

## 27226 - Environmental and Toxic Analysis

### Información del Plan Docente

<b>Academic Year</b>	2016/17
<b>Academic center</b>	100 - Facultad de Ciencias
<b>Degree</b>	452 - Degree in Chemistry
<b>ECTS</b>	5.0
<b>Course</b>	4
<b>Period</b>	Second semester
<b>Subject Type</b>	Optional
<b>Module</b>	---

### **1.Basic info**

#### **1.1.Recommendations to take this course**

Short summary

Environmental Analytical Chemistry is a optative course, that based on the concepts learned in the courses "Química Analítica I" and "Química Analítica II", tackles the importance and tasks of Analytical Chemistry and Instrumental Analysis in the control of environmental contamination. The course also explains the planning of the analytical strategies to solve a problem related with the analytical control of the environmental contamination, including analytical sampling and method selection, covering the main fields of application of analytical techniques in this subject, and establishing criteria to select the most suitable analytical technique.

Required Knowledge

To be able to follow this course the student has to have conceptual foundations of all the parts of the Chemistry and in particular of Analytical Chemistry and Instrumental Analysis. Basic knowledge of Geology, Biology and Biochemistry are also convenient.

#### **1.2.Activities and key dates for the course**

The course takes place during the second semester with four evaluations during that period and a final evaluation in June.

Mandatory seminars and assignments will take place during the semester.

### **2.Initiation**

#### **2.1.Learning outcomes that define the subject**

To be able to pass the course, students should be able to:

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1. Know the main analytical parameters determined in environmental samples and their meaning related with contamination processes
2. Use the terminology and concepts of environmental analysis
3. Consult the suitable legislation related with environmental control
4. Correctly apply the legal regulations for the determination of some frequent parameters in the analysis of environmental samples
5. Know the sampling methods and their relevance in the final analytical result
6. Know the particular analytical methodology to successfully carry out the determination of chemical substances in environmental samples
7. Plan and develop the analytical methods of the course regarding: study planning, sampling, sample handling, analysis and quality assurance
8. Design strategies to solve a real environmental analytical problem using the methodology shown during the course
9. Present and evaluate the results obtained from sample analysis. Produce reports with interpretation of the obtained data in the context of the sample

### 2.2.Introduction

### 3.Context and competences

#### 3.1.Goals

#### 3.2.Context and meaning of the subject in the degree

#### 3.3.Competences

#### 3.4.Importance of learning outcomes

### 4.Evaluation

### 5.Activities and resources

#### 5.1.General methodological presentation

##### Methodology summary

The form of instruction designed for this course is based on the following:

The course includes lecture sessions, seminars, and practical exercises in the lab.

Theory and seminars. 4 ECTS

- Theory: lectures of main subjects given by the teacher followed by debates. Problem-based learning with practical cases. Commentaries and debates based on recent news related with the control of environmental contamination.
- Seminars: presentation of the results of activities given by students and discussions with the rest of the students. In group developing and interpretation of practical cases.

Laboratory experiments. 1 ECTS. 10 h at laboratory. 25 h in total

## 5.2.Learning activities

## 5.3.Program

### Theory

1. General environmental legislation. Reports, studies. Private and public scope.
  2. Types and general characteristics of pollutants: water, earth, air, residues.
  3. Problems related with environmental contamination: environment and living beings. Origin, motility, transport, bioavailability, accumulation and toxicity of pollutants
  4. Sampling method for environmental analysis
  5. Techniques and methodologies in the analytical control of inorganic pollutants. Functional and chemical speciation.
  6. Techniques and methodologies in the analytical control of organic pollutants. Chiral analysis.
  7. Applications in the analysis of hydrosphere, soil, sediments, residues and living beings. Specific applications for the analysis of gaseous pollutants, atmospheric particulate matter and volatile organic compounds.
  8. In situ techniques and methodologies: sensors. Automatic networks. Screening techniques. Green methodology.
  9. Introduction to the analytical control of emergent pollutants: pharmaceutical residues, additives, nanomaterials, new pesticides, micotoxins.
10. Data processing and results elaboration.

### Laboratory

Contents of the laboratory experiments:

- In situ study of water quality. Chemical parameters determination
- In situ determination of chemical pollutants in the air
- Field trip to "Estación de control medioambiental de Zaragoza"

Out of the laboratory activities:

- Statistical analysis of the data obtain in the laboratory experiments
- Design of a working protocol for the chemical characterization of a real episode of environmental contamination.

## 5.4.Planning and scheduling

## 5.5.Bibliography and recomendated resources

<b>BB</b>	Dean, John R.. Environmental Trace analysis. Wiley, 2014
<b>BB</b>	Dean, John R.. Methods for environmental trace analysis / John R. Dean Chichester [etc.] : Wiley , cop. 2003
<b>BB</b>	Environmental analytical chemistry / edited by F.W. Fifield and P.J. Haines . - 2nd ed. Oxford [etc.] : Blackwell Science, 2000

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- BB** Loconto, Paul R.. Trace Environmental Quantitative Analysis. 2nd CRC Press. 2006
- BB** Reeve, Roger N.. Introduction to environmental analysis / Roger N. Reeve Chichester [etc.] : John Wiley & Sons, cop. 2002
- BC** Down, Randy D. (Ed.). Environmental Instrumentation and Analysis Handbook. Wiley-Blackwell. 2004
- BC** Einax, Jürgen W.. Chemometrics in environmental analysis. VCH Verlagsgesellschaft. 1997
- BC** Gómez Orea, Domingo. Evaluación ambiental estratégica : un instrumento para integrar el medio ambiente en la elaboración de planes y programas / Domingo Gómez Orea ; con la colaboración de, Mauricio Gómez Villarino, Alejandro Gómez Villarino Madrid : Mundi-Prensa, 2007
- BC** Guardia, Miguel de la (Ed.). Challenges in green analytical chemistry. Royal Society of Chemistry. 2011
- BC** Guía técnica para la evaluación y prevención de los riesgos presentes en los lugares de trabajo relacionados con agentes químicos. Madrid: Instituto Nacional de Seguridad e Higiene en el Trabajo. 2004
- BC** McDermott, Henry J.. Air monitoring for toxic exposures / Henry J. McDermott . - 2nd ed. Hoboken (New Jersey) : Wiley-Interscience, cop. 2004
- BC** Rajeshwar, Krishnan. Environmental Electrochemistry. Academic Press. 1996
- BC** Sogorb Sánchez, Miguel Angel. Técnicas analíticas de contaminantes químicos : aplicaciones toxicológicas, medioambientales y alimentarias / Miguel

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Ángel Sogorb Sánchez, Eugenio Vilanova  
Gisbert Madrid : Díaz de Santos, 2004

**BC**

Zhang, Chunlong Carl. Fundamentals of  
Environmental Sampling and Analysis.  
Wiley-Blackwell. 2007

### Online resources:

Agencia de Protección Ambiental de  
EE.UU (EPA) - [<http://www.epa.gov>]

Agencia Europea del Medio Ambiente -  
[<http://www.eea.europa.eu/>]

Comisión Europea. Medio Ambiente -  
[[http://ec.europa.eu/environment/index\\_es.htm](http://ec.europa.eu/environment/index_es.htm)]

DGA. Medio Ambiente -  
[<http://www.aragon.es/Temas/MedioAmbiente>]

Ministerio de Agricultura, Alimentación y  
Medio Ambiente -  
[<http://www.magrama.gob.es/es/>]