

Recursos renovables y biorrefinerías

Docente/s Responsable/s:

Dr. Apostolis Koutinas

Carga Horaria del Curso:

35 hs.

Destinatarios del Curso:

Docentes y alumnos de postgrado de Ingeniería Química, Ingeniería de Alimentos, Lie. En Ciencias Biológicas, etc.

Propuesta Sintética del Curso (Objetivos, Contenidos, Modalidad, Evaluación, Etc.)

Course objectives and content are developed in the following section. The course will be developed at the Chemical Engineering Department, UNS with a final evaluation.

Programa Analítico y Bibliografía Sintética:

Session 1 - An introduction to biorefinery development

Description of the global need to substitute fossil fuels for renewable resources as raw material for the production of fuels and chemicals. Description of the analogy between petroleum refineries and biorefinery development based on renewable resources. Classification of biorefineries based on the type of biomass utilised (e.g. starch-rich crops, sucrose-rich feedstocks, lignocellulosic plants and residues, oilseeds, various wastes). Presentation of a case study assessing the potential of biofuel and chemical production from renewable resources.

Session 2 - Design and economic evaluation

Preliminary techno-economic evaluation of biorefinery development including formulation of process flow sheets, description of major unit operations, estimation of total capital investment, estimation of total operating cost and profitability assessment. This lecture session will be useful in subsequent case studies.

Session 3 - Biofuel production

Description of biofuel types (e.g. bioethanol, biohydrogen, biodiesel) considering the type of renewable raw materials and the processing mode employed. Emphasis will be given on the production of microbial oil (or single cell oil) that could be used as an alternative to plant-derived oil for the production of biodiesel. Presentation of two case studies assessing the potential of bioethanol production from wheat and biodiesel production from microbial oil.

Session 4 - Chemical production from biomass

Introduction to platform chemical production from renewable resources as substitutes for major chemicals (e.g. ethylene, propylene) derived from petroleum and used by the current chemical industry. Emphasis will be given on platform chemicals (e.g. succinic acid, fumaric acid, itaconic acid) produced via industrial ("white") biotechnology. Green chemistry as a sustainable route to chemical production. Presentation of a case study assessing the potential of succinic acid production from wheat flour milling by-products.

Session 5 - Biodegradable polymer production

Introduction to biodegradable polymers that can be produced via microbial bioconversion of renewable resources. Emphasis will be given on the production of poly-lactic acid (PLA) and poly-hydroxyalkanoids (PHAs). Presentation of a case study assessing the potential of PHA production from various renewable raw materials.

Session 6 - Biorefinery development based on food waste

Description of various types of food processing and municipal wastes. Classification of food waste based on composition (e.g. carbohydrates, protein, oil, fats, minor constituents). Current treatment methods and future potential through valorisation for the production of value-added products (e.g. bio-energy, chemicals, biopolymers, food additives, specialities). Potential of biorefinery development through integration of food waste valorisation in traditional food industries. Presentation of a case study assessing the potential of chemical production from food wastes.

Session 7 - Life cycle analysis

Emphasis will be given on the description of life cycle assessment as an indispensable tool that should be used to evaluate the environmental impact of proposed biorefining concepts. This lecture session will be mainly an introduction to life cycle assessment.

Session 8 - Final evaluation.

Bibliography: see CV Koutinas.