



## IDENTIFYING DATA

### Chemistry applied to the marine environment II

Subject	Chemistry applied to the marine environment II			
Code	V10G061V01309			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Moldes Moreira, Diego Nieto Palmeiro, Óscar			
Lecturers	Calle González, Inmaculada de la Costas Rodríguez, Marta Moldes Moreira, Diego Nieto Palmeiro, Óscar			
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General description	<p>The student will acquire competences and skills on several topics of chemistry in the marine environment. In the first part of the subject, students will tackle important applications such as wastewater treatment, desalination and marine biotechnology.</p> <p>In the second part, students will acquire theoretical and practical competences regarding the analysis of chemical contaminants as well as other compounds of interest in the marine environment. In this case they will learn to use simple techniques for sample preparation prior to the measurement step and their applications in the compartments of the marine environment. The students will get knowledge about the relevance of chemistry regarding the marine environment.</p>			
	<p>English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.</p>			

## Training and Learning Results

Code	
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C6	Acquire the fundamentals and terminology of chemical processes.
C7	Apply to the marine and coastal environment the principles and methods used in Chemistry.
C8	Know the main pollutants, their causes and effects in the marine and coastal environment.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

## Expected results from this subject

Expected results from this subject	Training and Learning Results
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Recognise the main characteristics of the wastewater. Classify the wastewater depending on their origin.	A3		C6 C8	
Knowing the main technologies used for wastewater treatment and choosing the suitable one depending on the wastewater properties.	A3	B1	C6 C7	
Elaborate scientific documents with own data obtained by means of a simulation software	A3 A4 A5	B1 B4	C6 C7 C8	D1 D2
Recognise the main methodologies of sea water desalination	A3 A4	B1	C6 C7 C8	D5
Knowing the potential of the marine environment as a source of marketable products by means of biotechnological processes	A3 A4 A5		C6	
Enumerate the most important points regarding the setup of a control plan about marine pollution.	A4 A5	B1 B4	C6 C8	D2 D5
Choose and use the suitable material for sediments sampling. Choose the most important sentinel organisms for studying marine pollution.	A3 A4 A5		C6 C7 C8	
Apply the suitable chemical analytical techniques for the most interesting compounds in Environmental Chemistry. Knowing the suitable experimental conditions for the determination of a chemical compound depending on the selected technique.	A3 A4 A5	B1 B4	C6 C7 C8	D1
Being able to determine the concentration of a chemical compound in the marine environment depending on the analytical technique employed.	A3 A4 A5	B4	C6 C7 C8	D1 D2
Apply the fundamental concepts of quality control in an analytical laboratory.	A3 A5	B4	C7	D1

## Contents

### Topic

Wastewater treatment	Sources and classification of wastewaters. Physical, chemical and biological properties of wastewater. General operation of a wastewater treatment plant (WWTP). Pretreatment and primary treatment. Secondary treatment: aerobic and anaerobic systems, suspended and fixed biomass systems. Tertiary or advanced treatment.
Desalination of seawater	Technologies of desalination: thermal processes and processes with membranes. Environmental effects.
Marine biotechnology	Definition and importance of biotechnology. General diagram of biotechnological production. Procedures to obtain biotechnological products from marine organisms (biofuels, pharmaceutical products , biorremediation of pollutants)
Chemical analysis of pollutants in the water column, sediments and marine organisms.	Sampling methods. Methods for sample preparation and determination in the water column. Extraction, purification and determination methods of pollutants in sediments and marine organisms.
Analysis of marine biotoxines.	Chemical structure of marine biotoxines. Toxicity of marine biotoxines. Sample preparation. Methods of separation and detection.
Control and guarantee of quality in the measures.	Systems of guarantee of quality. Validation of analytical methods. Intercomparison assays.

## Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	2	3
Lecturing	20	30	50
Problem solving	2	10	12
Mentored work	7	21	28
Laboratory practical	10	10	20
Practices through ICT	5	1	6
Studies excursion	5	1	6
Presentation	0.5	1.5	2
Objective questions exam	2	4	6
Essay	0	12	12
Report of practices, practicum and external practices	0	2	2
Problem and/or exercise solving	1	2	3

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

<b>Methodologies</b>	
	Description
Introductory activities	The syllabus will be presented to the students (mainly aims, competences and evaluation criteria). Moreover the activities of the semester will be presented..
Lecturing	The professor will make an exhibition of the contents of the syllabus to develop, where the professor can pose some question to the students for his resolution in class. Likewise, the students can ask to the professor the questions that go arising along the exhibition. The material of the presentation will be available for the students before the session and will have to assist to her with said material. At the end of each subject, or of each group of subjects, will have to make a questionnaire that will resolve individually.
Problem solving	During the problem solving sessions, the teacher will explain the calculations to be made on a series of problems to calculate the concentration of a chemical contaminant in samples of biota and/or marine sediments.
Mentored work	During the session of computing practice, the students will obtain data related with the wastewater treatment. With these data the students will write a report with the same format of a scientific article. On the other hand, the students will study a practical case based in the analysis of a contaminant based on a bibliographic research.
Laboratory practical	The students will make some lab practices regarding the analysis of environmental pollutants and will present the corresponding report.
Practices through ICT	The students will make some practices of computer on the treatment of residual waters. They will consist in the utilisation of a simulator in which it will study the effect of diverse parameters in the process of treatment of the residual waters. The students will have to take data of the different parameters studied, which will be employed for the preparation of the Supervised Works.
Studies excursion	A visit to a wastewater treatment facility will be carried out. After the visit the students will answer to a brief questionnaire. Considering the economic possibilities of the centre, schedules and availability of companies of interest, the students could visit other company of interest related with the subject. The attendance to this visit wouldn't be mandatory.
Presentation	The students will do a brief presentation in public related with the analytical work made in the Supervised Works. The mates and the professor will be able to make questions on the presentation made.

### **Personalized assistance**

<b>Methodologies</b>	<b>Description</b>
Introductory activities	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Mentored work	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Presentation	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Laboratory practical	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Practices through ICT	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Studies excursion	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Lecturing	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Problem solving	

### **Assessment**

Description	Qualification	Training and Learning Results			
Laboratory practical	The accurate work of the student, the attitude to learn and the correct employment of the lab material will be assessed.	2.5	A5	B4	D2
Studies excursion	The students will visit a wastewater treatment facility. After that, a brief questionnaire must be answer.	5	A3 A4	C6	
Presentation	The students will do a brief public presentation related to the guided work derived from the seminar sessions.	2.5	A3 A4	B1	D2
Objective questions exam	Diverse quizzes of theoretical content and practical/theoretical content derived from the masterclasses will be made. These exams may contain type test questions, problems resolutions and/or questions with open answers	37.5	A3 A4 A5	B1 B4	C6 C7 C8 D1 D5
Essay	A scientific article must be written by the students. The data will be obtained by means of a wastewater simulation software. This counts for 20% of final evaluations. Moreover, a guided work must be carried out during/after the seminar sessions. This counts for 10% of final evaluation.	30	A3 A4 A5	B1 B4	C6 C7 C8 D1
Report of practices, practicum and external practices	The students will present an original report of the results obtained in the lab practices	10	A3 A4 A5	C6 C7 C8 D1 D2	
Problem and/or exercise solving	The problems will consist in calculating the concentration of a chemical contaminant, from the data normally obtained in a laboratory work, and expressing the result with the correct significant units and figures. The result obtained shall be evaluated, as well as the clarity and reasoning used to arrive at it. The final examination will consist in solving two such problems.	12.5	A4 A5	B1 B4	C7 D1

### Other comments on the Evaluation

Date, time and place of exams will be published in the official web of Marien Sciences Faculty:

<http://mar.uvigo.es/alumnado/examenes/>

To pass the subject, students have to achieve a minimum of 5 points up to 10 in each one of the qualified activities.

The activities with a lower qualification than 5 points will be repeated in the final exam.

The reports of practices, works and projects that do not reach the minimum qualification, will have to send with the timely corrections in the term that will estimate the lecturers in each case.

The realisation by part of the student of any proof of which show previously will be taken into account immediately for the final qualification and will be recorded in the record like student presented in the corresponding announcement.

An absence to one of the sessions of seminars or practical supposes the no evaluation of that qualified activity and will be repeated on next year.

### Sources of information

#### Basic Bibliography

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Aminot A., K rouel R., **Hydrologie des  cosyst mes marins: param tres et analyses**, Editions Quae, 2004

Garc a Est vez J.M., Olabarri a C., P rez S., Rol n  lvarez E., Ros n G., **M todos y T cnicas en Investigaci n Marina**, Tecnos-Anaya, 2011

Gianguzza A., **Marine chemistry: an environmental analytical chemistry approach**, Springer, 2012

#### Complementary Bibliography

Clark, Robert B, **Marine Pollution**, Oxford University Press, 2001

Mackenzie L. Davis, **Water and Wastewater Engineering. Design Principles and Practice**, McGraw-Hill, 2010

Jos  A. Ib n ez Mengual, **Desalaci n de aguas**, Instituto Euromediterr neo del Agua, 2009

Se-Kwon Kim, **Springer Handbook of Marine Biotechnology**, Springer London Ltd., 2014

A. Aminot, M. Chaussepied, **Manuel des Analyses Chimiques en Millieu Marin**, Centre National pour l'Explorations des Oceans. B, 1983

OECD, **Marine Biotechnology Enabling Solutions for Ocean Productivity and Sustainability**, OECDiLibrary, 2013

Beiras R., P rez S., **Manual de m todos b sicos en Contaminaci n Acu tica**, Universidade de Vigo, 2013

K. Grasshoff, K. Kremling, M. Ehrhardt, **Methods of Seawater Analysis**, 3, Wiley-VCH, 1999

Fifield F.W., Haines P.J., **Environmental Analytical Chemistry**, Blackie Academic, 1995

Harris D.C., **An lisis Qu mico Cuantitativo**, Revert , 2007

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## **Recommendations**

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### **Subjects that it is recommended to have taken before**

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Chemical oceanography I/V10G061V01204

Chemical oceanography II/V10G061V01209

Chemistry applied to the marine environment I/V10G061V01304

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