Course guide
240378 - 240IQU39 - Bioplastics: Experimental

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.
Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Optional subject).
Academic year: 2023 ECTS Credits: 4.5 Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: DOMINGO ANTXON MARTINEZ DE ILARDUYA SAEZ DE ASTEASU

Others: García Alvarez, Montserrat
Perez Gonzalez, Juan Jesus
Alla Bedahnane, Abdelilah
Tinajero Diaz, Ernesto
Antxon Martinez de Ilarduya

PRIOR SKILLS

Bachelor of Science or Engineering with knowledge of chemistry

REQUIREMENTS

Preferably, due to space limitations in laboratories and maintenance of safety distances, have enrolled in the specialty of chemistry of the MUEI.

TEACHING METHODOLOGY

1) Theoretical classes will be taught about the introduction to the different practical classes,
2) Laboratory practices about synthesis and characterization of polymers and biopolymers will be carried out.
3) If student group is large (> 10 students) a visit to a company in the polymers industry sector will be performed.
4) Self study: Implementation and reporting laboratory practices.

LEARNING OBJECTIVES OF THE SUBJECT

Introduction to the knowledge of basic concepts of polymers and eventually of biotechnology, by laboratory experimentation and instrumental analysis.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Self study</td>
<td>72,0</td>
<td>64.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>40,5</td>
<td>36.00</td>
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</tbody>
</table>

Total learning time: 112.5 h
## CONTENTS

### Introduction to polymers

**Description:**

**Full-or-part-time:** 3h

Theory classes: 3h

### Polymer characterization 1. FTIR

**Description:**
Introduction to FTIR. Polymer applications. Practice session with commercial polymers

**Full-or-part-time:** 3h

Theory classes: 1h
Laboratory classes: 2h

### Polymer characterization 2. NMR. Session 1

**Description:**
Introduction to Nuclear Magnetic Resonance. Polymer applications. Practical sessions in a 300 MHz NMR equipment.

**Full-or-part-time:** 3h

Theory classes: 1h 30m
Laboratory classes: 1h 30m

### Characterization of polymers 2. NMR. Session 2

**Description:**
Characterization of polymers by NMR. Session 2.

**Full-or-part-time:** 3h

Laboratory classes: 3h

### Synthesis of a polyester by melt polycondensation

**Description:**
Synthesis of a polyester by polycondensation reaction in bulk. Spectroscopic characterization of the end product

**Full-or-part-time:** 3h

Laboratory classes: 3h

### Synthesis of a polyester by enzymatic ring opening polymerization (ROP)

**Description:**
A polyester will be synthesized through ring-opening reaction from a macrolactone and different proportions of initiator. The effect of the initiator content on the obtained molecular weight will be studied.

**Full-or-part-time:** 3h

Laboratory classes: 3h
<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
<th>Full-or-part-time</th>
<th>Laboratory classes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Molecular weight determination. Viscometry and GPC</strong></td>
<td>Molecular weight determination. Viscometry and GPC</td>
<td>3h</td>
<td>3h</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>Determinación de los pesos moleculares promedio en número, peso, viscosimétrico y dispersidad mediante viscosimetría capilar y GPC.</td>
<td></td>
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<tr>
<td><strong>Determination of thermal properties. DSC and TGA</strong></td>
<td>Thermal analysis of synthesized polymers by differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA).</td>
<td>3h</td>
<td>3h</td>
</tr>
<tr>
<td><strong>Determination of mechanical properties</strong></td>
<td>Determination of mechanical properties of polymers by stress-strain tests.</td>
<td>3h</td>
<td>3h</td>
</tr>
<tr>
<td><strong>Preparation of polymeric nanoparticles. Determination of sizes and zeta potentials (DLS)</strong></td>
<td>Polymeric nanoparticles will be prepared with polymers synthesized in the laboratory using the emulsion/evaporation method. Various factors that affect their final size will be studied.</td>
<td>3h</td>
<td>3h</td>
</tr>
<tr>
<td><strong>Biotechnology. Structure of proteins.</strong></td>
<td>Determination of protein structure by molecular simulation programs</td>
<td>3h</td>
<td>3h</td>
</tr>
<tr>
<td><strong>Visiting a company.</strong></td>
<td>Visit a company of polymers</td>
<td>4h</td>
<td>4h</td>
</tr>
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</table>
Final exam

Description:
Examen final de la asignatura

Full-or-part-time: 2h
Theory classes: 2h

GRADING SYSTEM

1) Evaluation of practices and practical reports (NP)
2) Final exam (EF)
Final note: 0.7 NP + 0.3 EF
Reassessment only replaces final exam grade

BIBLIOGRAPHY

Basic:

RESOURCES

Other resources:
Synthesis laboratory fully equipped. Instrumentation: DSC (Perkin Elmer), TGA (Mettler), NMR (Bruker), GPC (Waters), DLS (Malvern), Ultrasounds (Hielscher), Universal Testing Machine (Zwick)