



| Teaching Guide           |   |        |                    |         |
|--------------------------|---|--------|--------------------|---------|
| Identifying Data         |   |        | 2020/21            |         |
| 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         | <p>1. Modifications to the contents<br/>No changes will be made</p> <p>2. Methodologies<br/>*Teaching methodologies that are maintained<br/>All methodologies are maintained and if the health situation requires it, they will be adapted to the non-presential mode through Moodle and Teams<br/>*Teaching methodologies that are modified<br/>No modifications</p> <p>3. Mechanisms for personalized attention to students<br/>Tutoring by Teams, Moodle and email</p> <p>4. Modifications in the evaluation<br/>No changes are made<br/>*Evaluation observations:<br/>The evaluation system and the percentages are maintained</p> <p>5. Modifications to the bibliography or webgraphy<br/>No changes will be made</p> |        |                    |         |

| Study programme competences / results |   |
|---------------------------------------|---|
| Code                                  | Study programme competences / results   |
| 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  |



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| 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 / results |                     |     |
| 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<br>AC6                            |                     |     |
| Analyze and discuss examples of applications using the knowledge acquired, including primary literature sources and scientific databases (SciFinder, WOK, Medline, etc.) |                                       | BC4<br>BC7          |     |
| Promote innovation in industry and in chemical research  | AC9                                   | BC5<br>BC10<br>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. | <ul style="list-style-type: none"> <li>- Importancia da etapa de preparación de mostra.</li> <li>- Técnicas clásicas de extracción.</li> <li>- Tratamento enzimático de mostra.</li> <li>- Tendencias na etapa de preparación de mostra.</li> <li>- Sistemas de mostraxe pasiva.</li> <li>- Mostraxe activa de aire e partículas.</li> </ul> |
| Unit 2. Supercritical fluid extraction.                         | <ul style="list-style-type: none"> <li>- Propiedades xerais dos fluídos supercríticos.</li> <li>- Instrumentación: compoñentes básicos dun extractor de FS.</li> <li>- Modos de extracción: métodos on-line e off-line.</li> <li>- Aplicacións.</li> </ul>   |
| Unit 3. Microwave assisted extraction.                          | <ul style="list-style-type: none"> <li>- Fundamentos teóricos.</li> <li>- Transformación da enerxía de microondas en calor.</li> <li>- Extracción con disolventes de alta perda dieléctrica.</li> <li>- Extracción con disolventes transparentes á radiación.</li> <li>- Instrumentación.</li> <li>- Aplicacións.</li> </ul>                 |
| Unit 4. Accelerated solvent extraction.                         | <ul style="list-style-type: none"> <li>- Fundamento.</li> <li>- Instrumentación.</li> <li>- Modo de operación.</li> <li>- Aplicacións.</li> </ul>  |



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|---------------------------------------|--|
| Unit 5. Solid phase extraction.       | <ul style="list-style-type: none"> <li>- Fundamento.</li> <li>- Tipos de fases sólidas.</li> <li>- Desenvolvemento de métodos.</li> <li>- Automatización da extracción en fase sólida.</li> <li>- Microextracción con adsorbentes empacados (MEPS).</li> <li>- Extracción en fase sólida dispersiva (dSPE, QuEChERS).</li> <li>- Dispersión da matriz nunha fase sólida (MSPD).</li> </ul>   |
| Unit 6. Solid phase microextraction.  | <ul style="list-style-type: none"> <li>- Introducción.</li> <li>- Principios básicos.</li> <li>- Modos de extracción.</li> <li>- Tipos de recubrimientos.</li> <li>- Parámetros que afectan o proceso de extracción.</li> <li>- Cuantificación.</li> <li>- Aplicacións.</li> </ul>   |
| Unit 7. Liquid phase microextraction. | <ul style="list-style-type: none"> <li>- Microextracción con pinga suspendida (Single-drop microextraction, SDME).</li> <li>- Técnicas de membrana (Membrane Assisted Solvent Extraction, MASE).</li> <li>- Microextracción con fibra oca (Hollowfiber-LPME)</li> <li>- Microextracción en fase líquida dispersiva (Dispersive liquid-liquid microextraction, DLLME).</li> <li>- Microextracción dispersiva asistida por ultrasóns (Ultrasound-Assisted Emulsification-Microextraction, USAEME)</li> </ul> |

| Planning                        |   |                                      |                               |             |
|---------------------------------|---|--------------------------------------|-------------------------------|-------------|
| Methodologies / tests           | Competencies / Results                      | Teaching hours (in-person & virtual) | Student's personal work hours | Total hours |
| Guest lecture / keynote speech  | A2 A9                                       | 12                                   | 18                            | 30          |
| Seminar                         | A2 A6 A7 B2 B4 B5<br>B7 B10 B11 C1 C3<br>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, cuestións 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 | <p>During the seminar sessions an individualized learning control of the students will be held and their questions will be resolved.</p> <p>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).</p> |
|---------|--|

| Assessment                      |   |   |               |
|---------------------------------|---|---|---------------|
| Methodologies                   | Competencies / Results                      | Description   | Qualification |
| Seminar                         | A2 A6 A7 B2 B4 B5<br>B7 B10 B11 C1 C3<br>C4 | Resolución de problemas e/ou casos prácticos (10%)<br>Realización de traballos e informes escritos (10%)<br>Exposición oral (traballos, informes, problemas e casos prácticos) (10%)<br>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  |
|--|
| <ul style="list-style-type: none"><li>- To be examined it is necessary to have attended 80% of the seminar classes and personalized attention.</li><li>- Continuous assessment (N1) represent 40% of the final grade and will consist of seminar sessions and personalized attention which will include:<ul style="list-style-type: none"><li>. Solving questions and/or case studies: 10%</li><li>. Carrying out papers and reports: 10%</li><li>. Oral presentation: 10%</li><li>. Questions along the course: 10%</li></ul></li><li>- The final exam (N2) will cover the entire contents of the subject.</li><li>- Student's final grade will be obtained applying the following formula:<br/><math display="block">\text{Final grade} = 0,4 \times N1 + 0,6 \times N2</math> N1 (0-10 points) N2 (0-10 points)</li><li>- Students who fail the course must attend all classes again.</li></ul> <p>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%.</p> |

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



|                      |  |
|----------------------|--|
| <b>Complementary</b> | <ul style="list-style-type: none"><li>- Pawliszyn, J.; Lord, H.L. (Ed.) (2010 ). Handbook of Sample Preparation. Wiley</li><li>- Dean, J.R. (Ed.) (2009). Extraction Techniques in Analytical Sciences. Wiley</li><li>- Scheppeers Wercinski, S.A. (Ed.) (1999). Solid Phase Microextraction. A Practical Guide. Marcel Dekker Inc.</li><li>- Pawliszyn, J. (Ed.) (1999). Applications of Solid Phase Microextraction. RSC Chromatography Monographs</li><li>- Pawliszyn, J. (1997). Solid Phase Microextraction. Theory and Practice. Wiley-VCH</li><li>- Fritz, J.S. (1999). Analytical Solid-Phase Extraction. Wiley-VCH</li><li>- Luque de Castro, M.D.; Luque García, J.L. (2002). Aceleration and Automation of Solid Sample Treatment. Elsevier</li><li>- Mitra, S. (Ed.) (2003). Sample Preparation Techniques in Analytical Chemistry. Wiley</li><li>- Self, R. (2005). Extraction of Organic Analytes from Foods. The Royal Society of Chemistry (RSC)</li><li>- Cela, R.; Lorenzo, R.A.; Casais, C. (2002). Técnicas de Separación en Química Analítica. Síntesis</li><li>- Kokosa, J.M.; Przyjazny, A.; Jeannot, M.A. (2009). Solvent Microextraction. Wiley</li></ul> |
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## Recommendations

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

### Subjects that are recommended to be taken simultaneously

### Subjects that continue the syllabus

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### 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.&nbsp;

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.