

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous Institute Affiliated to RGPV, Bhopal)

NAAC Accredited with A++ Grade

Name of the Course: Biomass Energy Conversion Techniques 910219

Proposed By: Dr. Sunita Sharma

Department: Applied Science

Credits: 03

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Objective of the course

This course will provide an insight to the basics of biomass, various conversion technologies and the different types of products that can be obtained upon successful conversion.

Unit I: Introduction: Major sources of energy: primary and secondary energy sources, conventional and non-conventional energy sources and their importance; Energy from bio-based feedstock: Availability of the feedstock, compositional analysis and properties of feedstock, preparation of fuel pellets using bio-additives, carbonization, torrefaction

Unit-II: Biomass: basics, dedicated energy crops, Oil corporations and microalgae, Enhancing biomass properties, Pretreatment of biomass: Barriers and its types, Dilute acid, alkali, ozone and hybrid methods Energy from coal: coal carbonization, gasification and liquefaction. Combustion process (biomass/coal): Combustion stoichiometry and combustion chemistry

Unit-III: Physical and Thermochemical conversion:

Simultaneous bio-char and bio-oil production and their application, hydrothermal liquefaction of bio-based feedstocks, comparison of biomass with conventional fuels Gasification (practice example), upstream and downstream processing, comparison of conventional gasification with sub-supercritical water gasification process, plasma gasification

Unit-IV: Biochemical conversion process:

Anaerobic digestion in landfills, landfill gas and biogas, bioconversion into biogas, single/two-stage anaerobic digestion, wet and dry fermentation, integrated centralized co-digestion plant concept, comparison of biochemical and thermochemical routes, competitive production of alcohol, bioethanol production from edible sources and non-edible sources, process description, distillation, combined biogas and bioethanol production.

Unit-V: Chemical conversion processes:

Biodiesel production, different types of feedstock, extraction process, mechanism of trans esterification, fuel characteristics of biodiesel, green diesel synthesis from bio-based feed stocks and their applications

Course Outcomes: Upon successful completion of the course, the student will be able to

CO-1: Explain the different sources of energy

CO-2: Describe the biomass pretreatment techniques required for energy production

CO-3: Explain Physical and Thermochemical conversion methods used for production of energy

CO-4: Explain Biochemical conversion process used for production of energy

CO-5: Explain Chemical conversion processes used for production of energy

Books Recommended

1. Basu S. (2013), Biomass gasification, pyrolysis and torrefaction, 2nd Ed., Publisher AP.
2. Sarkar S. (2010); Fuels and Combustion, Third Edition, CRC Press.