UNIVERSITAT DE BARCELONA
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Master's Final Project Proposals
2022/2023

Code	MEA-22/23-001
Title	Sustainability evaluation of bio-based wastewater treatment alternatives
Objectives	The objective of this work is conducting a sustainability (e.g., techno-economic and environmental) comparison between different biological-based wastewater technologies, such as conventional activated sludge, membrane bioreactor and integrated fixed-film activated sludge. Different treatment scenarios (e.g., flow-rates, organic load, treatment objectives...) will be considered and general conclusions drawn which will be useful concerning the planning, design and retrofitting of wastewater treatment plants (WWTPs).
Student work	The student will calculate life cycle costs and impacts of different biological treatment processes implemented in WWTPs with the help of specialized tools such as CapdetWorks (WWTPs preliminary design and costing) and SimaPro (LCA), respectively.
Subject Area (Effluent treatment; Solid Wastes and contaminated soils; Environmental Management)	Effluent treatment
Type (research or professional)	Research
Other comments	

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Code	MEA-22/23-002
Title	Evaluation of hydrochars from vine pruning waste for simultaneous removal of contaminants of emerging concern (CEC), ammonium and phosphate from wastewater
Objectives	The main objective of this work is to evaluate the CEC, ammonium, and phosphate co-adsorption capacity of hydrochars produced by hydrothermal carbonization (HTC) of vine pruning waste. This overall goal will be realized by focusing on the following specific objectives: (1) Compare the CEC, NH4+, and PO43- co-adsorption capacity of hydrochars produced under different HTC temperatures. (2) Compare the CEC, NH4+, and PO43- co-adsorption capacity of hydrochars modified with different H2O2 doses. (3) Compare the CEC, NH4+, and PO43- co-adsorption capacity of hydrochars modified with different Fe3+ doses. (4) Characterize the best performing hydrochars
Student work	The student will carry out activities as follow: - Characterization of vine pruning waste (e.g., moisture and ash content) - HTC experiments to produce hydrochar - Modification of hydrochar to increase the affinity towards CEC, NH4+, and PO43- - CEC, NH4+, and PO43- co-adsorption tests in batch mode - Adsorption kinetics experiments - Determination of adsorption isotherms - Analysis of hydrochar characterizations (e.g., TGA, CHONS, FTIR, SEM, EDX)
Subject Area (Effluent treatment; Solid Wastes and contaminated soils; Environmental Management)	Effluent Treatment
Type (research or professional)	Research
Other comments	

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Code	MEA-22/23-003
Title	Análisis de ciclo de vida en la producción de biopolímeros PHA
Objectives	Dentro del concepto de económica circular detectar las etapas y corrientes en las que se produce el mayor impacto ambiental
Student work	Realizar el análisis de ciclo de vida de un proceso y compararlo con los resultados del análisis exergético realizado previamente. La herramienta a utilizar es el OpenLCA. Redacción de la memoria.
Subject Area (Effluent treatment; Solid Wastes and contaminated soils; Environmental Management)	Solid Wastes
Type (research or professional)	Research
Other comments	

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Code	MEA-22/23-004
Title	Comparison of eco-gamma approach with other sustainability criteria assessments
Objectives	A novel and simple approach based on the measured parameters deviation produced by anthropogenic action called eco-gamma have been proposed. The aim of the present study is to critically compare this approach against other methods available in the literature for environmental sustainability assessment.
Student work	Perform a literature review about sustainability assessment tools and their applicability. Check some aspects such as how is widely used and how its results are accepted. Critically compare the different methods focussing in its strong and weak points and how they complement each other. Review some cases from the literature under the eco-gamma approach. Systematize the application of eco-gamma. Write the master thesis.
Subject Area (Effluent treatment; Solid Wastes and contaminated soils; Environmental Management)	Environmental Management
Type (research or professional)	Research
Other comments	-

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Code	MEA-22/23-005
Title	Development of an EDA tool for quality assessment of water bodies
Objectives	Develop and validate an innovative approach for Effect Directed Analysis (EDA) using freshwater organisms for the chemical and ecological quality assessment of the aquatic environment.
Student work	EDA is a combination of bioassay, sequential fractionation to reduce sample complexity, and subsequent analytical identification of toxicants in active fractions. The experimental settings of the EDA procedure will be optimized and tested using aquatic organisms (e.g. daphnia, algae or biofilms) as target of a selected battery of bioassays at lab-scale microcosms and synthetic mixtures of selected relevant contaminants of emerging concern (CECs). The fellow will design and optimize the appropriate experimental suitable to perform and EDA approach: (i) Optimization of the experimental settings according to the fractionation protocols to apply, by adapting methods previously described in the research group. (ii) The fractionation protocol will be adapted according to all the endpoints selected to allow minimum required sensitivity to measure specific responses on aquatic organisms exposed. (iii) Water spiked with reconstituted mixture of relevant environmental CECs will be used for method development. (iv) Fractions will be then tested on the aquatic organisms according to selected set of endpoints. (v) Target analysis of model CECs will be performed on bioactive fractions by LC-HRMS/MS. (vi) Measured bioassay responses and chemical analysis will be used to evaluate the performance of the optimized protocol. After methodological development, the EDA workflow will be validated in mesocosms at lab-scale exposing aquatic organisms to field water samples from upstream and downstream a wastewater effluent (WWE) discharge point in a river and performing suspect screening on extracts to identify sub-mixtures of CECs drivers of the toxicity in the bioactive fractions.
Subject Area (Effluent treatment; Solid Wastes and contaminated soils; Environmental Management)	Effluent treatment (assessment of CECs occurring in fresh-water bodies with WWE discharge as their main emission source) Environmental Management (development of EDA tool for quality assessment of water bodies implementing water management)
Type (research or professional)	Research
Other comments	

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Code	MEA-22/23-006
Title	Evaluation of the recovery of copper from solid waste through Solvent Extraction processes in a pilot plant
Objectives	The goal of this project is to experimentally define the parameters for the recovery of copper through a process involving three steps: Leaching, solvent extraction and electrodeposition, which we will evaluate through the use of a pilot plant, with the aim of designing a large-scale plant of copper recovery.
Student work	The student involved in this process will learn how to operate a small pilot plant with three different processes, and study several parameters in each of them: 1. Leaching: We need to study the factors involved in processing metallic copper into complete dissolution: time, stirring and the concentration of different reactants. 2. Solvent extraction: This is the most complex part of the system. With the existing pilot plant we can evaluate the necessary number of stages for complete extraction of copper into the organic phase, for washing and stripping. We will also evaluate the carryover of impurities through entrainment, as well as residence times, flow and O/A ratios (organic to aqueous phase ratio). 3. Electrodeposition (ED): After obtaining a pure copper solution through SX (solvent extraction), we will study the ED in terms of the necessary additives and number of cathodes in order to maintain a continuous operation. The three stages can initially be studied separately, but we will work with the goal of achieving continuous operation, a necessary step in designing a large-scale plant. The work would be conducted in Ivalore facilities in Sant Feliu de Buixalleu.
Subject Area (Effluent treatment; Solid Wastes and contaminated soils; Environmental Management)	Solid waste
Type (research or professional)	Research
Other comments	It is important to note that Ivalore fully intends to build a plant for the recovery of copper within the next few years, with a location already in mind. Therefore this research is very important for the design of the new plant, as well as for defining the parameters that can affect its operation, and it's a chance for a student to contribute to the real challenges of an evolution towards a more sustainable use of materials.

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Code	MEA-22/23-007
Title	Design of a copper recovery plant
Objectives	The aim of this project is to use bibliographic research as well as previous experience gathered in the R&D department of Ivalore to design a plant for copper recovery from solid waste through leaching, solvent extraction and electrodeposition.
Student work	The student will use firstly bibliographic research to choose the elements most suited to the requirements of the plant, and furthermore will design specific components according to the parameters provided by the R&D department. The plant in question will have the capacity of producing 1000 tons per year of copper. In the leaching stage of the process, the student will research which method and components are best suited for the leaching of waste metallic copper. The solvent extraction part will require the design of mixer-settlers, taking into account the flow, organic to aqueous phase ratio and other parameters. In the case of the electrodeposition section, the student will need to define the anodes and cathodes characteristics, as well as the requirements in terms of electricity. In general, several factors have to be taken into account in the design of the plant, such as efficiency, economic factors, compatibility of materials, etc.
Subject Area (Effluent treatment; Solid Wastes and contaminated soils; Environmental Management)	Solid waste
Type (research or professional)	Research
Other comments	The work would be conducted remotely most of the time, with some visits to Ivalore facilities in Sant Feliu de Buixalleu.