60459 - Asymmetric catalysis

Información del Plan Docente

Academic Year	2017/18
Faculty / School	100 - Facultad de Ciencias
Degree	543 - Master's in Molecular Chemistry and Homogeneous Catalysis
ECTS	2.0
Year	1
Semester	Second semester
Subject Type	Optional
Module	---

1.General information

1.1.Introduction

The field of study of the subject is the application of chiral compounds as catalysts in asymmetric synthesis. Chiral ligands and transition metals compounds in catalysis asymmetric are analysed. The reaction mechanisms and the practical applications of the most important enantioselective catalytic systems are studied.

1.2.Recommendations to take this course

It is recommended to have basic concepts of Inorganic Chemistry, Organic, Organometallic and Catalysis.

1.3.Context and importance of this course in the degree

Asymmetric Catalysis is a fundamental area inside the Catalysis that is closely related to other areas of Chemistry, such as Organometallic Chemistry and, Inorganic and Organic Chemistry. *Asymmetric Catalysis* is an optional subject of 2 ECTS scheduled in the second semester. The subject is included the optional module *Horizons in Molecular Chemistry*. The learning outcomes in this field are complemented by those of the three subjects included in the obligatory module of the master: *Catalysis*, *Synthetic Strategies in Advanced Organic Synthesis* and *Molecular Design in Inorganic and Organometallic Chemistry*. Moreover, *Asymmetric Catalysis* is closely related to the other subjects of the optional module: *Supramolecular Chemistry*, *Chemistry of Advanced Materials*, *Chemistry at the Frontiers of th the Biology or Sustainable Chemistry and Catalysis*.

1.4.Activities and key dates

The programmed activities will take place during the second semester in weekly two-hour sessions. The information about schedules, calendars and exams is available at the websites of the Sciences Faculty, https://ciencias.unizar.es/calendario-y-horarios, and the Master, http://masterqmch.unizar.es.

2.Learning goals

2.1.Learning goals

To know the general principles of stereochemistry and stereodifferentiation in catalysis.

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To know the most important enantioselective catalytic processes.

To analyse the most relevant parameters that characterize the efficiency of a catalyst in asymmetric reactions.

To evaluate the potential in asymmetric catalysis of homogeneous catalysts according to their nature.

To understand and interpret new knowledge in asymmetric catalysis.

2.2.Importance of learning goals

Learning outcomes of the subject are of great importance due to the significance of the field of study. Because of important industries such as agrochemicals, the flavors and fragrances, polymers and especially the pharmaceutical, produce and demand enantiopure compounds, the asymmetric synthesis is a discipline that plays a central role in current chemistry. Among the different methods available for the preparation of enantiopure compounds, asymmetric catalysis is a competitive methodology, and among different types of catalysts, the best expectations are focused on the use of transition metals complexes.

3.Aims of the course and competences

3.1.Aims of the course

The objective of the subject is to study the general principles of asymmetric catalysis, and the main catalytic systems based on chiral transition metal compounds, emphasizing the study of the reaction mechanisms.

3.2.Competences

To identify concepts related to the catalytic activity of chiral compounds and their application in the synthesis of optically active compounds.

To apply the acquired knowledge to interpret potential catalyst applications depending on their nature.

To interpret and evaluate the most important parameters that characterize the enantioselective catalytic reactions.

To design and evaluate organic reactions catalyzed by chiral transition metal compounds.

4.Assessment (1st and 2nd call)

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

Continuous assessment of this subject is based on the following activities:

1.- Class participation, exercises and questions proposed by the teacher (40%).

2.- Oral presentation and group discussion of the contents of selected scientific papers (60%).

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The students that have not passed the subject or wish to improve their score have the option to carry out a global test, either in the first or the second call, that will represent 100% of the final student's grade.

The number of official examination calls per registration and their use will be subjected to the statements of the *Regulation of Permanence in Master Studies* and the *Regulation of the Learning Assessment* (http://www.unizar.es/ice/images/stories/calidad/Reglamento%20Evaluacion.pdf). The latest document will also regulate the general design and scoring criteria of the assessment activities, as well as the exam schedules and timetable for the post-examination review.

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

The learning process designed for the course is essentially based on participative and interactive lectures that will be complemented with seminars and personalized tutorials. In order to encourage the scientific communication skills we propose the oral presentation of relevant scientific results and their discussion.

5.2.Learning tasks

The course includes the following learning tasks:

- Participative and interactive lectures (1.5 ECTS).
- Seminars (0.5 ECTS).
- Personalized tutorials.

5.3.Syllabus

The course will address the following topics:

Topic 1. Methodologies for the preparation of optically active compounds.

Topic 2. Asymmetric catalysis: general principles, non-linear effects.

Topic 3. Catalysts: design of ligands.

Topic 4. Asymmetric catalytic reactions: hydrogenation, hydrogen transfer, isomerization, hydroformylation, C-C bond formation, oxidation.

Topic 5. New trends in asymmetric catalysis.

5.4.Course planning and calendar

Further information concerning the timetable, classroom, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the Faculty of Science website https://ciencias.unizar.es.

The submission of assignments will be done according to the schedule to be announced in advance.

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Students will be provided with diverse teaching material either at reprography or through the University's virtual platform https://moodle2.unizar.es/add.

5.5.Bibliography and recommended resources

BB Asymmetric catalysis on industrial scale: challenges, approaches and solutions / edited by H. U. Blaser, E. Schmidt Weinheim: Wiley-VCH, cop. 2004

BB Blaser, H.U. (Ed.). Asymmetric catalysis on industrial scale: challenges, approaches and solutions Wiley-VCH. 2011

BB Catalytic asymmetric synthesis / edited by Iwao Ojima**.** - 2nd ed. New York [etc]: Wiley-VCH, cop. 2000

BB Catalytic asymmetric synthesis / edited by Iwao Ojima**.** - 3rd ed. New York [etc]: Wiley-VCH, cop. 2010

BB Mikami, K.; Lautens, M. (Eds.). New Frontiers in Asymmetric Catalysis. - 1st ed. John Wiley & Sons. 2007

BB Noyori, R. (Ed.). Asymmetric Catalysis in Organic Synthesis. Wiley. 1994

BB Walsh, P.J.; Kozlowski, M.C. (Eds.). Fundamentals of Asymmetric Catalysis. University Science Books. 2009

BC Caprio, Vittorio. Catalysis in asymetric synthesis / Vittorio Caprio and Jonathan M. J. Williams**.** - 2nd ed. Chichester: John Wiley & Sons, 2009

BC Catalytic asymmetric Friedel-Crafts alkylations / edited by Marco Bandini and Achille Umani-Ronchi ; with a foreword by George A. Olah Weinheim: Wiley-VCH, cop. 2009

BC Comprehensive asymmetric catalysis I-III / Eric N. Jacobsen, Andreas Pfaltz, Hisashi Yamamoto (eds.)**.** Berlin [etc]: Springer, cop. 1999

BC Comprehensive asymmetric catalysis. Supplement 1 / Eric N. Jacobsen, Andreas Pfaltz, Hisashi Yamamoto (eds.) Berlin [etc.]: Springer, cop. 2004

BC Comprehensive asymmetric catalysis. Supplement 2 / Eric N. Jacobsen, Andreas Pfaltz, Hisashi Yamamoto (eds.) Berlin [etc.]: Springer, cop. 2004

BC Kazmaier, U**.** Transition Metal Catalyzed Enantioselective Allylic Substitution in Organic Synthesis. Springer. 2013

BC Kobayashi S., Jorgensen K. A.(Eds.). Cycloaddition Reactions in Organic Synthesis. Wiley-VCH, Weinheim, 2001