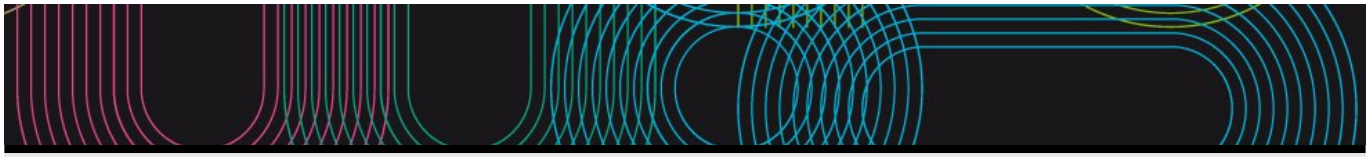

IDENTIFYING DATA				
Production of Basic Components from Lignocellulosic Waste				
Subject	Production of Basic Components from Lignocellulosic Waste			
Code	O01M142V01213			
Study programme	(*)Máster Universitario en Ciencia e Tecnoloxía Agroalimentaria e Ambiental			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	2nd
Teaching language	Galician			
Department	External Chemical Engineering			
Coordinator	Santos Reyes, Valentín			
Lecturers	Santos Reyes, Valentín Vila Babarro, Carlos			
E-mail	vsantos@uvigo.es			
Web				
General description	Know and implement the main technologies for the production of platform chemicals from residual lignocellulosic materials			

Competencies	
Code	
A1	
A3	
B4	(*)Que os estudantes sexean capaces de adaptarse a novas situacións, con grandes doses de creatividade e ideas para asumir o liderado de investigadores.
C1	
C8	
C10	
D1	
D2	
D3	
D4	
D5	
D6	
D7	
D8	
D9	
D10	
D11	Motivación poa calidade con sensibilidade hacia temas medioambientais

Learning outcomes				
Expected results from this subject	Training and Learning Results			
Knowing the potential of lignocellulosic residues (wood, prunings, straws, ...) as substrates for obtaining high added value products, candidates to replace to those now obtained from petroleum. Knowing the potential as platform chemicals of hydroxymethylfurfural (HMF), furfural, levulinic acid and formic acid	A1 A3	B4	C10	D1

Knowing the different processes in the treatment of lignocellulosic materials for obtaining the aforementioned platform chemicals. Obtain laboratory skills to carry them out.	A1	B4	C1 C8 C10	D1 D2 D4 D5 D7 D8 D11
Knowing the different analytical techniques for determining the chemical composition and structure of materials and studied compounds. Obtain skills to perform them at laboratory and knowledege for interpretation of the obtained data.	A1		C1 C8 C10	D1 D2
Critical analysis of recent studies published in scientific literature.	A1	B4	C1 C10	D1 D2 D3 D4 D6 D8 D9 D10
Acquiring skills in synthesis and organization of information, writing and exposition, through the development and public presentation of a related topic work.	A1	B4	C10	D1 D2 D3 D4 D6 D8 D11

Contents

Topic	
Introducion	- Biomass as a renewable resource - Platform chemicals obtained from biomass
Biomass fractionation	- Treatments for hemicellulose solubilization - Delignification treatments - Cellulose hydrolysis
Hemicelluloses	- Composition - Obtention
Cellulose	- Caracterization - Obtention
Levulinic acid	- Characteristics and properties - Production by acid hydrolysis of hexoses - Production using solid catalysts - Production using enzymes
Hydroxymethylfurfural (HMF)	- Characteristics and properties - Production by acid hydrolysis of hexoses - Biphasic systems - Production using ionic liquids
Furfural	- Characteristics and properties - Production by acid hydrolysis of pentoses - Biphasic systems - Production using ionic liquids

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practices	4	8	12
Presentation	3	24	27
Seminars	1	5	6
Lecturing	10	20	30

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

Methodologies

	Description
Laboratory practices	Laboratory experiments related with fractionation of lignocellulosic materials, chemical characterization of obtained fractions, production of levulinic acid by acid hydrolysis, and production of furfural in a biphasic system. These part is complemented with familiarization in analysis methodologies.

Presentation	The supervised work made by the student will be presented in the classroom to the teacher and classmates. Evaluation will consider organization of the information and domain of the exposed subject. Additionally the answers to the questions posed by the teacher and classmates will be considered, and participation as listener, according to the comments and questions raised in the classmates' presentations.
Seminars	Related with "Laboratory Practice" methodology, scheduled seminars address to perform analysis of the obtained experimental data. More specifically, applying material balances to the studied processes, implementing the kinetic modeling for acid hydrolysis of sugars in a spreadsheet, or off-line integration of different chromatograms.
Lecturing	Presentation at classroom of the fundamentals of the subject, using audiovisual methods and, in some cases, making basic experiments requiring little material and low-tech.

Personalized attention

Methodologies	Description
Laboratory practices	During the labs the teacher is present in the laboratory to guide, correct, and control their correct development and follow up.
Presentation	During the performance of the tutored work the professor will orient in the compiling, classifying and organizing of the information. This orientation will continue during subsequent elaboration of material to be used in exposition in classroom.
Seminars	In the presential part of the seminars, calculation methodologies to be employed for the interpretation of the experimental data obtained will be presented. Any student doubt will be solved. In the non presential part any question or consult made by the students will be answered using the e-learning platform, e-mail or in person during tutoring time.

Assessment

	Description	Qualification	Training and Learning Results			
Laboratory practices	It will be considered for evaluation the actitude and aptitude in the laboratory, the quality of the obtained data, and the answers/comments to the questions.	25	A1	B4	C1 C8 C10	D1 D2 D6 D9 D10 D11
Presentation	As "emitter: The organization and synthesis of the presented material, the clarity in the exposition, and the answer to the questions will be evaluated. As "receptor": Participation in classmates presentations will be evaluated, taking into account the comments / questions realized	20	A1		C1	D1 D3 D4 D7 D8 D11
Seminars	To be valuated: the attitude and aptitude, the skills in the use of the required software tools (spreadsheet, chromatographic analysis software), and the elaborated material.	20	A1		C1 C8 C10	D1 D4 D6 D8 D9 D11
Lecturing	Realization of an exam of the subject. It Will include relative questions to theoretical concepts, production methodologies, analytical methods and practical cases	35	A1	B4	C1 C8 C10	D3 D5 D8

Other comments on the Evaluation

1. It is necessary to obtain a minimum qualification of 4.0 (base 10) in every part to pass the subject (Exam, laboratory practices, oral presentations and seminars).
2. Students that can not attend in person must demonstrate that they have the necessary knowledge and skills in the laboratory. They will have to do the exam of the subject, to elaborate a homework whose oral presentation can be video recorded and uploaded to the e-learning platform, to solve some of the cases dealed in seminars, and to realize a exam about laboratory aspects. However, respect to laboratory practices, you are kindly requested to attend in person if possible.
3. In July the student can opt for examining of the exam or the methodologies not surpassed in the previous opportunity, or of those that wish to improve the previous qualification. The assigned qualification will be the best of that obtained in June or July for exam or every methodology.
4. The communication with the students will be made through the e-learning platform of the University of Vigo.

5. Examination dates: March, 22th 2019 at 10.00 and July, 12th 2019 at 10.00

Sources of information
Basic Bibliography
Complementary Bibliography
Robert-Jan Van Putten et al, **Hydroxymethylfurfural, a versatile platform chemical made from renewable resources**, ACS,
Edwin R.P. Keijsers eta l., **The cellulose resource matrix**, Elsevier,
Yomaira J. Pagán-Torres et al., **Production of 5-Hydroxymethylfurfural from Glucose Using a Combination of Lewis and Brønsted Acid Catalysts in Water in a biphasic reactor ...**, ACS,
Atsushi Takagaki et al., **Catalytic transformations of biomass-derived materials into value-added chemicals**, Springer,
Jean-Paul Lange et al., **Furfural- A promising platform for lignocellulosic biofuels**, Willey-VCH,
D.W. Rackemann y W.O.S. Doherty, **The conversion of lignocellulosics to levulinic acid**, John Willey and Sons,
S. Rivas, **Valorizacion de hemicelulosas de biomasa vegetal**, UVigo,
A. Morone, M. Apte, R.A. Pandey, **Levulinic acid production from renewable waste resources: Bottlenecks, potential remedies, advancements and applications**, Elsevier,
S. Dutta, S.De, B. Saha, I. Alam, **Advances in conversion of hemicellulosic biomass to furfural and upgrading to biofuels**, R. Society of Chemistry,
J. Cui, J. Tan, T. Deng et al., **Conversion of carbohydrates to furfural via selective cleavage of the carbon carbon bond**, R. Society of Chemistry,
A.M. Raspolli Galletti, C. Antonetti, V. de Luise et al., **Levulinic acid production from waste biomass**, Carolina State University,
J. Sadhukhan, K. Siew, E. Martínez-Hernández, **Novel integrated mechanical biological treatment systems for the production of levulinic acid from fraction of municipal waste**, Elsevier,

Recommendations
Subjects that are recommended to be taken simultaneously
Instrumental Techniques for Agri-Food and Environmental Analyses/O01M142V01109