cement Pastes

17. BIS SPECIFICATIONS

18. PHOTOGRAPHS OF MACHINERY WITH SUPPLIERS CONTACT DETAILS

Charcoal Briquettes Machine

Automatic Agrowaste Cum Biomass Briquette Making Machine

Automatic Biomass Briquette Machine

Agro Waste Biomass Briquetting Plant

Biomass Pellet Making Machine

Activated Carbon Making Plant

Biodiesel Plant

Fuel Ethanol Plant

Automatic Bioethanol Plant

Fully Automatic Fly Ash Brick Making Machine

Biomass Gasification Plant

Fluid Bed Gasifier for Thermal & Electrical

Acetic Acid Recovery Plant

19. PLANT LAYOUT & PROCESS FLOW CHART

## **About NIIR Project Consultancy Services (NPCS)**

NIIR Project Consultancy Services (NPCS) is a reliable name in the industrial world for offering integrated technical consultancy services. Its various services are: Pre-feasibility study, New Project Identification, Project Feasibility and Market Study, Identification of Profitable Industrial Project Opportunities, Preparation of Project Profiles and Pre-Investment and Pre-Feasibility Studies, Market Surveys and Studies, Preparation of Techno-Economic Feasibility Reports, Identification and Selection of Plant and Machinery, Manufacturing Process and/or Equipment required, General Guidance, Technical and Commercial Counseling for setting up new industrial projects and industry. NPCS also publishes various technology books, directories, databases, detailed project reports, market survey reports on various industries and profit making business. Besides being used by manufacturers, industrialists, and entrepreneurs, our publications are also used by Indian and overseas professionals including project engineers, information services bureaus, consultants and consultancy firms as one of the inputs in their research.

NIIR PROJECT CONSULTANCY SERVICES

106-E, Kamla Nagar, New Delhi-110007, India.

Tel: 91-11-23843955, 23845654, 23845886, +918800733955

Mobile: +91-9811043595

Email: [npcs.ei@gmail.com](mailto:npcs.ei@gmail.com), [info@entrepreneurindia.co](mailto:info@entrepreneurindia.co)

Website: [www.entrepreneurIndia.co](http://www.entrepreneurIndia.co)