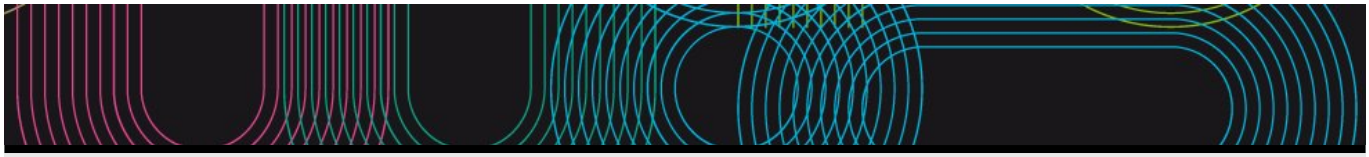

IDENTIFYING DATA				
Production of Basic Components from Lignocellulosic Waste				
Subject	Production of Basic Components from Lignocellulosic Waste			
Code	O01M142V01213			
Study programme	(*)Máster Universitario en Ciencia e Tecnoloxía Agroalimentaria e Ambiental			
Descriptors	ECTS Credits	Type	Year	Quadmester
	3	Optional	1st	2nd
Teaching language	#EnglishFriendly Galician			
Department				
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		Typology
CB1		• know • Know How
CG3	(*)Que os estudantes sexan capaces de desenvolver habilidades personais de razoamento crítico e constructivo para mellorar o funcionamiento dos proxectos de investigación en que intervén.	• know • Know How • Know be
CG4	(*)Que os estudantes sexean capaces de adaptarse a novas situacións, con grandes doses de creatividade e ideas para asumir o liderado de investigadores.	• know • Know How • Know be
CE1		• know • Know How
CE8		• know • Know How
CE10		• know • Know How
CT1		• know • Know How
CT2		• Know How
CT3		• know • Know How • Know be
CT4		• Know How • Know be
CT5		• Know How • Know be
CT6		• Know How • Know be
CT7		• Know How • Know be

CT8	• Know How • Know be
CT9	• Know How • Know be
CT10	• Know How • Know be
CT11 Motivación poa calidade con sensibilidade hacia temas medioambientais	• Know How • Know be

Learning outcomes	
Learning outcomes	Competences
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	CB1 CG4 CE10 CT1
Knowing the different processes in the treatment of lignocellulosic materials for obtaining the aforementioned platform chemicals. Obtain laboratory skills to carry them out.	CB1 CG3 CG4 CE1 CE8 CE10 CT1 CT2 CT4 CT5 CT7 CT8 CT11
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.	CB1 CE1 CE8 CE10 CT1 CT2
Critical analysis of recent studies published in scientific literature.	CB1 CG3 CG4 CE1 CE10 CT1 CT2 CT3 CT4 CT6 CT8 CT9 CT10
Acquiring skills in synthesis and organization of information, writing and exposition, through the development and public presentation of a related topic work.	CB1 CG3 CG4 CE10 CT1 CT2 CT3 CT4 CT6 CT8 CT11

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 practical	3	9	12
Presentation	2	36	38
Seminars	1	8	9
Lecturing	8	8	16

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

Methodologies

	Description
Laboratory practical	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 offline 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 assistance

Methodologies	Description
Laboratory practical	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	Evaluated Competencess

Lecturing	Realization of an exam of the subject. It Will include relative questions to theoretical concepts, production methodologies, analytical methods and practical cases	35	CB1 CG4 CE1 CE8 CE10 CT3 CT5 CT8
Laboratory practical	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	CB1 CG4 CE1 CE8 CE10 CT1 CT2 CT6 CT9 CT10 CT11
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	CB1 CE1 CT1 CT3 CT4 CT7 CT8 CT11
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	CB1 CE1 CE8 CE10 CT1 CT4 CT6 CT8 CT9 CT11

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 of the matter and laboratory skills. 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, 20th 2020 at 11.00 and July, 7th 2020 at 11.00

Sources of information

Basic Bibliography

Complementary Bibliography

Robert-Jan Van Putten et al, Hydroxymethylfurfural, a versatile platform chemical made from renewable resources, ACS, Chemical Reviews, 2013, 113, 1499-1597

Edwin R.P. Keijsers eta l., The cellulose resource matrix, Elsevier, Carbohydrate Polymers, 2013, 93, 9-21

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, ACS Catalysis, 2012, 2, 930-934

Atsushi Takagaki et al., Catalytic transformations of biomass-derived materials into value-added chemicals, Springer, Catal Surv Asia, 2012, 16, 164-182

Jean-Paul Lange et al., Furfural- A promising platform for lignocellulosic biofuels, Willey-VCH, ChemSusChem, 2012, 5, 150-166

D.W. Rackemann y W.O.S. Doherty, The conversion of lignocellulosics to levulinic acid, John Willey and Sons, Biofuels, Bioprod. Bioref., 2011, 5, 198-214.

S. Rivas, Valorizacion de hemicelulosas de biomasa vegetal, UVigo, Uvigo, 2013

A. Morone, M. Apte, R.A. Pandey, Levulinic acid production from renewable waste resources: Bottlenecks, potential remedies, advancements and applications, Elsevier, Renewable and sustainable energy reviews, 2015, 51

S. Dutta, S.De, B. Saha, I. Alam, Advances in conversion of hemicellulosic biomass to furfural and upgrading to biofuels, R. Society of Chemistry, Catalysis, Science and Technology, 2012, 2, 2025-2

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, Green Chemistry, 2016, 18, 1619-1624

A.M. Raspolli Galletti, C. Antonetti, V. de Luise et al., Levulinic acid production from waste biomass, Carolina State University, BioResources, 2012, 7, 1824-1835

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, Bioresource Technology, 2016, 215, 131-143

Peleteiro, S.; Santos, V.; Garrote, G.; Parajó, J. C, Furfural production from Eucalyptus wood using an acidic ionic liquid, Carbohydrate Polymers, 2016, 146, 20-25

Rivas, S.; Galletti, A.M.R.; Antonetti, C.; Licursi, D.; Santos, V.; Parajó, J. C., A biorefinery cascade conversion of hemicellulose-free Eucalyptus globulus wood: Production of concentrated levulinic acid solutions for gamma-valerolactone sustainable preparation products, Catalysis, 2018, 8, 169-184

Recommendations

Subjects that are recommended to be taken simultaneously

Instrumental Techniques for Agri-Food and Environmental Analyses/O01M142V01109