

Organic Contaminants in Aquatic Ecosystems and Their Environmental Risk (250674)

General Information

School	ETSECCPB
Departments	Departament d'Enginyeria Civil i Ambiental (DECA)
Credits	5.0 ECTS
Programs	MÀSTER UNIVERSITARI EN ENGINYERIA AMBIENTAL (pla 2014)
Course	2022/23

Main teaching language at each group

- Group 10Q1 Spanish (Q1)

Faculty

Responsible Faculty: Francisco Javier Sanchez Vila

Faculty: Sandra Molinero Gómez, Paula Felicidad Rodriguez Escales, Francisco Javier Sanchez Vila

Objectives of Education

CE01 - Apply scientific concepts to environmental problems and their correlation with technological concepts.

CE08-Dimension unconventional systems and advanced treatment and raise their mass balance and energy.

Explore scientific concepts and technical principles of quality management of the receiving means, atmosphere, water and soil, and applied to problem solving.

Explore scientific concepts and technical principles of management and treatment of gaseous emissions, water supply, sewage and waste and remediation techniques for groundwater and contaminated soils.

Sized systems for the treatment of major pollutants vectors in specific sectors of activity.

Interprets rules, identifies goals, assesses technical alternatives proposed unconventional solutions and priority actions.

Organic pollution in the continental waterways and applicable law.

Pollutants (POPs) and emerging organic (ECs):

Features and families.

Sources, fate and effects.

The Stockholm Convention. Measures and derivative obligations.

Analytical determination of POPs for ECs and Methodologies.

Sampling and pretreatment.

Main techniques of extraction and purification.

Instrumental Analysis.

Application examples.

Environmental monitoring of POPs and ECs.

Analysis and fate of POPs.

Analysis and ECs processes.

Transformation processes in the environment and identification of products.

Application examples.

Ecotoxicology of organic contaminants.

Bioavailability and bioaccumulation.

Environmental impact analysis.

Toxicity and mode of action of pollutants.

Escola de Camins

Endocrine disruptors: Description and main effects.
 Biomarkers and bioassays. Morphological, biochemical and molecular biology techniques.
 Effects of organic pollutants on human health:
 Description of the problems arising from the dispersion of organic pollutants.
 Routes of entry and effects at different stages of the life cycle.
 Assessment of the environmental risk.
 Top ecotoxicity models applicable.
 Application to the determination of environmental risk.
 Relationship between the chemical and ecological status risk.
 Top chemometric tools in the treatment and interpretation of data.

Knowing the main elements of legislation and state governing the presence of organic micropollutants in water, sediments and soils.

Recognizing the types of chemical contaminants, differentiating between priority and emerging.

Identifying their sources and routes of entry to the environment.

Understanding the processes of transformation that can undergo chemical pollutants in the environment.

Knowing the degree of removal of contaminants by chemical treatments.

Understanding the problems of chemical pollution in the context of global change.

Understanding the basics of environmental biomonitoring and ecotoxicology.

Knowing the main environmental effects and risks of organic pollutants on human health and the main chemometric tools available for treatment and interpretation of environmental data.

Competencies

Especific

Apply scientific concepts to environmental problems and their correlation with technological concepts.
 Dimension unconventional systems and advanced treatment and raise their mass balance and energy.

Transversal

SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

Total hours of student work

		Hours	Percentage
Supervised Learning	Large group	25.5 h	56.67 %
	Medium group	9.75 h	21.67 %
	Laboratory classes	9.75 h	21.67 %
	Guided Activities	0.0 h	0.00 %
Self Study		80.0 h	

Contents

Organic Pollution

State legislation and European legislation on air, water, soils and sediments. Water Framework Directive

Features and families. Sources, destination and effects in the environment. The Stockholm Convention. Main measures and derived obligations.

Sampling. Pretreatment of samples. Principles.

Contents: Theory and exercises: 0.75 ECTS.

Specific objectives:

(*) Obligatory fields

Purification techniques. Instrumental analysis for extraction and gas chromatography, chromatography fluid coupled to mass spectrometry. Ionization methodology. Description of the main types of mass analyzers. Quantification methods.

Specific Objectives

- * Know which compounds are under control (air-handling and use) regulations by national and European regulations.
- * Know the ways of access to information on legislation for environmental chemical pollutants for updating regulations.
- * Know the main families and differentiate between priority and emerging contaminants.
- * Understand key features, as well as the entry routes, fate and effects on the environment.
 - * Understand the main measures taken on priority pollutants to the Stockholm Convention .
- * Know how to properly take an environmentally representative sample.
- * Know the techniques used in the treatment to demonstrate prior to instrumental analysis the environmental concentration.

Environmental Monitoring

Analysis and destination of POPs. Development in the territory according to management programs and territorial development technology. Alternatives to implanted systems. Sustainability criteria. Examples.

Analysis ECs and processes. Introduction to the environmental transformation processes. Redox processes and environmental degradation in aquifers. Application of liquid chromatography coupled to mass spectrometry in the structural and environmental identification and characterization. Examples of products: flame retardant compounds, perfluorinated compounds, drugs (human and animals medicine).

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ECs and analysis processes. Introduction to the processes of environmental transformation.

Redox processes of environmental degradation in aquifers.

Evaluation and modeling of the results of the degradation process can experience pollutants in the environment.

Specific Objectives

- * Identify the environmental destination of contaminants based on their physicochemical characteristics.
 - * Know the possibilities mass spectrometry for the identification and characterization of transformation products.
 - * Identify the main sources of environmental pollution by the families of compounds considered.
 - * Understand the environmental problems associated with the presence of those contaminants in the aquatic environment.
 - * Identify the environmental destination of contaminants based on their physicochemical characteristics.
 - * Identify the environmental destination of pollutants based on their physicochemical characteristics.
 - * Recognize different degradation processes of pollutants in the environment.
- Calculations to find the impact on the concentrations of organic pollutants due to the processes of transport and degradation of contaminants can experience the environment.

Evaluation

Evaluation second part of the course

Specific Objectives

Final evaluation

Ecotoxicology

Bioavailability and bioaccumulation. Environmental impact analysis at different levels of organization. Toxicity and way of action of pollutants. Endocrine disruptors: description and main effects. Stress response mechanisms and the presence of contaminants. Biomarkers and biotests. Technical, morphological, biochemical and molecular biology.

Description of the specific problems arising from scattering organic pollutants persistent in the environment in human population. Ways of introduction and effects of these compounds in human beings in different stages of the life cycle.

Specific Objectives

- * Understanding the basics of environmental biomonitoring and ecotoxicology.
- * Knowing the most important techniques for assessing environmental pollution.
- * Identify families of pollutants harmful to human health.
- * Know the different effects that can cause the human body.

Environmental Risk

Main ecotoxicity models of complex mixtures of organic micropollutants. Application to the determination of environmental risk. Relationship between risk and chemical state ecològic. Principals chemometric tools in the treatment and interpretation of environmental data.

Examples of ecotoxicology and risk

Specific Objectives

- * Determine whether a chemical discharged into the environment aquàtic represents a risk for the ecosystem, through the application of chemometric tools and models ecotoxicity considered.
- * Complete knowledge through problem solving

Activities

Visit and practice in analytical laboratory

Visit a specialized laboratory and practice with basic and advanced tests related to the subject matter.

Dedication

10h

Teaching Methodology

For the students to achieve their goals and skills described above, the course is divided into three sessions:

- Classroom sessions, covering theoretical and practical aspects, with examples
- Non-contact sessions. Students will spend time outside the classroom in order to understand the theoretical content of the course and apply them in a classroom
- Evaluation sessions

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

Grading Rules

() The evaluation calendar and grading rules will be approved before the start of the course.*

The mark of the course is obtained from the ratings of continuous assessment and their corresponding laboratories and/or classroom computers.

Continuous assessment consist in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The teachings of the laboratory grade is the average in such activities.

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.

Test Rules

Failure to perform a laboratory or continuous assessment activity in the scheduled period will result in a mark of zero in that activity.

Office Hours

As agreed with the teachers of the subject both in person and via email.

Bibliography

Basic

- Administracions i entitats de normalització. Legislació europea i estatal.
- Diversos. Material bibliogràfic recomanat pel professorat.

Complementary

- Diversos. Internet: CE, ACA, ...
- Professors de l'assignatura. Treballs de recerca del professorat (Tesis doctorals, articles i llibres científics).