Universitat Autònoma de Barcelona

2017/2018

Evaluation and Definition of Chemical Environmental Parameters

Code: 102847
ECTS Credits: 6

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

Llengua vehicular addicional

Teachers

Raquel Montes Martinez
Jordi García Orellana
Maria del Mar Puyol Bosch

Prerequisites

It is necessary to pass previous subjects from Chemistry, such as: 102828 Química (Chemistry), 102846 Equilibri Químic i Instrumentació (Chemical Equilibrium and Instrumentatin), i 102844 Química de la contaminació (Chemical contamination).

Objectives and Contextualisation

The purpose of this subject is to train students in the knowledge of the resolution of environmental problems: define the problem, capture and conservation of samples, as well as possible pre-treatment and final analysis of the necessary parameters (as a function of the type of sample and the corresponding environmental problem).

For this reason, through Case Studies, different sampling techniques for soils and sediments will be presented, such as for water and air samples. Once we have taken the sample, the best method of conservation in each case (including containers of conservation, temperature, vacuum, etc.) must be checked. Once we have the samples, it is necessary to define the method of sample treatment to obtain the desired information, which usually is the content of compounds of different contamination rates, which will make it necessary to approach a suitable sample pre-treatment, also depending on the type of sample. So it will deal with issues of solvent extraction, or extraction in solid phase (SPE), as well as processes of leaching or digestion of samples, filtration, use of the Analytical Microwave, etc.

Once the sample is treated, it will be necessary to prepare it for the analysis and analyze it. Then, the potential of the different analytical techniques most commonly used in the characterization of environmental systems will be shown, in which the Analytical Chemistry is the obligatory reference. Furthermore, we should be able to decide for what purpose and in which moment one analytical instrumental technique can be useful to the best knowledge and control of the environemnt, and as well as for the development of the future professional activity of the current student. The use of spectroscopic techniques, electroanalytics, spectrometry, separation techniques (chromatography, capillary electrophoresis), radiochemistry in the different cases of study of environmental problems will be seen.

The assimilation of the contents of this subject is fundamental to understand the importance of the analytical information in an adequate management of natural resources, both its rational exploitation and its preservation and maintenance. In this subject, the importance of multidisciplinary knowledge in the resolution of complex environmental problems will be visualized, so, when necessary concepts of other related knowledge subjects will be exploited when nedded to solve an environmental and multidisciplinary real problem.

In fornt of an environmental problem, the main objective is that the student should be able to know how to plan it and have all the instrumental analytical information available to decide what type of procedure or analysis is necessary to follow, whith the objective to get the knowledge of the corresponding environmental problem. On the other hand, the results obtained are important for the student to be able to extract the maximum information, which allows him to know the situation in depth, which will make decisions in several ways: remediation, preservation, control of the environment, ... It is necessary that the student will be able to interact with the knowledge acquired in other disciplines in the resolution of environmental characterization processes, either natural processes or as following-up the impact in the ecosystems due to anthropogenic activities.

Skills

- Demonstrate adequate knowledge and use the most relevant environmental tools and concepts of biology, geology, chemistry, physics and chemical engineering.
- Quickly apply the knowledge and skills in the various fields involved in environmental issues, providing innovative proposals.

Learning outcomes

1. Apply chemical knowledge to solve problems in a quantitative or qualitative nature relating to the environment.
2. Develop work type chemical analysis from previously established procedures.
3. Handle tools and equipment in chemical laboratories standards of environmental control.
4. Identify the chemical processes in the surrounding environment and evaluate them properly and originally.
5. Interpret data from databases or by experimental measures, including the use of computer tools, identify the meaning and relate behavior in environmental systems.
6. Make correct assessments of health risks and environmental and socioeconomic impacts associated with chemicals and the chemical industry.
7. Recognize and analyze chemical problems and plan appropriate responses or work for resolution, including, where necessary, the use of bibliographical sources.

Content

Case Studies Introduction

Topics to deal with:

The analytical procedure: The analytical problem; Environmental matrices (air, continental water, seawater, rain, dust, sediment ...). Techniques and sampling equipment. Previous Operations, Sample Treatment

(Solvent Extraction, SPE, Analytical Microwave). Knowledge of the determination protocols and measurement techniques. Separation Techniques; Major components and trace analysis. Signal Measurement: Instrumental Analysis; And Treatment of results.

Electrochemical analysis techniques. (Electrical methods). Spectroscopic analysis techniques. (Optical methods). Separation techniques. Chromatography Environmental radioactivity

Environmental chemometrics

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.

Methodology

Theory classes, seminars and practical exercises

The exhibition model (master class) will be combined, with audiovisual support, and training activities that can be done in groups or individually.

In the master or theory classes, the teacher will offer an overview of the topics covered and will focus on those key concepts that help the student to understand and acquire the basic knowledge of the subject, responding to any doubts or questions that may arise. The student must supplement the knowledge acquired during the theoretical classes with the help of the material that the professor can give through the virtual campus as well as the recommended bibliography. For individual study and the preparation of the topics in depth, a basic and complementary bibliography will be indicated. Attendance hours will be devoted to the resolution of practical exercises, both individually and in groups, always supervised by the teacher in this part.

The activities are designed to acquire the specific competences as well as to develop the transversal competences.

On the other hand, and to promote the achievement of the learning objectives set, training activities will be introduced aimed at encouraging cooperative learning and the participation of students. Thus, the students associated in groups will select at the beginning of the course a subject related to the application of analytical tools in the obtaining of environmental information and will develop it throughout the semester. Periodic tutorials will be carried out by a group of seminars to discuss the evolution of the work preparation process. At the end of the semester, the oral presentations of the work carried out by the different groups will be made before the whole class and its discussion and evaluation.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Field practice	8	0.32	2, 5, 3
Ressolution of some cases	10	0.4	1, 2, 4, 5, 7
Teaching classes	32	1.28	1, 2, 6, 4, 5, 7
Type: Supervised			
Tuition	5	0.2	1, 2, 6, 4, 5, 3, 7
Work exposition	4	0.16	1, 2, 6, 4, 5, 7

Type: Autonomous			
Seminars preparation	20	0.8	1, 2, 6, 4, 5, 7
Study	50	2	1, 2, 6, 4, 5, 7

Evaluation

The competences of this subject will be evaluated by means of:

A) Two partial exams throughout the course of the whole subject (individual), with a weight of 75% to the final grade. With the possibility of recovery (by partial or total of the subject).

B) Work to be developed by groups throughout the semester. It will be a written summary report (maximum 10 pages) and an oral presentation in front of classmates. It will have a 25% weight in the final note.

To pass the subject, a minimum of 5 points (above 10) is required in the weighted average of the two partial exams with the work. To be able to do the average, each part must have a note greater than 4 points (over 10).

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Examination (individual)	75	6	0.24	1, 6, 4, 5, 7
Working in group	25	15	0.6	1, 2, 6, 4, 5, 3, 7

Bibliography

Daniel C. Harris, Anàlisi química quantitativa, Traducció 6a Ed., Ed. Reverté, 2006

Daniel C. Harris, Quantitative Chemical Analysis, 8th Ed., Ed. W.H. Freeman and Company, NY, 2010

James W. Robinson et al., Undergraduate Instrumental Analysis, 7th ed. CRC Press, Boca Raton, 2014

Douglas A. Skoog, Stanley R. Crouch, F. James Holler, Principios de Análisis Instrumental, 6a Ed. Cengage Learning Editores S.A., 2008

Gary D. Christian, Analytical Chemistry, 6th Ed., Wiley International, 2003

J.N. Miller, Statistics and Chemometrics for Analytical Chemistry, Prentice Hall traducció 2002

C.Baird, Química Ambiental, Ed.Reverté 2001

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