VNIVERSITAT DE VALÈNCIA

Course Guide
45011 Química Sostenible

COURSE DATA

Data Subject	
Code	45011
Name	Química Sostenible
Cycle	Master's degree
ECTS Credits	3.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
2249 - M.D. in Chemistry	Faculty of Chemistry	1	First term

Subject-matter

Degree	Subject-matter	Character
2249 - M.D. in Chemistry	7 - Optatividad en Química	Optional

Coordination

Name	Department
MUÑOZ ESPI, RAFAEL	315 - Physical Chemistry

SUMMARY

Sustainable Chemistry or Green Chemistry is the orientation of chemistry, as a set of theoretical and applied knowledge, whose specific objective is the prevention of environmental contamination and risks due to chemical substances, by introducing or promoting clean and safe production processes, and less toxic and polluting chemical products, without undermining their contribution to well-being and technological progress.

Sustainable Chemistry must be considered as a part of Environmental Chemistry and endeavours to achieve the current and future prevention of contamination and risk problems originated by chemical substances, by analysing the origin of these problems. With the premises, the objectives of Green Chemistry are the following:

Reducing the generation and use of contaminants in the chemical process

Reducing the risky character of the chemical process

Reducing the noxious effect of the chemicals used by the production sectors or the final consumer.

Reducing the use of extinguishable and scarce raw materials.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Chemistry knowledge acquired during the Chemistry Degree are required.

OUTCOMES

2249 - M.D. in Chemistry

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Be able to solve complex chemistry problems, whether in the academic, research or industrial application areas at a specialization or masters-level.
- Possess the necessary skills to develop multidisciplinary activities within the field of chemistry at the master's level.
- Be able to design, conduct, analyse and interpret complex experiments and data, as a specialist.
- Apply the advanced theoretical and practical knowledge gained in the different specialties of chemistry to R&D and innovation.

LEARNING OUTCOMES

- Be able to approach from the experimental and theoretical point of view real problems of a specialized scientific and / or technological nature, as well as propose solutions, in different areas of Chemistry.
- Be able to function in professional scientific-technological environments related to industry, research, development and / or innovation.
- Be able to transmit and disseminate results of scientific-technological activity.
- Be able to valorise the role of Chemistry and its influence on the environment
- Be able to valorise the important role of Green Chemistry in the search of more efficient and environmental friendly products and processes.
- Identify the residues generated in the different steps of the chemical processes in order to proceed to its possible reuse or selective collection of toxic residues.
- Describe the main sources of chemical products and their treatment for the transformation into added value materials.
- Know the role of chemistry in the main sources of renewable energy and in the methods for energy storage.

- Know the recycling processes of the main materials and metals.
- Design, synthesise and perform effective analytical processes for obtaining and valorising products.
- Use the different sustainable tools of Chemistry.
- Knowing how to apply the knowledge acquired to contribute to the Sustainable Development Goals (SDGs), such as the sustainable management of water, raw materials and energy sources (SDGs 6 and 7) and to develop a professional work with the least environmental impact and using alternative raw materials (SDGs 11, 14 and 15)

DESCRIPTION OF CONTENTS

1. Introduction

Objectives. Use of renewable sources of raw materials. Reduction of polluting substances: chemical substances (Atomic economy, Factor E) and energy.

2. Use of renewable sources from raw materials

Chemical products from glucose. Chemicals from fatty acids. Polymers from renewable sources. Other products from renewable sources.

3. Sustainable Process Design and Industrial Examples

Factors to consider for the design of a sustainable process. Complete study. Industrial examples.

4. Renewable energy sources

Main renewable energy sources. Solar, eolic, hydroelectric and biomass. Other renewable energy sources. Energy storage systems.

5. Recycling

Waste recycling: paper, plastics, glass, batteries, common metals (Al, Pb,...), scarce metals (Au, Rh, Pd, Ta,...),...

6. Enviromental pollution: solutions provided by chemistry

Introduction to the main problems of environmental pollution: global warming, photochemical smog, ozone layer and acid rain. Contributions of chemistry to their resolution.

7. Catalysis: green concepts and applications

Basic concepts of catalysis. -Catalysis and Green Chemistry. -Influence of catalytic processes in the E-factor and atomic efficiency. -Examples of the role of catalytic processes in Q.V .: Catalysis by acids and bases. Oxidation and catalytic reduction. Catalytic formation and C-C bonds. Enantioselective catalysis.

8. Biocatalysis and biotechnology

Biocatalysis. - Renewable materials and white biotechnology. -Integration of processes and catalytic cascades. -Catalysis for a green industry

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	21,00	100
Tutorials	6,00	100
Seminars	3,00	100
Development of group work	10,00	0
Study and independent work	15,00	0
Readings supplementary material	10,00	0
Preparation of evaluation activities	10,00	0
TOTAL	**75,00**	

TEACHING METHODOLOGY

The subject will be taught in asynchronous online mode. Among other training activities, the resolution of applied practical problems will be proposed, aimed at evaluating the student's understanding of the subject. The course will take place through the Virtual Classroom platform, a virtual space in which the teachers will post all the appropriate materials for the development of teaching and the control of student participation in the proposed activities,.

The continuous assessment will include the discussion of theoretical and practical questions in the virtual forums and in the tutorial sessions, as well as the conduction and submission of activities throughout the course about the different aspects studied in the subject.

EVALUATION

The evaluation of the subject will consist of the following sections:

1. Continuous assessment of the teachers (20% of the grade). Throughout the course there will be questionnaires and evaluable activities on each of the topics. In this assessment, different aspects will be taken into account:

- Resolucion of exercises and raising questions

- Critical spirit

- Resolution of the proposed activities

2. Presentation of tasks (30% of the grade). In addition to the questionnaires by topic of the continuous assessment, the teacher will propose other activities that must be submitted through the virtual classroom within the established periods. These activities may include, if considered appropriate by the teachers, the participation in a seminar or online talk and completion of related questionnaires.

3. Presential oral exam (50% of the grade). The exam will consist of an oral presentation followed by a discussion with the teachers. The guidelines for the oral exam and for the choice of topic will be announced at the beginning of the course. Both the choice and presentation of the topic, as well as the theoretical knowledge of content related to the subject will be assessed. The exam will be of such a nature that it will compel the student to relate aspects that appear in different topics of the subject (and, even, in other subjects).

REFERENCES

Basic

- M. Lancaster, Green Chemistry, An Introductory Text, Royal Society of Chemistry, Cambridge, 2002
- J. Clark, D. Macquarrie, Handbook of Green Chemistry and Technology, Blackwell, Oxford, 2002
- P. T. Anastas, J. C. Warner, Green Chemistry: Theory and Practice, Oxford University Press, Oxford, 1998
- R. Mestres, Química Sostenible, Ed. Síntesis, 2011
- Rothenberg, G., Catalysis. Concepts and Green Applications. Wiley-VCH, Weinheim, ISBN: 978-3-527-31824-7

Additional

- M. C. Cann, M. E. Connelly, Real-World Cases in Green Chemistry, American Chemical Society, Washington, 2000
- Revista Green Chemistry, 24 números año, Walter Leitner ed., RSC, desde 1999
- R. L. Garrett, Pollution Prevention, Green Chemistry, and the Design of Safer Chemicals, en, S. C. DeVito y R. L. Garrett Ed., Designing Safer Chemicals, ACS Symposium Series, American Chemical Society, Washington, 1996