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Positions open for 2020

Bioresources and Green Technologies

1. Innovative technologies for the removal of pharmaceutically active compounds from wastewaters
2. Upgrading mining residues: Electrodialytic technology and deep eutectic solvents for tungsten recovery and arsenic removal

Computation for Sustainability

3. Low cost technologies for assisting people with disabilities and older adults

Ecological Economics and Environmental Management

4. MESH - Modelling Ecosystem Services with stakeHolders
5. RPMIXES - Rural Policymixes for Ecosystems Services
6. Sustainability in product labels: linking environmental footprint to lifestyle
7. IDEATE - Imagining Degrowth Trajectories

Sustainable Water Sanitation, Wastes and Resources Recovery

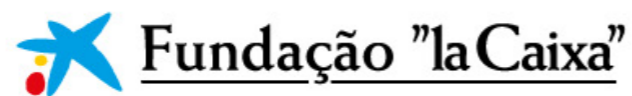
8. Study of quorum sensing and quorum quenching phenomena's in wastewater treatment using fixed film biomass

Applications open until:

4th February 2020



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Bioresources and Green Technologies

<https://www.cense.fct.unl.pt/research-areas/bioresources-and-green-technologies>

Innovative technologies for the removal of pharmaceutically active compounds from wastewaters

The main aspect to be investigated under this working program (WP) is the development of an advanced electro-technology for the removal of pharmaceuticals from wastewater before entering the agro-food system or its environmental discharge. Success in these goals would lead to enhancing environmental security by preventing the spread of pharmaceuticals in different environmental compartments. This WP aims to develop a technology based on electrochemical processes to remove pharmaceuticals from wastewater. Electro-technologies are effective solutions with high efficiency, lack of dependence on external chemicals and ease of control. The work is leveraged by previous and ongoing international projects: 4KET4Reuse (SOE1/P1/E0253) which developed an electro-reactor for micropollutants and microorganisms removal from aqueous matrices (National Patent Pending; registration# 115784, 18/09/2019) with a removal efficiency of emerging contaminants (pharmaceutical and personal care compounds) between 50 and 98% in 8 hours as well as microorganisms removal; CEMOWAS2 (SOE2/P5/F0505) and recently applied to another INTERREG SUDOE project to capitalize and improve developed electro-reactors. In all projects, there is a strict work with a WWTP from Lisbon metropolitan area.

Work will be developed at Resolution lab (CENSE, FCT NOVA) that is equipped to support the prosecution of this WP. It contains state of the art chromatographic systems such as GCxGC, HPLC, GC/MS/MS and GC-TOF/MS. The lab is co-working in the development of microbiological techniques. Team has experts in remediation techniques, namely electrokinetic process (all the core members have between 6 to 25 years of experience).

Job position description:

The WP comprises scientific and technological development, project management and dissemination & communication activities. Throughout the WP period, the candidate will be closely supported by the supervisors team. The WP is divided in three main scientific activities: (A1) implementation of general procedures: (1) detection/quantification of antibiotics, intermediates and degradation products (e.g. UV-Vis, UV-FL, MS); GC/MS; (2) microorganism analysis (e.g. microscope, MPN, TTC, CFU); (A2) development of a prototype effective in the removal of target classes of pharmaceuticals and microorganisms from effluent: (1) selection of target pharmaceuticals based on literature/EU reports on WWTPs wastewater (2) wastewater characterization, before and after EK, including pH, nutrients, or other elements (e.g. Fe and Cl) that may influence EK process (3) test of potentiostatic and galvanostatic conditions, electrodes material, etc. First test in simpler medium and then in raw wastewater; (A3) assess the effectiveness of using the treated effluent for irrigation using a representative culture as model (e.g. lettuce) including agronomic parameters and presence of pharmaceutically active compounds in the edible part. Management and evaluation activities: Candidate will be in charge of WP activities detecting possible problems to achieve the proposed objectives. Bi-monthly project team meetings to assess the project progress, comment results, adjust, assess implementation also focusing on internal presentation and critical analysis about the ongoing theory and methodological developments will guarantee the success of the proposed WP. Communication, dissemination and market potential: Tools for dissemination: i) academia: at least, 3 peer review articles; 3 scientific conferences communications, ii) communication with the society and policy makers. Market analysis assessing end-users needs, stakeholders and clients (industry, farmers, etc.) promoting a participative approach.

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Bioresources and Green Technologies

<https://www.cense.fct.unl.pt/research-areas/bioresources-and-green-technologies>

Upgrading mining residues: Electrodialytic technology and deep eutectic solvents for tungsten recovery and arsenic removal

The European Union and the United States of America recognized tungsten (W), respectively, as one of the 27 Critical Raw Materials (European Commission, 2017), and as one of the 35 mineral commodities considered critical to U.S. National Security and Economy (U.S. Geological Survey, 2018). Tungsten mine residues (MR) are also considered an environmental burden due to e.g. arsenic (As) content, are also secondary tungsten resources. Additionally, due to the waste rock that needs to be removed to access the ore, W mines produce volume-wise more waste than has originally been mined. The accumulation of residues in open pits generates serious landscape and other environmental problems. The focus of this working program will be the development of an electrodialytic technology combined with the use of deep eutectic solvents (DES), considered the solvents of the XXI century, for the recovery of W and As removal from MR. The work is leveraged by previous and ongoing international projects: MIREU – Mining and Metallurgy Regions of EU (H2020-SC5-2017-776811); REMIX – Smart and Green Mining Regions of EU (PGI02400); e.THROUGH - Thinking rough towards sustainability (H2020-MSCA-RISE-2017-778045). Work will be anchored at Resolution lab (CENSE, FCT NOVA), that in collaboration with REQUIMTE, contains all the equipment needed to support the prosecution of this program. Both labs account state of the art equipment for the analytical determinations required and RESOLUTION lab all the material required to design and assemble the electrodialytic reactors. Team has experts in simultaneous recovery and remediation techniques, namely electrokinetic process (all the core members have between 6 to 25 years of experience).

Job position description:

The program comprises scientific and technological development, project management and dissemination & communication activities. Throughout the program period, the candidate will be closely supported by the supervisor's team. The program is divided in three main scientific activities:

- (T1) Sample collection: Mining residues (MR) were collected at Panasqueira mine, Covilhã, Portugal. The MR corresponds to the rejected fraction from the sludge circuit, directly pumped into a dam.
- (T2) implementation of general procedures: extraction and quantification of W and As from the MR and sample characterization using e.g. SEM, XRD;
- (T3) DES production: (i) different DES will be produced and tested for enhancing ED efficiency; (ii) DES properties will be determined (e.g. viscosity, density).
- (T4) development of a prototype effective in the simultaneous recovery of W and removal of As from the MR: (i) design and test of different electrodialytic (ED) reactors (e.g. electrodes configuration, number of compartments); (ii) test of the operating parameters (e.g. current intensity) and optimization for W recovery.
- (T5) Life cycle assessment: a life cycle assessment will be done and the possibility of using the treated MR for the production of construction materials will be evaluated.

Management and evaluation activities: Candidate will be in charge of program. Bi-monthly project team meetings to assess the project progress, comment results, adjust, assess implementation also focusing on internal presentation and critical analysis about the ongoing theory and methodological developments will guarantee the success of the proposed WP. Communication, dissemination and market potential: Tools for dissemination: i) academia: at least, 3 peer review articles; 3 scientific conferences communications, ii) communication with the society and policy makers. Market analysis assessing end-users needs, stakeholders and clients (industry, farmers, etc.) promoting a participative approach.

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Computation for Sustainability

<https://www.cense.fct.unl.pt/research-areas/computation-sustainability>

Low cost technologies for assisting people with disabilities and older adults

The main idea behind this working program (WP) is the development of low cost solutions to improve the quality of life of people with temporary or permanent disabilities. This WP has the following specific goals:

- Use low cost technologies (e.g. low powered computers such as Raspberry PI or Jetson Nano) to develop robotic solutions that provides tele-assistance. In addition to this goal, we plan to use Artificial Intelligence techniques, such as Convolutional Neural Networks, in order to allow the robot to work in an autonomous mode, detecting falls and health problems.
- Develop novel interaction methods in order to build an immersive robotic telepresence system.

Success in our goals would lead to enhancing the quality of life of people with motor limitations by providing them a better assistance and mechanisms that allow them to have a more independent life in their own homes. This WP aims at improving robotic solutions to help older adults and those who have disabilities to have a better assistance, contributing to increase their level of independence.

The project will be developed at the Computation for Sustainability group (CENSE, FCT NOVA) that has appropriate conditions to support the prosecution of the WP. The team has experts in Assistive Technologies, Human-Computer Interaction, Artificial intelligence, Robotics, and Augmented Reality (all the core members have between 6 to 25 years of experience).

Job position description:

The WP include scientific and technological development, project management and communication activities. During the WP period, the candidate will be closely supported by his/her supervisors and members of the Computation for Sustainability group. The candidate will follow an iterative and user-centred development process encompassing four major phases: (1) identification of user needs and requirements, (2) design, (3) prototyping and (4) evaluation [1]. In the identification of user needs and requirements, Activity Theory (AT) [2] will be used as a analytical tool to specify design requirements and evaluate the impact of the interaction techniques developed, both quantitatively and qualitatively. The candidate will also conduct informal interviews with users to collect information about their needs, desires and motivations [3].

[1] J. Preece. Interaction Design: Beyond Human-computer Interaction. J. Wiley & Sons, 2nd edition, 2002.

[2] V. Kaptelinin and B. Nardi. Acting with Technology: Activity Theory and Interaction Design (Acting with Technology). MIT Press, 2006.

[3] J. Nielsen. Usability Engineering. Morgan Kaufmann, 1994.

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Ecological Economics and Environmental Management

<https://www.cense.fct.unl.pt/research-areas/ecological-economics-and-environmental-management>

MESH - Modelling Ecosystem Services with stakeHolders

MESH – Modelling Ecosystem Services with stakeHolders – aims to develop integrated and participatory modelling approaches supporting holistic and cross-sectoral policies to achieve success in the conservation, restoration and sustainable use of ecosystem services. Protection of life on terrestrial and inland freshwater ecosystems is a priority highlighted in Agenda 2030 and UN’s Sustainable Development Goals (cf. SDG 15). Even though up to 15% of land is currently under protection, biodiversity is still at risk and tools for participatory assessments of cross-sectoral policy impacts are still lacking. Freshwater ecosystems in particular offer many benefits to society, including clean water and air, recreation, natural resources, food, energy, as well as protection from natural disasters and mitigation of climate change. Thus, the proposed individual research project will bring forward systemic approaches for model-based policy design, analysis, and knowledge transfer. It envisages the enhancement of collaborative management of ecosystem services and a well-balanced attainment of SDGs in freshwater socio-ecological systems.

Job position description:

The successful candidate will conduct research towards a PhD degree through the implementation of the MESH workplan. The project will merge methods, theories and insights from environmental engineering, ecological economics, sustainability, and systems sciences. More specifically, the methodological approach to be promoted in this project will include: 1) a comprehensive review of needs and gaps related with methods for integrated modelling of freshwater ecosystem services in relation to achievement of SDGs. This includes stakeholder interviews across different societal groups – international organizations (e.g. UN-DSDG, ESDN), EU agencies (e.g. EEA), national agencies and river basin authorities, business sector, NGOs and academia; 2) Development of a participatory system dynamics modelling approach for studying the interrelationships between SDGs (namely, SDGs 15, 2, 6 and 13) in freshwater socio-ecological systems; 3) Empirically explore the approach by applying it to a study case in Portugal, working with the water and nature conservation authorities and local stakeholder groups; 4) Comparing and analyzing policy scenarios affecting water ecosystems health, livelihoods and food security, biodiversity, and climate change mitigation and adaptation in the studied site; 5) Developing model-based findings and best practices to promote integration of biodiversity and ecosystem services in cross-sectoral public policies and dissemination of the integrated modelling insights to the public at large. Anticipated duties include the completion of the specific proposal for the individual research project, development of the personal career development plan outlining specific training and support needs, dissemination of reports and models to relevant stakeholders, preparation of articles in appropriate scholarly journals with high impact, development of a dissemination and impact action plan, and fulfillment of PhD requirements for NOVA University Lisbon.

The workplace will be at the Campus of Caparica, School of Science and Technology, NOVA University Lisbon.

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Ecological Economics and Environmental Management

<https://www.cense.fct.unl.pt/research-areas/ecological-economics-and-environmental-management>

RPMIXES - Rural Policymixes for Ecosystems Services

A set of economic, social and environmental problems have been growing recently in Portuguese rural areas, highlighting the unsustainability of the prevailing development path. Landowners income is not sufficient to ensure adequate forest management and social and private interests are not aligned. This results in population decline, increased occurrence and severity of forest fires, expansion of invasive alien species, erosion, reduction of autochthonous species forests and biodiversity loss.

There is a need to recognize that agroforestry areas provide many contributions to social well-being, besides the products traded in markets (e.g erosion control, hydrological regulation, biodiversity conservation, reduced fire risk, aesthetics, recreational and leisure opportunities or cultural identity). This project aims to contribute to the development of innovative policymixes (i.e. combinations of articulated policy instruments) to encourage the provision of ecosystem services in rural areas, including, payments for ecosystems services, offsetting schemes and financial mechanisms (e.g. forests bonds, forest funds). The goal is to propose more adequate policymixes recognizing the multifunctionality of rural agroforestry spaces and the diversity of socio-ecological-institutional contexts (e.g. farm size, land ownership, culture, ecological features, informal rules).

Job position description:

The successful candidate will conduct research towards a PhD degree through the implementation of the RPMIXES workplan. The project assumes a transdisciplinary approach, integrating, as appropriate, methods, theories and insights from ecological economics, environmental engineering, ecology and forest engineering. Main tasks to be developed: 1) comprehensive review of relevant literature; 2) identification of forest and agroforest areas main problems and changes required; 3) development of a typology of forest and agroforestry systems, considering ecological and human contexts; 4) development of proposals for innovative policies arrangements to promote ecosystem services in rural spaces, adopting a policymix approach, and including tools to support the design, implementation and monitoring phases; 5) empirically explore the proposed approach by testing its application in a case study area in Portugal in a Living Lab setting; 6) study conditions for upscaling proposed solutions.

Anticipated duties include the completion of a detailed proposal for the individual research project, development of the personal career development plan outlining specific training and support needs, dissemination of results with relevant stakeholders, preparation of articles in appropriate scholarly journals with high impact, development of a dissemination and impact action plan, and fulfillment of PhD requirements for NOVA University Lisbon.

The workplace will be at the Campus of Caparica, School of Science and Technology, NOVA University Lisbon.

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Ecological Economics and Environmental Management

<https://www.cense.fct.unl.pt/research-areas/ecological-economics-and-environmental-management>

IDEATE - Imagining Degrowth Trajectories

Humans have become a global geophysical force, leading humanity into the Anthropocene, an age of uncertain global changes caused by anthropogenic activities (Steffen et al., 2015). Debates around ecological and social limits to economic growth and new ways to deal with resource scarcity without compromising human wellbeing have re-emerged in the last few years, especially with the increasing calls for a degrowth approach (e.g. Schneider et al., 2010). The project IDEATE - Imagining degrowth trajectories - aims to advance knowledge on concrete opportunities and obstacles to perform a downscaling of the throughput of consumption and production, contributing to the broad degrowth goal of transitioning from a materialistic to a convivial and participatory society (Cosme et al., 2017). Research will be conducted in straight connection with both policymakers and niche sustainability initiatives that are exploring alternative ways to the mainstream ideas of mass production and consumption of goods and services. The research team will ideate how production and consumption dynamics would be sustainable in a non-growing economic system. The ensurance of sustainable consumption and production patterns is a priority highlighted in Agenda 2030 and UN's Sustainable Development Goals (cf. SDG 12), and this research aims to contribute to this goal.

Job position description:

The successful candidate will conduct research towards a PhD degree through the implementation of the IDEATE workplan. The project will merge methods, theories and insights from environmental engineering, ecological economics, sustainability, and transition theories. More specifically, the methodological approach to be promoted in this project will include: 1) a comprehensive review of literature related with degrowth concrete proposals; 2) a comprehensive review of dimensions that are seen as obstacles to niche sustainability initiatives to thrive, as well as of the methods used to assess them; 3) development of a participatory method to assess the concrete obstacles and pathways to overcome them; 4) empirically explore the approach by applying it to a study case in Portugal; 5) developing recommendations for cross-sectional public policies based on the findings of the research.

Anticipated duties include the completion of the specific proposal for the individual research project, development of the personal career development plan outlining specific training and support needs, dissemination of results to relevant stakeholders, preparation of articles in appropriate scholarly journals with high impact, development of a dissemination and impact action plan, and fulfillment of PhD requirements for NOVA University Lisbon.

The workplace will be at the Campus of Caparica, School of Science and Technology, NOVA University Lisbon.

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Ecological Economics and Environmental Management

<https://www.cense.fct.unl.pt/research-areas/ecological-economics-and-environmental-management>

Sustainability in product labels: linking environmental footprint to lifestyle

Many studies have highlighted that unsustainable consumption patterns, especially in industrialized countries, are the main cause of environmental degradation. When assessing the environmental burdens of a product, it is important to note that individual businesses no longer compete as isolated entities, but rather as supply-demand chains in a complex network of multiple business relationships. We need to think in aggregate effects of the economic system, with a better view of how our actions affect the Planet and the limits of natural resources. Life cycle assessment (LCA) is a well-recognized approach by both academia and business, with abundant report in the literature of its use for eco-design and eco-labelling. However, it has not contributed much to "life cycle thinking" in businesses, because it is time consuming, data intensive, difficult to standardize, and requiring expert advice. LCA is also absent from consumers' choices, because such information is not commonly available.

A methodology called EcoBlok is under development by the Ecodesign team at CENSE, to bring life cycle thinking to everyday business. The aim is to create product labels with environmental indicators, which represent realistically the sustainability of resource use implicated by each product, and can be understood by both business and final consumers. Research under way includes: data standardization and cross-referencing, definition of relationships between key impact domains, automation of big data gathering and testing of the method at different scales. EcoBlok may be used in a larger scope of applications, depending on the results of ongoing research. It has already been used in a number of case studies, for LCA, environmental reporting, ecodesign and benchmarking of industrial production methods. Further applications are under study.

Job position description:

The job position is for a doctorate student with CENSE, who will integrate the Ecodesign research team to tackle one or more of the following challenges under study:

- Data standardization and cross-referencing, reconciling commonly available data sources such as official statistics, pollution release inventories, environmental management and sustainability reports, and LCA databases;
- Definition of relationships between key impact domains, including water abstraction, resource extraction, land use, conservation of biodiversity, greenhouse gas emissions, other polluting emissions to air, and polluting emissions to water and land;
- Automation of big data gathering from public databases that offer essential information in standard formats, including geo-referenced information from multiple sources;
- Testing of the method at different scales, from the consumers product level, to whole economic sectors, to the assessment of communities' lifestyles;
- Exploration of different uses of this approach, including ecotaxation.

The workplace will be at the Campus of Caparica, School of Science and Technology, NOVA University Lisbon.

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Sustainable Water Sanitation, Wastes and Resources Recovery

<https://www.cense.fct.unl.pt/research-areas/sustainable-water-sanitation-wastes-and-resources-recovery>

Study of quorum sensing and quorum quenching phenomena's in wastewater treatment using fixed film biomass

The fixed biomass systems (commonly known as biofilm systems) had an unquestionable role in the history of the wastewater treatment, namely in the treatment of both municipal and industrial waste streams, for several decades. Nowadays, is widely recognized the applications of this kind of biomass namely at biofilters or in designated mixed systems. There is however, a necessity to optimize these systems, make them more efficient, compact and easier to explore. One way to do this is to know and better control the biofilm regarding it as a uniform macrostructure with similar behavior. Many facets of biofilms remain poorly understood, namely and more recently the communication between microorganisms and its influence in the reactor's performance. Biofilm cells can coordinate behavior via intercellular "communication" using biochemical signaling molecules. Bacteria can produce chemical signals ("talk") and other bacteria can respond to them ("listen") in a process commonly known as cell-cell communication or cell-cell signaling. This system of population recognition has been termed "quorum sensing" (QS) and "quorum quenching"(QQ). Until now, there is no clear information about the QQ in bioreactors, as well as whether QS and endogenous QQ would synergistically regulate the behaviors of microbial consortia in wastewater treatment bioreactors. Therefore, the main objective of this project is to study whether there is a coexistence of endogenous QQ and QS activity in a fixed film process, with a rotating biological contactor (RBC) as an example, and explore the feasibility to improve reactor performance through regulating endogenous QQ activity and to contribute to a better understanding of reactor-scale empirical information.

Job position description:

This research project comprehends three main tasks:

Task 1 – Characterization of Biofilm Ages to improve wastewater treatment

The main objective of this task is to study fixed films with controlled and constant in time, ages, namely biodegradation rates, biofilm structures, species behaviours, in an approach that is usual in suspended biomass, namely in activated sludge. In this task, for each assay, the reactors will be operated with a constant biofilm age and not, as usual, a continuous biofilm growth process. The mean residence time of microorganisms in the reactor will be controlled and maintained constant.

The final goal of this task (and that will be pursued in task 2) is to relate the main results with possible real condition and operational parameters and reactors configurations, thereby improving the performance of fixed biomass systems. Task 2 – Study of biofilms QS, QQ and structure maintaining the biofilm age constant in time

The main objective of this task is to improve the knowledge of QS and QQ in biofilms with the final goal of an efficient wastewater treatment. As referred before, this kind of information is still incipient and there are no consistent data that relates the reactors performance in the removal and in the decontamination of a wastewater and the QQ and QS phenomena's. This task also comprehends a biofilm structure characterization through FISH and DNA sequencing techniques.

This task will include two subtasks, namely: Species identification and characterization with FISH and molecular techniques, namely DNA sequencing; Quorum sensing and quorum quenching of every assay performed in task 1. Task 3 – Monitoring QS and QQ in a real wastewater treatment plant – Fixed film reactor. According to the main results obtained in tasks 1 and 2, it will conduct a monitoring campaign in a real wastewater treatment plant (WWTP). The selection of the WWTP will be made according to the biological reactor type (it must be fixed film) and according to the real operational parameters.

The workplace will be at the Campus of Caparica, School of Science and Technology, NOVA University Lisbon.

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