FICHA DE UNIDADE CURRICULAR (UC)

POLITÉCNICO DE PORTALEGRE

Atualizado a	2026/03/23
Ano Lectivo / Periodo	2024/25 / S2
Microcredencial	Microcredencial Wire Cost - Training School-Waste Biorefinery Technologies for accerlerating Sustainable - Energy Processes
Nível do Quadro Europeu de Qualificações	8
Regime de Funcionamento	Presencial
Língua de ensino	Inglês

ECTS/tempo de trabalho (horas)

ECTS	Total	Horas de contacto semestral								
		T	TP	PL	S	TC	E	O	OT	EC
2	50	17	10	4	4	0	0	0	15	0

T - Teóricas; TP - Teórico-práticas; PL - Prática-laboratorial; S - Seminário; OT - Orientação tutorial; TC - Trabalho de campo; E - Estágio; EC - Ensino Clínico; O* - Outras horas caraterizadas como Ensino Clínico ao abrigo da Diretiva nº 77/453/CEE de 27 Junho adaptada pela Diretiva 2005/36/CE;

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Pré-requisitos [unidades curriculares que lhe devem preceder ou competências à entrada]	To be enrolled in a doctoral degree program or to have completed the doctoral degree within the last 8 years
Objetivos de aprendizagem	1. Understand the principles and practices of sourcing sustainable feedstocks for industrial applications, focusing on minimizing environmental impact and promoting economic viability. 2. Analyze the optimization of biomass and waste supply chains, addressing logistical challenges, technological advancements, and economic factors to maximize efficiency and effectiveness. 3. Acquire knowledge of techniques for characterizing and evaluating the quality and composition of raw materials, applying both theoretical and practical analytical methods. 4. Gain a comprehensive overview of bioenergy, including its sources, conversion technologies, environmental impacts, and its role in the global energy landscape. 5. Study pretreatment methods to enhance efficiency and yield in biorefineries, understanding their impact on the structure and composition of raw materials. 6. Learn about biological conversion processes using microorganisms to produce biochemicals, focusing on optimizing conditions for maximum yield and efficiency. 7. Explore the valorization of agro-industrial residues for the production of bioplastics and bio-composites, analyzing environmental and economic benefits. 8. Understand the production and application of biochars as adsorbents or catalysts, investigating carbonization, activation, and modification technologies. 9. Investigate the production of value-added products from biorefineries, identifying opportunities and challenges in the development and commercialization of these products. 10. Study the integration of biorefineries into existing industries, focusing on European case studies and best practices, evaluating the benefits and challenges of such integration.
Objetivos de Desenvolvimento Sustentável	
Conteúdos Programáticos	Sourcing sustainable feedstock: Strategies for identifying and acquiring raw materials: Explore the principles and practices involved in sourcing sustainable raw materials for industrial applications. It

[estrutura de conteúdos a desenvolver para o total de horas previsto]

covers the various strategies for identifying and acquiring raw materials with a view to minimizing environmental impact and promoting economic viability. Its main objective is to understand the fundamentals of the sustainable supply of raw materials; analyze the different origins and applications; evaluate the environmental, economic and social impacts of the supply of these raw materials.

Optimizing biomass and waste supply chains: From harvesting to reprocessing: Provide an understanding of the optimization of biomass and waste supply chains, focusing on processes from harvesting to pre-processing. Involving logistical challenges, technological advances, economic factors and sustainability, in order to maximize the efficiency and effectiveness of supply chains. The aim is to understand the main supply chains; logistical and operational challenges; technologies and their impact on optimizing the supply chain for pre-processing; strategies for better efficiency and sustainability.

Characterization techniques for assessing feedstock quality and composition: Provide knowledge of the techniques for characterizing and evaluating the quality and composition of the raw materials to be used. This will provide students with the necessary skills to evaluate the properties of raw materials, covering both theory and practice in the application of different analytical methods. The objective is to understand the importance of characterization; different techniques and their applications; the ability to develop appropriate methods according to the raw material to be studied; interpretation and analysis of data; application of techniques.

Bioenergy: A general overview: Provide a comprehensive overview of bioenergy, covering its different sources, technologies, environmental impacts and impact on the global energy landscape. It explores the fundamentals of bioenergy production from different sources, the conversion technologies available according to the raw materials available, and the economic, environmental and political aspects that influence its development and deployment. The aim is to understand the basic principles and concepts of bioenergy; the different sources of bioenergy; the technologies used for processing and producing of biofuels.

Pretreatment methods to enhance efficiency and yield in biorefineries: To study the different pretreatment methods used to increase efficiency and yields in biorefineries. It will also include the provision of principles, techniques, and technologies involved in the pretreatment of biomass and other raw materials in order to improve the overall efficiency of production processes. The objectives are to understand the role and importance of pretreatment; the different available methods and mechanisms; analysis of the impact of pretreatment on the structure and composition of raw materials; efficiency and yield improvements; and the application of methods in practical scenarios.

Biological conversion processes: How to harness microorganisms for biochemical production: Provide training in the biological conversion processes that use microorganisms to produce biochemicals. It covers the principles, techniques and applications of microbial conversion, with a special focus on optimizing conditions in order to obtain maximum yield and efficiency. Its main objectives are to understand the fundamentals of biological conversion processes; the different microorganisms used; the metabolic pathways involved in conversion processes; the analysis of conditions and optimization to maximize yields; and practical applications.

Agro-Industrial residue valorization for production of bioplastics and bio-composites: Explore the valorization of agro-industrial residues for the production of bioplastics and bio-composites. This course covers the principles, techniques, and benefits of converting residues into valuable products, highlighting sustainability and economic viability. The objectives are to understand the fundamentals of agro-industrial residue valorization, identify processes for converting residues into bioplastics and bio-composites, analyze the environmental and economic impacts of residue valorization, and develop strategies for efficient and sustainable valorization.

Biochars as adsorbents or catalysts: Carbonization, activation, and modification technologies: Learn about the use of biochars as adsorbents or catalysts, focusing on carbonization, activation, and modification technologies. This course provides a comprehensive understanding of biochar production and its applications in various industrial processes. The objectives are to understand the principles of biochar production, explore carbonization, activation, and modification technologies, analyze the applications of biochars as adsorbents or catalysts, and evaluate the performance and efficiency of biochars in different processes.

Value-added products from biorefineries: Opportunities and challenges: Investigate the production of value-added products from biorefineries, including opportunities and challenges. This course covers the identification, development, and commercialization of high-value products derived from biorefinery processes. The objectives are to understand the potential of value-added products from biorefineries, identify key opportunities and challenges in product development, explore strategies for successful commercialization, and analyze case studies and best practices in the industry.

	Biorefinery integration into existing industries: European case studies and best practices: Study the integration of biorefineries into existing industries, with a focus on European case studies and best practices. This course covers the principles, strategies, and benefits of biorefinery integration, highlighting successful examples and lessons learned. The objectives are to understand the principles of biorefinery integration, explore strategies for integrating biorefineries into existing industries, analyze European case studies and best practices, and develop insights into the benefits and challenges of integration. Hydrogen in the context of biorefineries: Examine the role of hydrogen in biorefineries, covering production, utilization, and integration. This course provides an understanding of hydrogen's potential to enhance biorefinery processes and contribute to sustainable energy solutions. The objectives are to understand the role of hydrogen in biorefineries, explore hydrogen production methods and technologies, analyze the integration of hydrogen into biorefinery processes, and evaluate the environmental and economic impacts of hydrogen utilization. Scientific communication: Strategies for clear and engaging presentations: Develop skills in scientific communication, focusing on strategies for delivering clear and engaging presentations. This course covers techniques for effective communication of complex scientific concepts to diverse audiences. The objectives are to understand the principles of effective scientific communication, develop strategies for clear and engaging presentations, practice techniques for communicating complex concepts, and enhance skills in visual and verbal communication. European patents and Intellectual Property Rights (IPR): Gain knowledge of European patents and intellectual property rights (IPR), focusing on the protection and commercialization of innovations. This course covers the legal framework, application process, and strategic management of patents and IPR. The objectives are to understand the European patent system and IPR framework, explore the application and approval process for patents, develop strategies for managing and protecting intellectual property, and analyze case studies and best practices in IPR management. Unlocking energy potential and product diversity with thermochemical conversion processes: Explore thermochemical conversion processes for unlocking energy potential and product diversity. This course covers the principles, technologies, and applications of thermochemical methods for converting biomass into energy and valuable products. The objectives are to understand the principles of thermochemical conversion processes, explore technologies for biomass conversion, analyze the energy potential and product diversity of thermochemical methods, and evaluate the efficiency and sustainability of conversion processes. Advances in chemical transformations for biorefineries via catalytic conversion techniques: Investigate advances in chemical transformations for biorefineries, focusing on catalytic conversion techniques. This course provides an understanding of the latest developments in catalytic processes and their applications in biorefinery operations. The objectives are to understand the principles of catalytic conversion techniques, explore recent advances in chemical transformations for biorefineries, analyze the applications and benefits of catalytic processes, and evaluate the efficiency and sustainability of catalytic conversions. Research and Innovation funding schemes: Learn about research and innovation funding schemes, focusing on opportunities and strategies for securing funding. This course covers various funding sources, application processes, and effective management of research projects. The objectives are to understand the landscape of research and innovation funding, identify key funding sources and opportunities, develop strategies for successful funding applications, and manage and execute funded research projects effectively.
Metodologias de ensino	Lectures, technical visits, experimental work
Metodologia de avaliação	Oral presentations and final report
Bibliografia	**1 - Bibliografia Principal** Lehmann, J., & Joseph, S. (Eds.). (2015). Biochar for Environmental Management: Science, Technology and Implementation (2nd ed.). Routledge. https://doi.org/10.4324/9780203762264 Yebo Li, Samir Kumar Khanal (2016). Bioenergy: Principles and Applications. ISBN: 978-1-118-56831-6 Görgens, J.F., Carrier, M., García-Aparicio, M.P. (2014). Biomass Conversion to Bioenergy Products. In: Seifert, T. (eds) Bioenergy from Wood. Managing Forest Ecosystems, vol 26. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-7448-3_7 Guran, S. (2020). Thermochemical Conversion of Biomass. In: Mitra, M., Nagchaudhuri, A. (eds) Practices and Perspectives in Sustainable Bioenergy. Green Energy and Technology. Springer, New Delhi. https://doi.org/10.1007/978-81-322-3965-9_8

Bose, D., Bhattacharya, R., Rizvi, A., Poonia, A., Saraf, D., Ghodke, P. (2022). Biorefineries: An Integrated Approach for Sustainable Energy Production. In: Verma, P. (eds) Thermochemical and Catalytic Conversion Technologies for Future Biorefineries. Clean Energy Production Technologies. Springer, Singapore. https://doi.org/10.1007/978-981-19-4316-4_8

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Guduru, R.K., Singh, R., Vij, R.K., Tiwari, A.K. (2024). Hydrogen Production From Biomass. In: Arya, R.K., Verros, G.D., Verma, O.P., Hussain, C.M. (eds) From Waste to Wealth. Springer, Singapore. https://doi.org/10.1007/978-981-99-7552-5_15

Dasappa, S., Shivapuji, A.M., Stanislaus, M.S. (2024). Green Hydrogen from Biomass Through Gasification A Carbon Negative Route for Hydrogen Production. In: Goel, M., Sen, G. (eds) Climate Action and Hydrogen Economy. Green Energy and Technology. Springer, Singapore. https://doi.org/10.1007/978-981-99-6237-2_11

Inamuddin, Tariq Altalhi (Eds) (2022). Handbook of Bioplastics and Biocomposites Engineering Applications. Print ISBN:9781119160137 |Online ISBN:9781119160182 |DOI:10.1002/9781119160182

2 - Bibliografia Complementar