COURSE DATA

Data Subject	
Code	36471
Name	Compuestos Orgánicos de Interés Industrial
Cycle	Grade
ECTS Credits	4.5
Academic year	2018 - 2019

Study (s)

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Faculty of Chemistry	4	Second term

Subject-matter

Degree	Subject-matter	Character
1110 - Degree in Chemistry	17 - Organic Chemistry Applied	Optional

Coordination

Name	Department
CUÑAT ROMERO, ANA CARMEN	325 - Organic Chemistry

SUMMARY

The subject “Organic compounds and materials of industrial interest” belongs to the section “Applied Organic Chemistry” with 15 ECTS credits. This is an optative subject with 4.5 ECTS credits, which is imparted in the 7th semester of the fourth course.

This is a subject with a clear informative character. Is important that the student, as a future candidate for an industrial professional career, recognize the main sectors of the chemical industry, such as surfactants, fungicides, hydrocarbons, polymers and pharmaceutical industry. It involves basic knowledge of the main sources of raw materials, either renewable (petroleum, natural gas or coal) or not renewable (biomass). Additionally, and due to the growing interest of the environmental aspects in the chemical industry, is adequate a basic knowledge of the reactions of organic compounds in the environment, together with the contribution of chemistry to a sustainable development, and the principles that governs the so called green chemistry.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

The student should get acquainted with the previously gained concepts of Chemistry and Biology, basic pillars that support an important part of the contents of this subject. Specifically, the study of the general organic chemistry imparted during the second and third year of the grade will help to a better understanding of the contents.

OUTCOMES

1110 - Degree in Chemistry

- Develop capacity for analysis, synthesis and critical thinking.
- Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional.
- Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.
- Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications.
- Relate the macroscopic properties and the properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids and other materials.
- Show knowledge of the structure and reactivity of the main classes of biomolecules and the chemistry of the main biological processes.
- Recognise and analyse new problems and plan strategies to solve them.
- Evaluate, interpret and synthesise chemical data and information.
- Recognise and evaluate chemical processes in daily life.
- Develop sustainable and environmentally friendly methods.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.

- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.
- Have basic skills in the use of information and communication technology and properly manage the information obtained.

LEARNING OUTCOMES

1 Apply knowledge of basic organic chemistry to design and selective preparation of compounds with high added value.

2 To know the interest and the incidence of natural products and fine chemical products obtained in the various areas of daily life.

3 Learn to assess the importance of stereochemical aspects of the products studied both in their synthesis and their practical application.

4 Learn acquire, use and transmit bibliographic information related to organic compounds.

5 Acquire an overview of the organic chemical industry

6 Know the main organic compounds of industrial interest

7 Understand how organic compounds are prepared from their primary sources

8 To assess the problems associated with scaling and sustainability of the reactions of preparation of compounds with high added value

9 Perceiving sustainable chemistry as a viable way to develop chemistry currently

10 Know how to organize and plan tasks

11 Teaming up with a serious and professional behavior and gender

DESCRIPTION OF CONTENTS

1. No renewable sources of raw materials: oil, natural gas, coal

Oil refining. Fractional distillation of petroleum. Oil as a source of basic chemicals. Thermal cracking: production of olefins. Cracking and catalytic reforming: production of branched alkanes, cycloalkanes and aromatics. Natural gas as a source of chemicals. Coal as a source of chemicals. Syngas. Basic organic chemicals. Methane and derivatives. Ethylene and derivatives. Propylene and derivatives. C4 hydrocarbons and derivatives. Aromatic hydrocarbons and derivatives. Acetylene.

2. Renewable sources of raw materials: biomass

The cycle of organic matter. Biomass: classification according to the source. Basic components of biomass. Biorefineries: integrated biorefinery concept. Biorefinery models. Energy and chemicals from biomass. Fuels from biomass. Chemicals from biomass high in carbohydrates. Chemicals from biomass with high lipid content. Chemicals from biomass with high protein content. Transformations of renewable raw chemical materials.

3. Organic products in Industry: polimers

Polymers: degree of polymerization, molecular weight, functionality. Classification. Polymers and stereochemistry. Types of polymerization. Polymerization of addition: ionic, radical and of coordination. Polymerization of condensation. Homopolymers and copolymers. Polymerization methods. Physical properties of the polymers and their relationship to the structure. Composition of commercial plastics additives. Polymer processing. Representative polymers. Mixed organic- inorganic polymers. Biodegradable polymers. Polymers and environment.

4. Organic products in Industry: surfactants

Introduction: surface tension, adsorption vs absorption, hydrophobic effect. Properties of surfactants: micellar effect, detergent effect, emulsifying effect, wetting effect, dispersing and solubilizing effects, foaming effect. Hydrophilic-lipophilic balance (HLB). Classification of surfactants. Anionic surfactants. Cationic surfactants. Nonionic surfactants. Amphoteric surfactants. Other types of surfactants: silicone, fluorinated and natural surfactants. Commercial detergents: composition, types of additives. Environmental behavior of surfactants

5. Organic products in Industry: plaguicides

Introduction. Classification of pesticides. Insecticides, fungicides, herbicides. General characteristics of the pesticide industry. Activity of pesticides. Mode of action: representative examples. Discovery and development of pesticides. Search of the lead compound. Lead optimization. Evaluation and commercial development. Pesticides and environment.

6. Organic products in Industry: colorants and pigments

Color and electromagnetic spectrum. Models of colors generation. Dyes and pigments: basis for color. Dyes vs pigments. Pigment types. Main types of dyes: azo, carbonyl, anthraquinone, indigoid, phthalocyanine, other organic dyes. Classification of dyes by the method of application. Dyes of group 1: anionic, cationic, direct, scattered. Dyes of group 2: reactive, vat, sulfur. Organic pigments. Food additives: dyes.

7. Organic products in Industry: drugs

Discovery and drug design. Optimization. Preclinical and clinical development. Approval and Marketing. Main groups of drugs: representative examples. Drugs as merging contaminants

8. Green chemistry introduction

Green chemistry definition. Green chemistry principles and practical examples. E factor. Waste generation prevention. Atom economy. Less hazardous/toxic chemicals. Safer products by design. Solvents and reaction conditions. Renewable raw materials. Energy efficiency. Catalysis. Chemical derivatization. Non persisntent products. Real time monitorization. Risk evaluation.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Tutorials	7,00	100
Development of group work	17,00	0
Study and independent work	30,50	0
Preparation of practical classes and problem	20,00	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

This subject was conceived to give to the student the role of principal actor of its own learning and is organized in the following manner:

- **In-person theoretical classes.**

These classes will be dedicated to the exposition to the students of the fundamental aspects of the subject. Thus, the different topics found in the program will be discussed in detail in an orally form. In this manner, the student will obtain a global and comprehensive view of the subject. Both, the blackboard and power point presentations will be used during this time. Previously to the classes, the educational material needed for an easy follow-up of the subject will be introduced in the Aula Virtual.

Those classes will be complemented with the personal work of the student.

- **Practical classes.**

In those classes, the application of the concepts introduced in the theoretical classes will be performed for the students. Previously to the attendance of those practical classes, the students will be revised the problems proposed by the professor. The resolution of those problems will be carried out either by the professor or by the students, in an individual form or in a team-work.

- **Tutorial classes.** There will be 11 sessions total distributed uniformly along the course. Each session will last for one hour. During those sessions, the professor will evaluate the learning process of the students, which will be organized in small groups previously. Home work previously settled by the professor will be collected. In the same token, the tutorial classes will be used to solve the problems that could arise to the students along the course, together with the guidance in the selection of the most appropriate methods for the resolution of possible future problems.
    - **Seminars**. There will be 6 seminar sessions that will last one hour each along the semester. In those seminars, some aspects related to the theoretical classes will be discussed in more detail, in order to facilitate its understanding and application. One half of the time will be consumed with these clarifying aspects, while the other half will be employed in oral presentations of the students, of the exercises proposed by the professor. To this end, the students will be grouped in small team works, like in the tutorial classes.

EVALUATION

The academic performance of the student and the final grade of the course will be due, in a weighted manner, regarding the average obtained in each of the parts evaluated. All grades will be based in an absolute score over 10 points, according to the established scale in RD 1125/2003. These criteria will be kept at the second examination session.

The following parts will be considered and evaluated:

1. Direct assessment of the Professor (0.5 points)

In this assessment several aspects will be considered. Among them, we can highlight the following:

• In-person assistance to the classes with an active participation.

• Progression in the use of the proper language of organic chemistry.

• Problem resolution and questions.

• Critical spirit.

2.Tutorials (globally 2 points). In the final grade of each student the following aspects will be considered:

• The contents and both oral and written exercises proposed by the professor in each team-work.

3. Exams (7.5 points): The exam will take place in the date established by the Chemistry Faculty and it will be the same for all the subgroups of the subject. The exam will consist in several questions and exercises which allow the professor the evaluation of the aforementioned competences adquired by the students. Obtaining a minimum of 3.5 points out of 7.5 in the exam will be mandatory in order to pass the subject.

In the second examination session, the qualification obtained in parts 1 and 2 will be maintained and the third part will be evaluated again (the new exam).

The student could be evaluated only with a written exam on the contents of the subject treated during lectures, tutorials and seminars, so that the teacher can evaluate whether the student has acquired the skills and knowledge related to the subject. This test will be 100% of the overall grade. In this case the student must resign from the continuous evaluation and choose this type of assessment presenting a written application at the registry of the secretary of the department.

REFERENCES

Basic

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