Course guide
240EQ332 - 240EQ332 - Bioplastics and Polymer Biomaterials

Last modified: 27/05/2024

Unit in charge: Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.

Degree: **Academic year:** 2024 **ECTS Credits:** 4.5
Languages: English

LECTURER

Coordinating lecturer: CARLOS ENRIQUE ALEMAN LLANSO

Others: Primer quadrimestre:
CARLOS ENRIQUE ALEMAN LLANSO - T10
LUIS JAVIER DEL VALLE MENDOZA - T10

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEMQ1. Apply knowledge of mathematics, physics, chemistry, biology and other natural sciences, obtained through study, experience, and practice, critical reasoning to establish economically viable solutions to technical problems.

CEMQ9. Manage the Research, Development and Technological Innovation, based on the transfer of technology and property rights and patents.
CEMQ13. Organization, presentation and defense, now that all the credits of the curriculum, an original exercise performed individually before a university tribunal, consisting of a comprehensive project of Chemical Engineering professional nature which synthesize skills acquired in teachings.

Generical:
CGMQ4. Conduct proper research, undertake design and lead the development of engineering solutions in new or unfamiliar environments, linking creativity, originality, innovation and technology transfer.
CGMQ6. Ability to analyze and synthesize to the continued progress of products, processes, systems and services using criteria of safety, affordability, quality and environmental management.
CGMQ11. Possess independent learning skills to maintain and enhance the competencies of chemical engineering to enable the continued development of their profession.

Transversal:
CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

TEACHING METHODOLOGY

Lectures and presentation of works

LEARNING OBJECTIVES OF THE SUBJECT

Learn the basic knowledge about bioplastics and polymeric biomaterials. Gain theoretical understanding and design allowing bioplastics and polymeric biomaterials. Learning to reason about relations structure - properties. Learn reasoning schemes that apply in the field of research in bioplastics and polymeric biomaterials.

STUDY LOAD

Type	Hours	Percentage
Hours small group	40,5	36.00
Self study	72,0	64.00

Total learning time: 112.5 h

CONTENTS

1. Biosustainability and biodegradability

Description:
Sustainable development. Green chemistry: atomic economy. The parameters of sustainability. Analysis of biological cycles (LCA). Toxicity. Biodegradability. Biodegradation mechanisms and evaluation methods. Regulation of sustainability. Bioplastics.

Full-or-part-time: 6h
Theory classes: 6h

2. Sustainable monomers

Description:
Traditional naturally occurring monomers. Chemical and biotechnological production processes. Green Catalysis. Sustainable Ethylene bioethanol. Sustainable additives: Green plasticizers. Lignin as a source of monomers.

Full-or-part-time: 4h
Theory classes: 4h

3. Polymers and sustainable bioplastics

Description:
Impact of the manufacture and use of polymers. LCA analysis polymers. New synthesis strategies. Sustainable methods of polymerization. Replacing traditional toxic monomers: New bioplastics. New alternatives from carbohydrates and natural oils. The Contribution of polylactic acid recycling techniques.

Full-or-part-time: 6h
Theory classes: 6h

4. Nanostructured Polymers and copolymers

Description:
Biopolymers of technological interest: starch and cellulose. Proteinaceous biopolymers. Modifications and industrial applications. Polymers bacterial polyesters and polysaccharides. Industrial applications. Economic aspects.

Full-or-part-time: 4h
Theory classes: 4h

5. Biomarials and living systems

Description:
Biomaterials: classification. Biocompatibility and hemocompatibility. Response of living beings. Regulations and biocompatibility tests. Surface modification. Surface analysis. Sterilization

Full-or-part-time: 5h
Theory classes: 5h

6. Polymeric biomaterials

Description:
Surgical sutures. Adhesives. Polymer cements. Dental restorations and implants. Hydrogels. Contact lenses. Artificial skin. Polymers in pharmaceutical tablets. Controlled release of drugs.

Full-or-part-time: 7h
Theory classes: 7h

7. Advanced bioplastics

Description:
New biocomposites based bioplastics. Flexible and low migration bioplastics. Hybrid bioplastics. Sustainable bioplastics based coatings: paint and plastic coatings.

Full-or-part-time: 6h
Theory classes: 6h

8. Boplastics based on peptides and polypeptides

Description:
Polypeptides based bioplastics. Bioplastics obtained from the self-assembly of peptides: Peptide materials. Bioplastic conjugates.

Full-or-part-time: 6h
Theory classes: 6h

GRADING SYSTEM

NC= (NP1+NP2+NP3) / 3
Where NC is the course mark and NP1-NP3 are the marks of the three parts in which the subject is divided.

EXAMINATION RULES.

Examination: it consists of several theoretical and practical questions related with the topics explained along the course.

BIBLIOGRAPHY

Basic:
- Lendlein, Andreas; Sisson, Adam L. (eds.). Handbook of biodegradable polymers : synthesis, characterization and applications [on line]. Weinheim: Wiley-VCH, cop. 2011 [Consultation: 21/05/2020]. Available on: http://onlinelibrary.wiley.com/book/10.1002/9783527635818. ISBN 9783527635818.
- Bastioli, Catia (ed.). Handbook of biodegradable polymers. 2nd ed.. Shrewsbury: Smithers Rapra Technology, 2014. ISBN 9781847355270.
- Alemán, Carlos; Bianco, Alberto (eds.). Peptide materials : from nanostructures to applications [on line]. Chichester: John Wiley & Sons, 2013 [Consultation: 21/05/2020]. Available on: http://onlinelibrary.wiley.com/book/10.1002/9781118592403. ISBN 9781118592403.