

25238 - Analytical technology for the detection of contaminants

Información del Plan Docente

Academic Year	2016/17
Academic center	201 - Escuela Politécnica Superior
Degree	277 - Degree in Environmental Sciences
ECTS	6.0
Course	
Period	Four-month period
Subject Type	Optional
Module	---

1. Basic info

1.1. Recommendations to take this course

1.2. Activities and key dates for the course

2. Initiation

2.1. Learning outcomes that define the subject

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

Being a subject taught in Grade 4th year, it is part of the basis that the student has already received some general basic knowledge of chemical analysis. It is intended that the student take hold such knowledge, expand and put them into practice. Therefore, this subject is scheduled to be eminently practical.

This course is designed to be developed in 4 hours straight sessions a week. Depending on how advanced or not the matter, 2 sessions of theoretical class and then 2 sessions of classes applied (computer room, laboratory, case studies, problems) or sessions laboratory practice 4 hours will be given, in addition to the outputs field sampling.

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On the other hand, practices or applied sessions are open and modifications can be made having regard to possible demands of students enrolled, as well as joint participation with other subjects of the same course.

This course is very practical and it is intended that students are able to apply the knowledge and skills they have acquired. Therefore, teaching is scheduled giving great weight to the practical and applied part, but from an intensification of theoretical knowledge, on which laboratory work will be developed. In order to optimize the learning process, the theoretical and practical classes are interspersed, reducing the time from students acquire the necessary knowledge or receive the corresponding instructions until applied in the laboratory.

5.2.Learning activities

1. Theoretical sessions. They consist of lectures and participatory sessions in the classroom.

2. Sessions cabinet. various activities will be held including: planning work to develop in the laboratory sessions, exhibition of actual cases, study of research papers, computer room classes concerning literature searches, databases, etc.

3. Laboratory sessions. the theoretical knowledge acquired to apply to the analysis of real samples (sampling and analysis) will be implemented. The student must follow specific protocols for the management of the different instrumental techniques of analysis included in the course, including sampling, preparation and chemical treatment of the samples, handling equipment and collection and processing of data and interpretation of Results.

4. Tutorials. Sessions, student demand, to resolve any doubts both theoretical sessions and practices.

5.3.Program

THEORY

Unit 1. *Bibliographic search related to analytical methods for the detection of contaminants.* Legislation, scientific magazines, official methods and standardized methods.

Unit 2. Planning an analysis of contaminants in environmental simple. Sample protocol. Real case studies (practical) of environmental analysis.

Unit 3. Calibration Methods. External calibration. Standard addition and the use of an internal pattern. A study of the quality parameters in Chemical Analysis. Basic Chemometrics.

Unit 4. Determining the metals present in environmental samples. Methods of digestion/decomposition. Atomic Emissions Spectroscopy-ICP. Emission Spectroscopy - Mass Spectroscopy. Introduction to simple solids for determining metal. Real case studies.

Unit 5. Determination of organic contaminants in environmental settings.

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5.1- Separation methods, conventional methods of extraction and more specific methods for the analysis of organic contaminants (solid-phase extraction, solid-phase microextraction, supercritical fluid extraction). Extract cleaning methods. Practical case studies (articles of investigation).

5.2- Chromatographic Analysis Techniques. Optimization of chromatographic separation. Selection of chromatographic columns. Introduction to using sample for the analysis of volatile organic compounds (techniques of the purge and trap system, technique of headspace analysis). Selective detection systems (ECD, nitrogen-phosphorous detector) and universal detection systems (UV spectrometry, mass Spectrometry, FID). Practical case studies.

PROGRAM OF LABORTORY PRACTICALS

Section I- *Sampling and characterization of drinking water taken from different areas*. Determining various parameters of water quality (pH, conductivity, chloride, residual chloride, hardness, nitrates, sulphates, phosphates, oxidability)

Section II- *Sampling and characterization of urban sewage* (before and after purification). Determination of different contaminant parameters (Solids in Suspension, organic nitrogen, ammoniac, phosphates, DQO, DBO).

Section III- *Determination of heavy metals in solid waste* (sewer sludge, industrial or agricultural waste). Study of bioavailability.

Section IV- *Determination of organic compounds* (poly-aromatic hydrocarbons) in water and soil. Optimization of: extraction methods, Chromatographic separation (High Performance Liquid Chromatography, and Gas Chromatography), detection system for Mass Spectrometry.

Section V- *Selection of a method for the determination of a contaminant in an environmental sample putting in practice the different techniques of measuring, calibration method and quality control*. Utilization of the Standard Material Certification.

5.4.Planning and scheduling

The course consists of 30 contact hours of lectures and 30 contact hours dedicated to practical work in the laboratory that will be held regularly during the 15-week semester.

5.5.Bibliography and recommended resources

Basic bibliography

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| BB | Análisis químico de trazas / Editoras:
Carmen Cámara, Concepción
Pérez-Conde . Madrid : Sintesis, 2011 |
| BB | Sogorb Sánchez, Miguel Angel. Técnicas
analíticas de contaminantes químicos :
aplicaciones toxicológicas,
medioambientales y alimentarias / Miguel
Ángel Sogorb Sánchez, Eugenio Vilanova |

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Recomended bibliography

- BC** Aguas / PANREAC . Barcelona [etc.] : Montplet & Esteban, 1983
- BC** Análisis químico de aguas residuales / Jesús Beltrán de Heredia Alonso ... [et al.] [Badajoz] : Universidad de Extremadura, Instituto de Ciencias de la Educación : Abecedario, 2004
- BC** Dean, John R.. Extraction methods for environmental analysis/ John R. Dean. . - Reprint. Chichester [etc.]: John Wiley & Sons, 1998.
- BC** Dean, John R.. Methods for environmental trace analysis / John R. Dean . Chichester [etc.] : Wiley , cop. 2003
- BC** Dunnivant, Frank M.. Environmental laboratory exercises for instrumental analysis and environmental chemistry / Frank M. Dunnivant Hoboken, New Jersey : John Wiley & Sons, cop. 2004
- BC** Harris, Daniel C.. Análisis químico cuantitativo / Daniel C. Harris . 3ª ed. Barcelona [etc.] : Reverté, cop. 2007
- BC** Métodos normalizados : para el análisis de aguas potables y residuales / preparado y publicado conjuntamente por American Public Health Association, American Water Works Association, Water Pollution control Federation ; directora de edición Mary Ann H. Franson Madrid : Díaz de Santos, D.L. 1992
- BC** Métodos oficiales de análisis / [publicados por el] Ministerio de Agricultura, Pesca y Alimentación, Dirección General de

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Pesca y Alimentación, 1993-1994

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environmental analysis / Roger N. Reeve
Chichester [etc.] : John Wiley & Sons, cop.
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Trace determination of pesticides and their
degradation products in water / [edited by]
Damià Barceló, Marie- Claire Hennion .
2nd. ed. Amsterdam [etc.] : Elsevier, 2003