

**Evaluation and Definition of Chemical
Environmental Parameters**

Code: 105027
ECTS Credits: 3

Degree	Type	Year	Semester
2501915 Environmental Sciences	OT	4	0

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Other comments on languages

Material

Teachers

Jordi García Orellana

Prerequisites

Have pass the course of Chemical Equilibrium and Instrumentation (102846) of 2nd year.

Objectives and Contextualisation

Distinguish the different levels of problems depending on whether we speak of the majority components or trace analysis in the environment (Analyzes: heavy metals, rare earths, radionuclides and stable isotopes, organic pollutants such as VOCs, BETEX, PAHs, pesticides and herbicides , and emerging contaminants (drugs). Identify different environmental matrices (air, continental water, seawater, rain, dust, sediment) Identify the different stages of the analytical procedure: know how to define the analytical problem; previous operations to be carried out (sampling adequate sample collection, transport of appropriate samples, in-situ measurements, etc.), sample treatment (dissolution and / or extraction, use of Analytical Microwave), distinguish the need for different separation techniques; different techniques Instrumental for the measurement of the signal (Instrumental Analysis: electrical, optical, chromatographic, radiochemical, mass spectrometry, and technical methods and recognize methods of data processing (calibration methods), as well as the statistical treatment of the results and measurement of the quality of the result. Evaluation and interpretation of the results and proposals for improvement, if applicable.

Present a case study from the beginning to the end, from the identification of the problem to the treatment of the results and the evaluation and proposals for improvement.

Competences

- Adequately convey information verbally, written and graphic, including the use of new communication and information technologies.
- Analyze and use information critically.
- Collect, analyze and represent data and observations, both qualitative and quantitative, using secure adequate classroom, field and laboratory techniques
- Demonstrate adequate knowledge and use the most relevant environmental tools and concepts of biology, geology, chemistry, physics and chemical engineering.
- Demonstrate concern for quality and praxis.
- Demonstrate initiative and adapt to new situations and problems.
- Learn and apply in practice the knowledge acquired and to solve problems.
- Quickly apply the knowledge and skills in the various fields involved in environmental issues, providing innovative proposals.
- Teaming developing personal values regarding social skills and teamwork.
- Work autonomously

Learning Outcomes

1. Adequately convey information verbally, written and graphic, including the use of new communication and information technologies.
2. Analyze and use information critically.
3. Apply chemical knowledge to solve problems in a quantitative or qualitative nature relating to the environment.
4. Demonstrate concern for quality and praxis.
5. Demonstrate initiative and adapt to new situations and problems.
6. Develop strategies for analysis and synthesis relating to the environmental implications of industrial processes.
7. Develop work type chemical analysis from previously established procedures.
8. Identify the chemical processes in the surrounding environment and evaluate them properly and originally.
9. Interpret data from databases or by experimental measures, including the use of computer tools, identify the meaning and relate behavior in environmental systems.
10. Learn and apply in practice the knowledge acquired and to solve problems.
11. Make correct assessments of health risks and environmental and socioeconomic impacts associated with chemicals and the chemical industry.
12. Observe, recognize, analyze, measure, and so properly and safely represent chemical processes applied to environmental sciences.
13. Recognize and analyze chemical problems and plan appropriate responses or work for resolution, including, where necessary, the use of bibliographical sources.
14. Teaming developing personal values regarding social skills and teamwork.
15. Work autonomously

Content

Presentation and explanation of the possible cases of study and the proposal of work to be carried out in these cases (to be chosen by groups of students).

Theoretical contents

Introduction.

Lesson 1: Environment and Analytical Chemistry; Major components and trace analysis. The analytical procedure: The analytical problem; Previous Operations, Sample Treatment (Analytical Microwaves), and Separation Techniques; Signal Measurement: Instrumental Analysis; and Treatment of results.

Lesson 2: Environmental matrices (air, continental water, seawater, rain, dust, sediment ...). Knowledge of the determination protocols and the measurement techniques. Techniques and sampling equipment. Relations between chemical parameters and environmental conditions, and their determination: spatial and temporal dimensions.

Environmental chemometrics.

Lesson 3: Analytical Chemistry and Quality. Statistical description of the quality of the measures. Introduction to hypothesis tests. Calibration Linear regression Calculation of the concentration of an unknown sample and uncertainty. Standard addition method. Internal pattern method. Sensitivity and detection limit. Signals and noise.

Environmental quality (ISO).

Lesson 4: A quality management system allows to ensure the traceability of a "sample" from the beginning of the "procedure" to the end. ISO (International Organization for Standardization) is composed of national standard organisms (NSB). Historical evolution of quality management. What is quality? Quality management system. Quality models and objectives. The 10 principles of good quality experimental practices. Vocabulary: Quality Management System, Quality Planning, Quality Assurance, Quality Control, etc. Implementation of the quality system: steps, training, documents and responsibilities. Review of the quality system. Audits

Introduction to the analysis.

Lesson 5: INSTRUMENTAL: Electrical, optical, chromatographic, radiochemical, mass spectrometry, and coupled methods.

Lesson 6: ANALYSIS: heavy metals, rare earths, radionuclides and stable isotopes, organic pollutants (VOCs, BETEX, PAHs, pesticides and herbicides, ...), emerging pollutants (drugs).

Presentation of work related to case studies.

Methodology

Master classes to present the theoretical contents of the subject.

Classes of classroom problems to work on some of the concepts of the theory classes, as well as to tutor the work related to the case studies studied.

Field trip in some possible case studies.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Field trip	8	0.32	2, 4, 11, 8, 12, 13, 14
Solving problems classes	5	0.2	3, 10, 5, 4, 6, 7, 13, 15, 14
Teaching class	15	0.6	2, 11, 8, 9, 12, 1
Type: Supervised			
Tutoring	5	0.2	2, 3, 5, 4, 6, 7, 11, 9, 12, 13, 1, 15, 14
Type: Autonomous			

Assessment

The acquisition of the theoretical contents will be evaluated through two partial exams, each with a weight of 25%, corresponding both partial to 50% of the mark of the subject.

On the other hand, evidence will be evaluated throughout the course, in order to be able to evaluate the learning of the students when applying the chemical knowledges acquired to the resolution of problems of quantitative or qualitative nature related to the environment. This part will correspond to 20% of the final mark of the subject.

Finally, and not least, the remaining 30% will correspond to the evaluation of cooperative work developed in the root of the approach, development and final resolution of a case study, to choose from among the list of proposals for the group of students . It will be necessary to present a written document, in Word format (to facilitate its editing and assessment by the teaching staff), as well as to make an oral presentation in front of the entire class group.

There will be a recovery from the theoretical exams (of each part or partial separately). In order to be able to attend the recovery, the student must have been previously evaluated of continuous assessment activities that are equivalent to 2/3 of the final mark.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Cooperative work Case study	30%	20	0.8	2, 3, 10, 5, 4, 6, 7, 11, 8, 9, 12, 13, 1, 14
Evidences	20%	5	0.2	2, 3, 10, 4, 6, 7, 11, 9, 13, 1, 15, 14
Theory exam 1nd part	25%	3	0.12	3, 10, 6, 11, 13, 1
Theory exam 1st part	25%	3	0.12	3, 10, 6, 11, 13, 1

Bibliography

- 1) Daniel C. Harris, Anàlisi química quantitativa, Traducció 6a ed, Ed. Reverté, 2006.
- 2) Daniel C. Harris, Quantitative Chemical Analysis, 9th ed, Ed. MacMillan Education, NY, 2016.
- 3) James W. Robinson et al., Undergraduate Instrumental Analysis, 7th ed. CRC Press, Boca Raton, 2014.
- 4) Gary D. Christian, et al. Analytical Chemistry, 7th Ed., Wiley International, 2014.
- 5) J.M. Andrade-Garda, et al. Problems of Instrumental Analytical Chemistry, Ed., World Scientific, 2017. (Cap. 6)