66239 - Waste valorization processes. Biorefinery

Información del Plan Docente

Academic Year	2017/18
Faculty / School	110 - Escuela de Ingeniería y Arquitectura
Degree	531 - Master's in Chemical Engineering
ECTS	6.0
Year	
Semester	Half-yearly
Subject Type	Optional
Module	---

1.General information

1.1.Introduction

The development of valorization programs is necessary in the current waste management systems. The subject Valorisation of Waste. Biorefinery, addresses the study of different alternatives for recycling and recovery of the most important waste materials, with special dedication to organic waste and its energy recovery within the global framework of the circular economy

1.2.Recommendations to take this course

To take the subject of Waste Recovery. Biorefinery is recommended to follow previuosly the subject "Environmental Engineering", obligatory subject that belongs to the common module of the industrial branch at all Engineering Degrees. Attendance to class, continuous study and day-to-day work are essential for the student to achieve satisfactorily the proposed learning.

1.3.Context and importance of this course in the degree

The student who studies this subject will contribute as a bag of knowledge, skills and learning outcomes acquired in the subject "Environmental Engineering" of Chemical Engineering Degree, or similar, in which the fundamentals on waste are presented.
The subject of Waste Valorization. Biorefinery is complemented with the subject "Environmental Management at the Industry" (Obligatory Matter of 6 ECTS, taught in the first semester of the Master's degree), as well as with the rest of subjects that constitute the Optional Matter of Environmental Engineering, all within Of the Module of Processes and Products Engineering.
In this sense, in the course of the subject the student will acquire competences directly aimed at the professional practice in the environmental field, from a point of view of analysis and design of waste treatment."

1.4.Activities and key dates

It is a subject of 6 ETCS credits, which is equivalent to 150 hours of student work, to be done in both face-to-face and non-face-to-face hours, broken down as follows:
* 35 hours of face-to-face class, distributed in approximately 3 hours per week. In them will be exposed the theoretical contents and concepts necessary for the resolution of practical cases.
* 15 hours of problem-based learning, distributed in approximately 1 hour per week. In them will develop problems and practical cases in companies of the sector and coordinated in content with the temporal evolution of theoretical

expositions.

* 7 hours of laboratory related to waste characterization.
* 3 hours of visits to companies in the sector of waste recovery and biorefinery.

* 20 hours of application work that will consist of the development, expansion, documentation, resolution ... of cases proposed by the students or by the teachers, based on the concepts seen in the classroom. These works will be distributed during the course, will be individual or small group (2-3students) and will be translated into a deliverable that will be corrected and qualified.
* 60 hours of personal study and guardianship, distributed throughout the semester.
* 10 hours of evaluation tests, corresponding to exams.
The schedule of the subject is adapted to the one established by the Faculty of Engineering and Architecture (EINA), as well as its schedules and calendar of exams, and they can be consulted all in their Web page: http://eina.unizar.es

2.Learning goals

2.1.Learning goals

The student, to overcome this subject, must demonstrate the following results ...
Know the current processes of valorization of the main waste generated.
Analyze different recovery alternatives and select the most suitable for a particular waste.
Apply acquired knowledge to plan the recovery of a waste.
It determines operating conditions in the main stages of the recovery processes.

2.2.Importance of learning goals

The monitoring and passing of the subject aims to complete the scientific and technical training of the student, and set the specific knowledge of the module of Process Engineering and Product, defined in Resolution of June 8, 2009 of the General Secretariat of Universities - BOE 4 August 2009-, in its concrete application to environmental management.
With this intention, it is intended that the student is able to acquire the learning results that are listed in the corresponding section.

3.Aims of the course and competences

3.1.Aims of the course

The subject and its expected results respond to the following approaches and objectives:
This subject aims to provide the student with scientific and technical knowledge about the processes and technologies of waste treatment, within the framework of current legislation. It is intended that the student knows the main types of waste, their problems and their main treatment pathways.

3.2.Competences

Generic Competencies
* Ability to apply the scientific method and principles of engineering and economics, to formulate and solve complex problems in processes, equipment, facilities and services, in which the subject experiences changes in its composition, state or energy content, characteristic of the Chemical industry and other related sectors including pharmaceutical, biotechnology, materials, energy, food or environmental (CG1).
* Design, design, calculate, and design processes, equipment, industrial facilities and services in the field of chemical

engineering and related industrial sectors in terms of quality, safety, economy, rational and efficient use of natural resources and Environment (CG2).
* To manage and manage technically and economically projects, facilities, plants, companies and technology centers in the field of chemical engineering and related industrial sectors (CG3).
* Conduct appropriate research, design and direct the development of engineering solutions in new or poorly understood environments, relating creativity, originality, innovation and technology transfer (CG4).
* To know how to establish mathematical models and to develop them through appropriate informatics, as scientific and technological basis for the design of new products, processes, systems and services, and for the optimization of others already developed (CG5).
* Ability to analyze and synthesize the continuous progress of products, processes, systems and services using criteria of safety, economic viability, quality and environmental management (CG6).
* Integrate knowledge and face the complexity of making judgments and decision making, based on incomplete or limited information, including reflections on the social and ethical responsibilities of professional practice (GC7).
* Lead and define multidisciplinary teams capable of resolving technical changes and management needs in national and international contexts (GC8).
* Adapt to change, being able to apply new and advanced technologies and other relevant developments, with initiative and entrepreneurship (GC10).
* Have the skills of autonomous learning to maintain and improve one's own competences Of chemical engineering that allow the continuous development of the profession (CG11).

Specific Competences
* Apply knowledge of mathematics, physics, chemistry, biology and other natural sciences, obtained through study, experience, and practice, with critical reasoning to establish economically viable solutions to technical problems (CE1).
* To design products, processes, systems and services of the chemical industry, as well as the optimization of others already developed, taking as technological basis the different areas of chemical engineering, comprehensive of processes and phenomena of transport, separation operations and engineering of Chemical, nuclear, electrochemical and biochemical reactions (CE2).
* Conceptualize engineering models, apply innovative methods in problem solving and suitable software applications for design, simulation, optimization and control of processes and systems (CE3).
* Ability to solve problems that are unfamiliar, incompletely defined, and have competing specifications, considering possible methods of solution, including the most innovative, selecting the most appropriate, and being able to correct the implementation, evaluating the different solutions. Design (CE4).
* Direct and supervise all types of installations, processes, systems and services of the different industrial areas related to chemical engineering (CE5).
* Design, construct and implement methods, processes and facilities for the integral management of solid, liquid and gaseous supplies and wastes in industries, with the capacity to evaluate their impacts and their risks (CE6).
* Directing and managing the organization of work and human resources applying industrial safety, quality management, occupational risk prevention, sustainability, and environmental management criteria (CE8).
* Adapt to structural changes in society motivated by economic, energy or natural factors or phenomena, to solve the problems arising and to provide technological solutions with a high commitment to sustainability (CE10).
* Conduct and carry out verification, control of facilities, processes and products, as well as certifications, audits, verifications, tests and reports (CE11).

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

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The student must demonstrate that he / she has achieved the expected learning outcomes through the following assessment activities
Option 1:
The evaluation is global and includes:
1. Realization of problems and cases proposed during the course development. The corresponding deliverables will be of a periodic nature and will be graded considering their content, the understanding of the concepts that are demonstrated in them and the correct presentation.
2. Conduct a test at the end of the course.
The grade of the subject will be calculated according to the following formula:
Note = 0.25.P + 0.75.E
Being: P the grade obtained in the accomplishment of the problems and the periodical deliveries, and E the note of the final exam.
A minimum grade of 4'0 out of 10 is required in each part to average the final mark and to pass the subject.
Option 2:
Those students who do not want / can follow the evaluation according to option 1, may choose to take a similar exam examination (100% of the final mark) with the final exam of option 1.

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. It favors the development of a critical view of the industry processes. A wide range of teaching and learning tasks are implemented, such as

- Lectures, where the fundamentals of each topic will be presented.
- problem-solving and case studies will be presented and analyzed for a better comprehension. The problems and industrial cases are the effective complement and way to allow and verify the compression of each concept.
- Assignments and autonomous work.

Students are expected to participate actively in the class throughout the semester.

5.2.Learning tasks

The course includes the following learning tasks:

- Lectures (35 hours). The theory of the different proposed topics will be taught. Practical cases will be analyzed as examples of the methodologies.
- Practice sessions (15 hours). In these classes, practical cases will be solved by students under the supervised of the professor. Problems or cases will be related to the theoretical part explained in lectures.
- Laboratory sessions (7 hours). They are related to waste characterization.
- Visits to companies (3 hours). Visit to facilities of the waste recovery and biorefinery sectors.
- Assignment (20 hours). individual or in group. Various activities by will be proposed by the teachers.
- Autonomous work and study (50 hours). It is strongly recommended to study continuously throughout the semester.

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- Tutorials (10 hours).
- Assessment (10 hours).

5.3.Syllabus

The course will address the following topics:

SECTION 1. INTRODUCTION

- Wastes valorization processes: preparation for reuse, recycling, other varlorization processes (energy recovery). Analysis of advantages and limitations

SECTION 2. RECYCLING, and REUSE INDUSTRIAL PROCESSES

- 1. Description of processes and technologies. Application to different sectors (glass, plastics, used tires, vehicles out of use, biodegradable organic waste, etc.). National and regional strategic agendas for waste and residues
- 2. Recovery of waste materials landfilled "landfill mining"

SECTION 3. INDUSTRIAL PROCESSES ENERGY RECOVERY

- Description of processes and technology. Incineration with energy recovery, pyrolysis, gasification. Biodiesel production

SECTION 4. SYNERGY BETWEEN DIFFERENT PROCESSES

- Biorefinery concept. Integral valorization of residual biomass

5.4.Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website.

5.5.Bibliography and recommended resources

- Handbook of solid waste management / [editors] George Tchobanoglous, Frank Kreith . - 2nd ed. New York [etc.] : McGraw Hill, cop. 2002
- Tratamiento y valorización energética de residuos / Xavier Elias Castells, director [Madrid] : Fundación Universitaria Iberoamericana : Díaz de Santos, D.L. 2005