Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 215 - Faculty of Chemistry

Cycle .

Degree GQUIMI20 - Bachelor's Degree in Chemistry

Year Fourth year

COURSE

26112 - Macromolecular Chemistry

Credits, ECTS: 6

COURSE DESCRIPTION

The aim of this course is that the student knows the most common synthesis methods in the production of polymers or macromolecules: step polymerization and chain polymerization with its different variants. Likewise, the course contains an introduction to the methods of chemical modification of already synthesized macromolecules that can result in substantial variations of their properties and in applications in diverse fields. This knowledge is interesting in order to approach, finally, the different processes of environmental degradation of macromolecular materials, due to the competition of oxygen with light, heat, mechanical aggressions and biodegradation. The practical laboratory sessions will develop the student's skills in relation to different synthesis and modification reactions of macromolecules as well as very representative degradation processes.
This subject is an optional course of the Macromolecular Materials speciality, it is studied in the fourth year of the Chemistry Degree and it is complemented with other subjects of the same speciality. Both theoretical and practical classes are given in the first four-month period.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The course is part of the macromolecules speciality, within the advanced module and, as such, shares the transversal competences assigned to this module. More specifically, this course develops the competences [M03.CM01] [M03.CM11] [M03.CM12] [M03.CM13] [M03.CM17] and [M03.CM18].

M03.CM01: Understanding and knowledge of the basics of general methods of obtaining synthetic macromolecules, their chemical modification and the various processes of environmental degradation.

M03.CM11: Ability to design, arrange and carry out experimental processes and to use instrumental techniques appropriate to different types of chemical problems.

M03.CM12: Knowledge of online tools and services that provide information in the field of chemistry.

M03.CM13: Communicate processes related to chemistry and related subjects, in oral presentations and/or written reports , using one of the two official languages of the Basque Autonomous Community or English.

M03.CM17: Demonstrate skills of observation, analysis and synthesis with critical and self-critical capacity.

M03.CM18: Demonstrate the ability to learn and work in an autonomous manner towards the development of professional life.

The coordination of this subject with the others of the Module corresponds to the Coordination Commission of the Degree in Chemistry.

Theoretical and Practical Contents

Introduction. Definitions and general concepts about macromolecules and synthesis of macromolecules. Polymerizable structures and polymerization techniques. Classification of polymerization reactions.

Step Polymerisation . General scheme. Molecular weight control. Cycling versus polymerisation. Exchange reactions. Non-linear polymers. Polymerisation techniques. Open and closed polymerisation systems. Staged copolymerisation. Types of reactions that lead to polymers of interest

Chain polymerisation. General scheme. Useful reactions for chain polymerisation. Live polymerisation. Polymer structure. Roof temperature. Radical polymerisation. Ionic polymerisation of alkenes and cyclic monomers Stereospecific polymerisation. Copolymerization.

Polymer modification reactions. Properties. Polymer skeleton reactions. Lateral group reactions. Macromolecule cross-linking Graft and block copolymers

Polymer degradation. Definitions and general aspects. Experimental techniques. Thermal and thermoxidative degradation. Photoxidative degradation. Mechanical oxidative degradation. Biodegradation. Stabilisation against degradation: antioxidants and photo-stabilisers.

Polymer synthesis and degradation practices (Laboratory practices). Use of different synthesis reactions to prepare and modify polymers, and the use of different techniques to study the degradation of polymeric materials.

TEACHING METHODS

The subject of this course has been divided in two modules of eminently theoretical character, and a practical module.

In the master classes the theoretical contents of the subject will be explained. The seminars will be organized in groups where questions about the theoretical and practical contents of the subject will be discussed. These questions will be presented by the students in an oral and written way. The practical laboratory classes will cover a wide variety of aspects of the subject and will be carried out in groups. Each group will carry out the practices proposed by the teacher.

The theoretical modules will be evaluated in the corresponding controls:

1. Step polymerization, chain polymerization
2. Modification of macromolecules and polymer degradation.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	40	5		15					
Horas de Actividad No Presencial del Alumno/a	60	15		15					

Legend:

M: Lecture-based	S: Seminar	GA: Applied classroom-based groups
GL: Applied laboratory-based groups	GO: Applied computer-based groups	GCL: Applied clinical-based groups
TA: Workshop	TI: Industrial workshop	GCA: Applied fieldwork groups

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 45%
- Multiple choice test 10%
- Exercises, cases or problem sets 30%
- Oral presentation of assigned tasks, Reading¿ 15%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

- Written test
- Individual tests
- Group work
-Exposition of works
- Carrying out practices

Continuous evaluation with mandatory participation in each and every one of the following evaluable activities: 2 control tests, Seminars, Laboratory practices.

45% of the final mark will be distributed between the written exams of the two controls, with 30% for the first control and 15% for the second control. If the student passes the first control, he releases the corresponding part and in the final exam he will take the 2nd control and the 1st if he has not passed it. This test will serve to evaluate the competences M03CM01, M03CM11 and M03CM17.
The remaining 55% of the final mark will be distributed as follows:

- Laboratory practice: 30%. Includes: continuous assessment in laboratory work based on observed attitude and progress and detailed practice documents/reports. Attendance at the laboratory practices will be a condition for passing the course. The qualification of NOT SUBMITTED will be given to the student who does not take the final written test, as this weighs more than 50% of the overall mark. The competences associated to this evaluation are: M03CM01, M03CM11, M03CM12, M03CM13, M03CM17and M03CM18.

- Seminars: 15%. It includes the continuous evaluation based on the participation in the activities of interaction in class and in oral presentation of works in group. The evaluation corresponds to the competences: M03CM01, M03CM12, M03CM13 and M03CM17.
- Individual Tests: 10%. Work to be done individually in the e-classroom. The assessment examines the following ability:

M03CM01

NOTE: The criteria for rejecting continuous evaluation are those established in Chapter 2, Article 12 of the legislation regulating the evaluation of students for EHU degree courses. The conditions to be eligible for the evaluation by means of a single test are those established in Chapter 2, article 8 of the legislation regulating the evaluation of students of the EHU degree courses. In this case, the single test will consist of a set of theoretical/practical questions and laboratory practice.

The student will be given the qualification of NOT PRESENTED
- to renounce in time the continuous evaluation
- who, having requested a final evaluation, does not show up on the day of the test
- that even if he had attended some activity during the course he did not show up at the final written test.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

in the extraordinary announcement all the objectives for the course will be evaluated and the final mark corresponds to 100%.

MANDATORY MATERIALS

the materials required will be indicated in the Teaching Guide.

BIBLIOGRAPHY

Basic bibliography

G. Odian. Principles of Polymerization, 3th Edition. Wiley-Interscience, 1991.
R.J. Saunders. Organic Polymer Chemistry, 2nd edition. Chapman and Hall, 1988.
H.H.G. Jellinek and H. Kachi (ed.). Degradation and Stabilization of Polymers.
Elsevier, 1989.
N. Grassie and G. Scott. Polymer Degradation and Stabilisation. Cambridge University Press, 1985.

Detailed bibliography

P.Rempp, E.W. Mervill. Polymer Synthesis, 2nd edition, Hüthig and Wepf, 1991.
S.R. Sandler., W. Karo, J. A. Bonesteel, E.M. Pearce. Polymer Synthesis and Characterization. Academic Press, 1998.
M.P. Stevens. Polymer Chemistry. An introduction, 3rd edition. Oxford University
Press, 1999.
A. Ravve. Principles of Polymer Chemistry, 2nd edition. Plenum Publishers, 2000.
F.J. Davis. Polymer Chemistry. Oxford University Press, 2004.
W.L. Hawkings. Polymer Degradation and Stabilisation. Springer Verlag, 1984.
G. Geuskens. Degradation and Stabilisation of Polymers. Applied Science Publishers, 1975.
R.T. Conley. Thermal Stability of Polymers. Marcel Dekker, 1970.

Journals

Macromolecules
Polymer
Polymer Degradation and Stabilization

Web sites of interest

Macrogalleria: http://pslc.ws/spanish/index.htm

OBSERVATIONS

An average of 4 must be obtained in each part of the evaluation.