Last update: 23-04-2019

220074 - Lignocellulosic Biorefineries

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering

Teaching unit: 714 - ETP - Department of Textile and Paper Engineering

Academic year: 2019

Degree: BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Teaching unit Optional)

ECTS credits: 3 Teaching languages: English

Teaching staff

Coordinator: Cristina Valls

Others: Teresa Vidal
Blanca Roncero

Teaching methodology

The course is divided into parts:
- Theory classes
- Laboratory Sessions
- Self-study for doing reports and activities.

In the theory classes, teachers will introduce the theoretical basis of the concepts, methods and results and illustrate them with examples appropriate to facilitate their understanding.
In the lab sessions, students will practice the knowledge acquired setting practical experiments. Students will be organized in small groups. The results of practical experiences will be summarized in reports that each student will have to perform individually.
Students, independently, need to work on the materials provided by teachers in order to fix and assimilate the concepts. The teachers provide the syllabus and monitoring of activities (by ATENEA).

Learning objectives of the subject

In this course students will learn the main aspects of a Lignocellulosic Biorefinery and their relation with the Paper Industry. The main goal Lignocellulosic Biorefineries is to replace the Petroleum Refinery in order to reduce the Climate Change. By treating the Biomass with chemical, mechanical or biotechnological treatments, biofuels (like bioethanol or biodiesel) and biobased materials (like bioplastics or nanocellulose) can be obtained. All these concepts will be explained during the course in combination with practical sessions.

Study load

Total learning time: 75h	Hours large group:	30h	40.00%
	Self study:	45h	60.00%

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Content

Module 1: Introduction to the Lignocellulosic Biorefineries

Learning time: 10h

Theory classes: 3h
Self study : 7h

Description:
1. The need to substitute the petroleum refineries for the lignocellulosic biorefineries in order to contribute to a more sustainable development will be exposed.

Related activities:
Practical sessions of Microscopic Analysis of Biomass.

Module 2: Biotechnological, mechanical and chemical treatments of Lignocellulosic Biomass

Learning time: 31h

Theory classes: 13h
Self study : 18h

Description:
In order to produce biofuels or biomaterials the lignocellulosic biomass has to be fragmented into the different components. The different possibilities of treating the biomass will be analyzed.

Related activities:
Practical session of Microscopic Analysis of Microorganisms.
Practical sessions of biotechnological, mechanical and chemical treatments of Lignocellulosic Biomass.

Module 3: First and second-generation of biofuels and biomaterials

Learning time: 15h

Theory classes: 7h
Self study : 8h

Description:
The differences between the first generation biorefineries (also called food-biorefineries) and the second-generation biorefineries (also called non-food biorefineries) will be discussed. Students will learn about the different ways of obtaining biofuels (like bioethanol or biodiesel) and biomaterials.

Related activities:
Practical session of Process Simulation by CADSIM.

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Module 4: Biorefinery: The Paper Mill of Tomorrow	Learning time: 19h Theory classes: 7h Self study : 12h

Description:
The tendency of converting a Pulp and Paper Mill into a Biorefinery will be explained. Students will learn the different bioproducts that can be obtained from a pulp mill (like vanillin, xylitol or nanocellulose).

Related activities:
Practical sessions of characterization of lignocellulosic-treated biomass.

Qualification system

The final grade depends on the following assessment criteria:

- Activity 1(Lab sessions), weight: 10%
- Activity 2 (Lab written reports), weight: 30%
- Activity 3 (Oral presentation), weight: 20%
- Activity 4 (Final exam), weight: 40%

Bibliography

Basic:

Ek, Monica; Gellerstedt, Göran; Henriksson, Gunnar. Pulp and paper chemistry and technology. Berlin: De Gruyter, cop. 2009. ISBN 9783110213393.

Wertz, Jean-Luc, Bédué, O. Lignocellulosic Biorefineries. Lausanne: EPFL Press, cop. 2013. ISBN 978294022268.

Complementary:

Ek, Monica; Gellerstedt, Göran; Henriksson, Gunnar. Pulp and paper chemistry and technology. Berlin: De Gruyter, cop. 2009. ISBN 9783110213416.

Ek, Monica; Gellerstedt, G.; Henriksson, G. Pulp and paper chemistry and technology. Vol. 2, Pulping chemistry and technology. Berlin: De Gruyter, cop. 2009. ISBN 9783110213416.

García Hortal, José Antonio. Fibras Papeleras. Barcelona: Edicions UPC, 2007. ISBN 9788483019160.