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AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2014

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Nombre: GONZALEZ GARCIA, SARA
Referencia: RYC-2014-14984
Área Científica: Tecnología Química
Correo Electrónico: saraglezgarci@yahoo.es

Título:

Environmental Technologies and Sustainable Management applied to industrial, forest and agricultural proceses

Resumen de la Memoria:

I performed my Ph.D. focused on the application of Life Cycle Assessment (LCA) methodology to non-food industrial processes derived from lignocellulosic feedstocks (paper pulp, fibreboards, bioethanol, lignosulphonates and bitumen nanoemulsions) in order to determine their environmental sustainability from an industrial ecology perspective. In parallel to my thesis and since one of the woody processes environmentally analysed was the TCF kraft pulp production, I participated in a pilot research study focused on the enzymatic TCF bleaching sequence using laccase and mediators (1-hydroxybenzotriazole, violuric acid, syringaldehyde and methyl syringate), evaluating the aerobic and anaerobic biodegradability and toxicity to *Vibrium fischeri* of enzymatic bleaching sequence effluents and their comparison with the conventional bleaching sequence commonly used at industrial scale. My post-doctoral research can be divided in 8 main lines:

- i) The assessment of forest systems focused on industrial wood production using the Tool for Sustainability Impact Assessment (ToSIA) methodology, a dynamic sustainability impact assessment model to assess sustainability impacts in forest wood chains
- ii) The production of energy crops for bioenergy as well as the simulation of second generation bioethanol production chains (eucalypt, poplar, willow, Ethiopian mustard, hemp, flax and acacia) by means of a biochemical process including enzymatic hydrolysis and simultaneous saccharification and fermentation and its environmental performance
- iii) Environmental assessment of anaerobic digestion processes using single wastes such as pig slurry, cattle manure, etc and the co-digestion process with energy crops, organic fraction of municipal solid wastes and/or sewage sludge
- iv) Ecodesign of industrial products introducing changes on industrial process from an environmental point of view (furniture and metal sector)
- v) Environmental analysis of food sector with emphasis on dairy sector (UHT milk, cheese and yoghurt) and pig and broiler chicken production
- vi) The production of green products with the aim of substituting phenol-formaldehyde resins with bio-based phenolic materials in combination with phenol-oxidizing enzymes as well as the production of tannin-based insulating foams using different scenarios of the technology and supply chains
- vii) Assessment of marine systems (*Haematococcus pluvialis*, *Tetraselmis suecica* and *Phaeodactylum tricorutum*) for the production of potential bioactive molecules with pharmaceutical and food applications (red antioxidant carotenoid astaxanthin, polyunsaturated fatty acids and eicosapentaenoic acid)
- viii) Development of an evaluation system of greenhouse gas emissions at real time as result of energy consumption in activities carried out in a city (Santiago de Compostela) in order to introduce the concept of Smart City

As it is shown, my main research lines are focused on environmentally analyse production systems in order to identify environmental loads and redesigning them towards more efficient and sustainable systems. The current research lines are carried out thanks to the development of a comprehensive network of collaborative research with Spanish and overseas institutions, demonstrating the multidisciplinary feature of my research, which has led to successful joint funding applications and numerous scientific contributions.

Resumen del Currículum Vitae:

I graduated in Chemical Engineering in 2005 (awarded Extraordinary Prize) at the University of Santiago de Compostela (USC). I continued with my Ph.D. funded by MEC via FPU fellowship (2006-2010) with the topic of environmental sustainability of added value products from lignocellulosic feedstocks from a biorefinery perspective using the Life Cycle Assessment methodology. During my Ph.D. studies, I was a guest researcher at The Forestry Research Institute of Sweden (3.6 months, Uppsala, Sweden) and at the Department of Industrial Ecology (3.7 months, Leiden, The Netherlands). In September 2009, I received my Ph.D. degree in Chemical and Environmental Engineering (European mention) being awarded with the distinction Cum Laude and Extraordinary Prize. After my Ph.D., I conquered 2 competitive postdoctoral fellowships granted by the Spanish and Galician Governments to support my research on the identification and quantification of the environmental impacts of industrial activities related with forest, food and bioenergy sectors as well as with product eco-design. During this period, I hold positions as postdoctoral researcher for 3 months at the European Forest Institute (2009, Finland), 1.5 years at the Department of Life Sciences in the Imperial College of London (2010-2011, United Kingdom) and 1.5 years at the Department of Environment and Planning in the University of Aveiro (2012-2014, Portugal). In 2013, I obtained Juan de la Cierva fellowship (MICINN, Spanish Government, competitive programme) with a qualification 100/100 at Department of Chemical Engineering (USC). In February 2014, I obtained the positive assessment by the ANECA as **◆ Profesor Contratado Doctor ◆**, **◆ Profesor Ayudante Doctor ◆** and **◆ Profesor**



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de Universidad Privada♦. My scientific production encompasses 60 peer-review SCI publications (44 as first author, 49 as corresponding author and 1 as last author), 3 non-SCI papers, 3 book chapters and 55 contributions to international conferences (27 oral presentations). My current h-index is 16 (Scopus). I have been involved in 17 competitive research projects (9 European projects, 3 National projects and 5 Regional projects) and 13 industry-funded contracts (2 Connecta PEMES 2014 and 1 FEDER funded projects). I have teaching experience with more than 200 hours (Transport Phenomema Lab, Environmental Technology Lab, Environmental Engineering Lab, Biochemical Engineering Lab, Chemical Process Integration and Environmental Quality & Management), I belong to the Plan de Organización Docente (POD) at the Department of Chemical Engineering (USC) from 2014 with 80 hours/year. Moreover, I was invited as guest lecturer by the Limerick Institute of Technology (Ireland), University of Aveiro (Portugal) and Center for Industrial Ecology (University of Coimbra, Portugal) as well as I am lecturer in the master ♦Mecanismo de Desarrollo Limpio y Eficiencia Energética♦ organized by Pontificia Universidad Católica de Valparaíso (Chile). I am co-director of 3 Ph.D. theses, 12 master theses (7 completed) and 1 degree thesis. I act as referee of prestigious journals in my research topic and I have worked as evaluator for ANEP and Pontificia Universidad Católica de Peru. Regarding management activities at the university, I am coordinator of 3rd course in the Degree of Chemical Engineering.



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Nombre: GONZALEZ FERNANDEZ, CRISTINA

Referencia: RYC-2014-16823

Área Científica: Tecnología Química

Correo Electrónico: cegofe@hotmail.com

Título:

Linking wastewater bioremediation by means of microalgae cultivation and energy production out of this biomass

Resumen de la Memoria:

The most innovative aspect of Dr. Gonzalez research is the ability of microalgae to uptake nutrients as a bioremediation technology for wastewater treatment by photosynthetically produced oxygen. The contribution of Dr Gonzalez to this field was the successful performance of an enclosed tubular biofilm photobioreactor treating swine slurry (Water Science and Technology 2008). This reactor configuration provided simultaneous and efficient carbon, nitrogen and phosphorous removal due to the phototrophic biofilm established in the inner wall of the photobioreactor, (Applied Microbiology and Biotechnology 2009). Moreover, the combination of high pHs and high ammonium concentrations were identified as the main inhibitory factors governing the efficiency of photosynthetically oxygenated processes treating swine slurry (Applied Microbiology and Biotechnology 2008).

Microorganisms population dynamics and different nitrogen availabilities attained under the different photobioreactor configuration resulted in different conversion efficiencies (Bioresource Technology 2010, Applied Microbiology and Biotechnology 2011). Nevertheless, macromolecular biomass composition remained similar (Ecological Engineering 2010). The main conclusion withdrawn was that the frequently so-claimed nitrogen recovery by microalgae biomass was overestimated and some other mechanisms such as stripping and denitrification were also responsible for nitrogen removal (Bioresource Technology 2011).

The candidate identified microalgae cell walls as the main barrier hampering anaerobic digestion of this biomass. (Biofuels, Bioproducts and Biorefining 2012). In order to enhance anaerobic biodegradability, the candidate studied different pretreatments on batch assays employing different strains (Biomass and Bioenergy 2012, Bioresource Technology 2012, Bioresource Technology, 2013; Energy, 2014, Fuel 2014). The energetic balances however showed that pretreatments in the conditions tested were not positive, and thus higher concentration of biomass should be used to achieve a more balanced system (Applied Energy 2014).

Literature linked the limited biodegradability of microalgae to cell wall carbohydrates. In this sense, the candidate focused on carbohydrate accumulation by studying potential strategies to manipulate enzymatic activities (Biotechnology Advances 2012). In the context of elucidating microalgae cell walls composition, different biocatalysts were tested (Energy Conversion and Management, 2014). Proteases application prior anaerobic digestion was proven to be highly efficient to increase methane yield of the most common microalgae strains (Bioresource Technology 2014). Therefore, it was evidenced that despite the common belief that carbohydrates are responsible for the low digestibility, cell wall proteins were the main polymers hampering anaerobic digestion.

Currently, the group led by Cristina is extending their knowledge on anaerobic digestion of these substrates by moving forward from batch anaerobic test to tanks operated under semicontinuous feeding mode. Additionally, the research group is also studying the implementation of microalgae systems in conventional wastewater (Bioresource Technology, 2015) and evaluating other photosynthetic microorganisms such as cyanobacteria (Energy Conversion and Management, 2015).

Resumen del Currículum Vitae:

Dr Gonzalez has been fully dedicated to scientific research for more than twelve years. The applicant has published a total of 33 articles (h factor:16). When the candidate finished the Chemistry degree, she moved to the University of Cincinnati (USA) and worked in research activities for more than 2 years while fulfilling a Master of Science. After that, Dr Gonzalez got the PhD degree in Chemical Engineering and Environmental Technology at the University of Valladolid (2008). She carried out her thesis in the field of livestock wastes treatment for the removal of organic matter by means of mechanical and photosynthetic oxygenation on the liquid matrix and biogas production on the solid matrix.

The eagerness of the applicant to learn new technologies has led Dr Gonzalez towards an international network. During her PhD, she went to Wageningen University (The Netherlands) to work on biogas production using lignocellulosic substrates. After her PhD, she joined the technological center ITACyL (Technological Institute of Agriculture of Castilla-León) where she continued working on lab and real-scale plants dealing with livestock effluent. After that, she got a postdoc position at the LBE-INRA (France) to work on the optimization of biogas production using microalgae. Those years of research have given the candidate the opportunity to work closely with private companies and participate in several activities of knowledge dissemination (conferences, workshops and transfer of knowledge symposia).



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Nowadays, Cristina González is Senior Assistant Researcher of Biotechnological Processes at IMDEA Energy. Her research is focused on advanced processes for biofuel production using microalgae as substrates. Cristina González has been involved in international and national funded projects, as well as projects with private companies.

Dr Gonzalez spent the first years of her career studying microalgae cultivation in synthetic media and wastewaters, while her activity has moved towards the optimization of microalgae usage for energy purposes during the last years. The main research line that the candidate is developing focuses on the potential linkage between wastewater grown microalgae and energy production out of this biomass. Those years of research helped the candidate identifying the main bottlenecks of this linkage. In the international scenario, the candidate is an active member of the subgroup **Algae** of the Bioenergy European Research Alliance. Cristina has shown her leadership abilities since she is developing the role of day-to-day manager of the Unit where she works currently. At this stage of her career, Cristina is leading as principal investigator 3 projects at regional, national and European level. In this later one, the candidate is coordinating 30 research groups belonging to public institutions and private companies from 15 different countries. This project gave her and her research group a great visibility at international level. Out of this international research network of the candidate, she has also been invited as committee member for PhD theses evaluation. All these facts clearly show the excellence and recognized expertise of the candidate at international level.

Regarding teaching duties, she supervised several master theses and she is co-director of two PhD theses that presumably will be finished in 2015. Cristina González has proven strong motivation for a research career and independency.



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Nombre: RADJENOVIC, JELENA
Referencia: RYC-2014-15363
Área Científica: Tecnología Química
Correo Electrónico: jradjenovic@icra.cat

Título:

ELECTROCHEMICAL SYSTEMS AS THE NEXT-GENERATION TECHNOLOGY FOR CONTAMINATED WATER TREATMENT

Resumen de la Memoria:

I am an internationally recognized expert on wastewater treatment technologies, with a particular focus on the fate of persistent chemical contaminants. During my scientific career I have conducted research on biological treatment methods such as membrane bioreactor, as well as physico-chemical processes (high pressure membranes, ozonation, solar-driven advanced oxidation processes). In recent years spent at The University of Queensland, Australia (2009-2014), I have been working on the development of green chemical processes, among which electrochemical systems stand out as a promising, next generation wastewater treatment technology. The long-term goal of my research is developing cost-effective, safe, and sustainable systems to manage water resources.

My scientific production encompasses 33 peer-reviewed journal publications (17 of which as first author, and 4 as senior author) and 28 conference publications. I have authored two and co-authored three book chapters. Jointly, these publications have been cited more than 1200 times, leading to an H-index of 17. I have been supported with highly competitive fellowships for most of my scientific career (Marie Curie IIF fellowship, Smart Future fellowship in Australia, JAE pre-doc).

I graduated at the Faculty of Technology and Metallurgy, Belgrade University, Serbia, as the best student in 2004 (GPA 9.75/10). In 2005, I was awarded the JAE scholarship for pre-doctoral research training from the Spanish Ministry of Education and Science to conduct a PhD under the supervision of Prof Damia Barcelo (winner of the prestigious Jaume I environmental award), and Prof Mira Petrovic. During my PhD I was involved in two European projects funded by the FP6, and several Spanish projects. In 2009, I obtained my PhD at the University of Barcelona, Spain, with cum laude distinction. Shortly after, I moved to the Advanced Water Management Centre (AWMC-The University of Queensland, Australia), an internationally renowned centre of excellence for water research. In 2012, I won an Early Career Fellowship on a very competitive Smart Future scheme of the Queensland Government (<10% success rate). In 2013, I was promoted to a leader of the Environmental Electrochemistry group at AWMC, which consist of four research fellows and six PhD students. I have supervised several higher degree students, with one PhD completed in 2012 (as principal advisor), and four more on-going (two as principal advisor and two as co-advisor). I am currently an adjunct fellow of AWMC.

I have successfully lead and managed several projects related to the development of chemical-free systems for wastewater treatment, awarded by the Australian Research Council, The University of Queensland and Queensland Government, and several industry partners, with the total budget of around 1 million AU\$. I have also built an international contact network with reputed researchers and institutions. In 2013, I won a Marie Curie International Incoming Fellowship (12% success rate) to continue with my research at the Catalan Institute for Water Research (ICRA) in Gerona, Spain.

I have one invited keynote lecture, and was a chair at the two last IWA specialist Micropol&Ecoazard conferences. I have one patent application on electro-dialytic recovery of nutrients from wastewater.

I had one career break (maternity leave, August, 2013-February, 2014)

Resumen del Currículum Vitae:

ACADEMIC BACKGROUND

11/2014-present: Marie Curie Research Fellow at the Catalan Institute for Water Research-ICRA (Gerona, Spain).

09/2009-09/2014: Research Fellow at the Advanced Water Management Centre (AWMC), The University of Queensland (Brisbane, Australia).

01/2013-09/2014: Group Leader, Environmental Electrochemistry group at the AWMC-UQ.

07/2009: PhD thesis Fate and behaviour of pharmaceutical residues in wastewater and drinking water treatment, Faculty of Chemistry, The University of Barcelona (Barcelona, Spain). Thesis supervisors: D. Barcelo, M. Petrovic, M.T. Galceran.

01/2005-07/2009: PhD student at the Department of Environmental Chemistry, Institute of Environmental Assessment and Water Research (IDAEA), Spanish National Research Council (CSIC) (Barcelona, Spain).

09/1999-09/2004: Undergraduate studies of Biochemical Engineering and Biotechnology, Faculty of Technology and Metallurgy, The University of Belgrade (Belgrade, Serbia).

RESEARCH RESULTS

- Marie Curie International Incoming Fellowship (2014-2016), European Commission FP7 Framework, 12% success rate.

- Smart Future Early Career Fellowship (2012-2015), Queensland Government, <10% success rate.

- JAE pre-doctoral fellowship (2005-2009), Consejo Superior de Investigaciones Científicas-CSIC.



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- Leader of the Environmental Electrochemistry group at the AWMC-UQ.
- 33 peer-reviewed journal publications and 28 conference publications; >1200 citations (www.scopus.com), 5 book chapters (2 as first author and 3 as a co-author), H-index=17.
- 5 PhD thesis supervised (3 as principal advisor), 2 honours thesis, and co-supervised several visiting master and PhD students.
- project manager of ARC Linkage project (2009-2012) (AU\$600,000); chief investigator in 3 research and 2 infrastructure projects at the AWMC-UQ; participated as a researcher in 2 European and 2 Spanish projects at IDAEA-CSIC.

SCIENTIFIC STAYS

September, 2009-September, 2014: Post-doctoral stay at the Advanced Water Management Centre, The university of Queensland, Australia.

September-November, 2008: Pre-doctoral stay at the Department of Technical and Environmental Protection, Water Quality Control, Technical University of Berlin. Berlin, Germany.

May-June, 2008: Pre-doctoral stay at the Solar Platform Almeria (PSA). Almeria, Spain.

MAIN RESEARCH AREAS

Environmental Electrochemistry, Chemical Oxidation Processes, Electrodialysis, Advanced LC-MS Techniques, Fate of Wastewater-Derived Pollutants in Conventional and Advanced Water and Wastewater Treatment.

CAREER BRAKES

From August, 2013 until February, 2014, I was on a maternity leave.

REWARDS AND SCHOLARSHIPS

1. Marie Curie International Incoming Fellowship, European Commission, 11/2014-11/2016. Gerona, Spain.
2. Smart Future Early Career Fellowship, Queensland Government. 03/2012-03/2015. Brisbane, Australia.
3. JAE Pre-doctoral Research Grant, Spanish National Research Council (CSIC). 01/2006-12/2009. Barcelona, Spain.
4. Honour of the best student graduated in the year 2004, Faculty of Technology and Metallurgy, Belgrade University. 09/2004. Belgrade, Serbia.
5. Reward of the Government of Republic of Serbia, awarded to 500 best students of Belgrade University. 2001. Belgrade, Serbia.
6. Scholarship from the Ministry of Science, Research and Technology, Government of Republic of Serbia. 09/2002-09/2004. Belgrade, Serbia.



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Nombre: PEREZ ESTRADA, LEONIDAS ARMANDO

Referencia: RYC-2014-15194

Área Científica: Tecnología Química

Correo Electrónico: leonidas.perez@gmail.com

Título:

Development of advanced catalytic oxidation processes for the degradation of emerging contaminants

Resumen de la Memoria:

The research career of the candidate was developed during his master, doctoral and two postdoctoral stages in Mexico, Spain and Canada, and since 2012 as Assistant Professor at the University of Alberta (Canada) with his research group working in new research lines. The candidate's career has provided highly innovative contributions to the scientific fields of Environmental Chemistry, Analytical Chemistry, Advanced Oxidation Processes, Catalysis, Photocatalysis, and Environmental Omics. Among the different research topics that the candidate has undertaken during his career, his main research line has been focused on environmental application of solar energy, advanced oxidation processes, mass spectrometry, and recently catalytic thermal oxidations processes where he combines the use of wet oxidation principles with the catalytic properties of natural clay particles. The main goal has been to develop more efficient and environmental friendly oxidation processes for the degradation of priority contaminants using alternative energies. In order to maximize the efficiency of these processes and minimize the energy requirements, the candidate has developed new analytical evaluation methods and analysis strategies to detect and identify unknown by-products produced during the degradation reactions, generated new information on kinetics and principal parameters to control during different oxidation processes, combined different toxicity assays to assure the safety of the process effluent, combined different catalysts and nanoparticle to reduce the activation energy of the free radical reactions. Among the processes addressed within these research line are included:

- HP/HT Inductive Thermal Oxidation Reactors. This work aim to develop novel reactors to carry out fundamental research on oxidation processes at high temperature and high pressure using different chemical oxidants, catalyst and supports. The use of inductive heating increases the efficiency of the thermal input that the process requires, and allows the use of new nanomaterials that respond to electromagnetic pulses.

- Advance Thermal Oxidation of Mature Fine Tailings. This research studies the separation of oil-based tight emulsions that constitute the larger volumes of the Oil Sands Tailings. The objective is to study the formation of free radicals in the pore water and the rupture of the inter-particle bridging bonds to separate residual bitumen from solid particle and provoke a fast consolidation, recover the residual bitumen and reuse the extracted water back in the process.

Another important research line dealt with the potential applications of Advanced Catalytic Thermal Oxidation for the treatment of Hydraulic Fracturing flowbacks, degradation of organic pollutants, synthetic proppants and the oxidation of Natural Organic Radioactive Materials (NORM). These processes include the use of novel graphene-based catalysts and solar concentration chemical reactors.

The candidate has experience in teaching and training high-qualified personnel. Furthermore he has demonstrated ability to create and lead his own research group, and also to develop research collaborations with other researchers, public institutions and industrial partners. This has resulted in an important number of projects and publications as shown in the CV attached.

Resumen del Currículum Vitae:

Leonidas Perez Estrada graduated in Chemical Engineering from the University of Sonora (Mexico) in 2000. He started his research career during his Master in Environmental Engineering in the same university. His research was focused on the evaluation of three geometries of solar collectors to carry out photochemical reactions, with which he graduated with honours in 2003. In the same year he was the recipient of the CONACYT Doctoral Fellowship and started in the joint program between the Solar Platform of Almería-Ciemat and the University of Almería (UAL), in Spain, under the supervision of the internationally renowned researchers Dr. Sixto Malato Rodriguez and Dr. Ana Agüera Lopez. He obtained his PhD in Advanced Chemistry (Cum Laude) in 2008 from the UAL. His PhD thesis was focused on the analytical evaluation of photochemical degradation of EU-priority pollutants using solar oxidation process. During his doctoral stage he published 16 high impact scientific papers (5 as author and 11 as co-author) and presented oral and poster communications in more than 20 national and international conferences. In 2009 the candidate was selected for a two-years postdoctoral research contract at the University of Alberta (top 5 university in Canada) under the supervision of Dr. Jonathan Martin. There, the applicant focused on the development of mass spectrometry methods for the identification and characterization of naphthenic acids in oil sands tailings water. The relevance and significance of the results obtained is reflected in 6 high impact journal papers. In 2011 the candidate was offered a two-years senior postdoctoral research contract to work with Dr. Mohamed Gamal El-Din at the University of Alberta. There, the candidate focused on the analytical evaluation of ozone and other oxidation processed, developed new analytical methods for Ion Mobility-mass spectrometry, and trained young doctoral students in experimental design, oxidation processes, and mass spectrometry analysis. The results in this stage were published in 9 high impact journal papers and more than 10 national and international conferences. After a competitive selection process the candidate was appointed as Assistant Professor in the Department of Civil and Environmental Engineering at the University of Alberta in September 2012. He has lectured various undergrad and grad courses summing more than 347 hours of teaching. As a principal



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investigator he has established his own research group where he had supervised/co-supervised more than 10 graduate students. He has started the Advanced Catalytic Thermal Oxidation Process Laboratory where various reactor prototypes have been created. He has started collaborations with industrial partners through technical viability projects and secure funding from different sources. He has participated in 11 national and international projects and led 5 projects; published more than 40 research papers in peer-reviewed journals and more than 60 presentations in national and international conferences, 1 book, obtained an h-index of 17, participated in more than 10 examination tribunals (Master and Doctoral thesis), and is a frequent reviewer for 15 SCI high impact factor journals.