Teaching Guide				
Identifying Data				2021/22
Subject (*)	Advanced Sample Preparation Techniques		Code	610509324
Study programme	Mestrado Universitario en Investigación Química e Química Industrial (Plan 2020)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Optional	3
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Departamento profesorado másterQuímica			
Coordinador	Alonso Rodriguez, Elia	E-mail	elia.alonso@udc.es	
Lecturers	Alonso Rodriguez, Elia	E-mail	elia.alonso@udc.es	
Web	www.usc.es/gl/centros/quimica/curso/master.html			
General description	This course focuses on training the student to obtain a detailed and current knowledge of different theoretical and practical aspects related to sample preparation techniques (extraction, purification and concentration methods) used in the analysis methods.			
Contingency plan	1. Modifications to the contents No changes will be made 2. Methodologies *Teaching methodologies that are maintained All methodologies are maintained and if the health situation requires it, they will be adapted to the non-presential mode through Moodle and Teams *Teaching methodologies that are modified No modifications 3. Mechanisms for personalized attention to students Tutoring by Teams, Moodle and email 4. Modifications in the evaluation No changes are made *Evaluation observations: The evaluation system and the percentages are maintained 5. Modifications to the bibliography or webgraphy No changes will be made			

Study programme competences	
Code	Study programme competences
A2	Suggest alternatives for solving complex chemical problems related to the different areas of chemistry.
A6	Design processes involving the treatment or disposal of hazardous chemicals
A7	Operate with advanced instrumentation for chemical analysis and structural determination.
A9	Promote innovation and entrepreneurship in the chemical industry and in research.
B2	Students should apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
B4	Students should be able to communicate their conclusions, and the knowledge and the reasons that support them to specialists and non-specialists in a clear and unambiguous manner
B5	Students must possess learning skills to allow them to continue studying in a way that will have to be largely self-directed or autonomous.
B7	Identify information from scientific literature by using appropriate channels and integrate such information to raise and contextualize a research topic
B10	Use of scientific terminology in English to explain the experimental results in the context of the chemical profession
B11	Apply correctly the new technologies to gather and organize the information to solve problems in the professional activity.
C1	CT1 - Elaborar, escribir e defender publicamente informes de carácter científico e técnico

C3	CT3 - Traballar con autonomía e eficiencia na práctica diaria da investigación ou da actividade profesional.
C4	CT4 - Apreciar o valor da calidade e mellora continua, actuando con rigor, responsabilidade e ética profesional.

Learning outcomes			
Learning outcomes	Study programme competences		
Define concepts, principles, theories and applications of different sample preparation techniques	AC2		
Propose alternatives to the traditional extraction techniques for solving complex chemical problems	AC7		
Apply advanced extraction processes in innovative fields of industry and chemical research		BC2	
Innovate in sample preparation methods used in chemical analysis in different areas of chemistry	AC9		
Assess risks and environmental impacts of new sample preparation techniques against conventional techniques, proposing "Green Analytical Chemistry" alternatives	AC2 AC6		
Analyze and discuss examples of applications using the knowledge acquired, including primary literature sources and scientific databases (SciFinder, WOK, Medline, etc.)		BC4 BC7	
Promote innovation in industry and in chemical research	AC9	BC5 BC10 BC11	CC4
Employ of advanced instrumentation for chemical analysis	AC7		
Work and learn independently and with initiative			CC3
Write and present scientific and technical reports			CC1

Contents	
Topic	Sub-topic
Unit 1. Introduction to advanced sample preparation techniques.	- Importancia da etapa de preparación de mostra. - Técnicas clásicas de extracción. - Tendencias na etapa de preparación de mostra. - Sistemas de mostraxe pasiva. - Mostraxe activa de aire e partículas.
Unit 2. Supercritical fluid extraction.	- Propiedades xerais dos fluídos supercríticos. - Instrumentación: compoñentes básicos dun extractor de FS. - Modos de extracción: métodos on-line e off-line. - Aplicacións.
Unit 3. Microwave assisted extraction.	- Fundamentos teóricos. - Transformación da enerxía de microondas en calor. - Extracción con disolventes de alta perda dieléctrica. - Extracción con disolventes transparentes á radiación. - Instrumentación. - Aplicacións.
Unit 4. Accelerated solvent extraction.	- Fundamento. - Instrumentación. - Modo de operación. - Aplicacións.
Unit 5. Solid phase extraction.	- Fundamento. - Tipos de fases sólidas. - Desenvolvemento de métodos. - Automatización da extracción en fase sólida. - Microextracción con adsorbentes empaquetados (MEPS). - Extracción en fase sólida dispersiva (dSPE, QuEChERS). - Dispersión da matriz nunha fase sólida (MSPD).

Unit 6. Solid phase microextraction.	- Introdución. - Principios básicos. - Modos de extracción. - Tipos de recubrimientos. - Parámetros que afectan o proceso de extracción. - Cuantificación. - Aplicacións.
Unit 7. Liquid phase microextraction.	- Microextracción con pinga suspendida (Single-drop microextraction, SDME). - Técnicas de membrana (Membrane Assisted Solvent Extraction, MASE). - Microextracción con fibra oca (Hollowfiber-LPME) - Microextracción en fase líquida dispersiva (Dispersive liquid-liquid microextraction, DLLME). - Microextracción dispersiva asistida por ultrasóns (Ultrasound-Assisted Emulsification-Microextraction, USAEME)

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A2 A9	12	18	30
Seminar	A2 A6 A7 B2 B4 B5 B7 B10 B11 C1 C3 C4	7	28	35
Mixed objective/subjective test	A2 A6 B2	2	6	8
Personalized attention		2	0	2
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	Nelas abordaranse os fundamentos teóricos e instrumentais de cada unha das técnicas de preparación de mostra. Proxectaranse diapositivas, e nalgúns casos utilizaranse animacións informáticas ou algún vídeo, que facilitarán o seguimento das explicacións. Durante a presentación dos distintos temas iranse formulando preguntas ao fío dos conceptos explicados co obxecto de dinamizar as clases e fomentar a participación.
Seminar	Sesións realizadas con profesorado propio do Máster, ou con profesionais convidados da empresa, a administración ou doutras universidades. Resolución de casos prácticos (problemas, cuestiones tipo test, interpretación e procesamento da información, avaliación de publicacións científicas, etc.). Ademais, utilizarase algunha das clases de seminario para que os alumnos presenten os traballos expostos nalgún dos temas e para poder discutilos en grupo.
Mixed objective/subjective test	Proba escrita utilizada para a avaliación da aprendizaxe do alumno.

Personalized attention	
Methodologies	Description

Seminar	During the seminar sessions an individualized learning control of the students will be held and their questions will be resolved. Students being recognized officially as partial-time and entitled not to attend the lectures will be attended in a tutorships regime (set hour with teacher in advance).

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Seminar	A2 A6 A7 B2 B4 B5 B7 B10 B11 C1 C3 C4	Resolución de problemas e/ou casos prácticos (10%) Realización de traballos e informes escritos (10%) Exposición oral (traballos, informes, problemas e casos prácticos) (10%) Avaliación continua do interese e actitude do alumno mediante preguntas e cuestións durante o curso (10%)	40
Mixed objective/subjective test	A2 A6 B2	Realizarase un exame final que versará sobre a totalidade dos contidos da materia.	60

Assessment comments
- To be examined it is necessary to have attended 80% of the seminar classes and personalized attention. - Continuous assessment (N1) represent 40% of the final grade and will consist of seminar sessions and personalized attention which will include: . Solving questions and/or case studies: 10% . Carrying out papers and reports: 10% . Oral presentation: 10% . Questions along the course: 10% - The final exam (N2) will cover the entire contents of the subject. - Student's final grade will be obtained applying the following formula: Final grade = 0,4 x N1 + 0,6 x N2 N1 (0-10 points) N2 (0-10 points) - Students who fail the course must attend all classes again. For students being recognized officially as partial-time and entitled not to attend the lectures, the final exam represent 80% of the final grade and supervised projects 20%. The fraudulent performance of the tests or evaluation activities will directly imply the failure grade '0' in the matter in the corresponding call, thus invalidating any qualification obtained in all the evaluation activities for the extraordinary call

Sources of information	
Basic	- Pawliszyn, J. (Ed.) (2012). Comprehensive Sampling and Sample Preparation. Elsevier

Complementary	- Cela, R.; Lorenzo, R.A.; Casais, C. (2002). Técnicas de Separación en Química Analítica. Síntesis - Ibañez, E.; Cifuentes, A. (2017). Green Extraction Techniques: Principles, Advances and Applications. Elsevier - Dean, J.R. (Ed.) (2009). Extraction Techniques in Analytical Sciences. Wiley - Pawliszyn, J.; Lord, H.L. (Ed.) (2010). Handbook of Sample Preparation. Wiley - Kokosa, J.M.; Przyjazny, A.; Jeannot, M.A. (2009). Solvent Microextraction. Wiley - Self, R. (2005). Extraction of Organic Analytes from Foods. The Royal Sociaty of Chemistry (RSC) - Mitra, S. (Ed.) (2003). Sample Preparation Techniques in Analytical Chemistry. Wiley - Fritz, J.S. (1999). Analytical Solid-Phase Extraction. Wiley-VCH - Pawliszyn, J. (1997). Solid Phase Microextraction. Theory and Practice. Wiley-VCH - Pawliszyn, J. (Ed.) (1999). Aplications of Solid Phase Microextraction. RSC Chromatography Monographs - Scheppeers Wercinski, S.A. (Ed.) (1999). Solid Phase Microextraction. A Practical Guide. Marcel Dekker Inc. - Luque de Castro, M.D.; Luque García, J.L. (2002). Aceleration and Automation of Solid Sample Treatment. Elsevier

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
/
Other comments
Recommendations to pass the course: Regular attendance to classes is recommended and resolve questions that arise during the study of the subject. It is important that the student read the literature recommended by teachers prior to the development of each seminar session. Performance of a work under the direct guidance of teachers through attendance at sessions of personalized attention.