



AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2015

Turno de acceso general

Nombre: SERRANO CANTADOR, LUIS
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Área Científica: Tecnología Química
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Título:

Biorefinery processes as source of high added value products

Resumen de la Memoria:

The scientific career of the applicant results an evolution from the pulp and paper production with alternative raw materials to the complete utilisation of the components in the lignocellulosic biomass (biorefinery). In this way, the researcher develops a line with great expectation in the scientific community to the obtaining of high value added products from agricultural wastes mainly.

During his PhD in the University of Cordoba, he was focused in the use of palm oil residues as alternative raw material for pulp and paper production using classic and new methods as organosolv processes.

After his PhD period, the researcher stayed in the Polytechnic Institute of Grenoble- Pagora (France) to change the vision about pulp and paper industries to biorefinery industries with use of the by-products (lignin mainly) to produce high added value products, energy and/or biomaterials.

From 2008, the researcher has focused his scientific career in the biorefinery concept based in that the biomass can be a source of energy, valuable chemicals, pharmaceuticals and food additives.

In this way, the research line developed for the researcher is focused in 5 topics:

- Fractionation of lignocellulosic biomass, to obtain mainly lignin, cellulose and hemicelluloses. The influence of the raw material, pulping and hydrothermal processing conditions on the characteristics of fractions is studied.

- Lignin recovery and transformation to high added value products. Processes such as selective dehydroxylation, desmetoxylation, selective dealkylation and hydrogenolysis in order to break the lignin molecules are developed in view of synthesizing new, efficient and more reactive macromonomers. New reactions with ultrasound and microwave techniques are used to increase yields and selectivity in the depolymerisation.

- New routes for cellulose. The use of cellulose out of the traditional use as pulp and paper. Modified cellulose extends its application field for specific applications as paper with special properties, adsorbents, biomaterials, etc.

- Separation and purification of hemicelluloses and its transformation to chemicals. The use of hemicelluloses has gained great interest for using in many applications. Interesting products as bioethanol, xylitol, furfural or lactic acid could be produced.

- Direct conversion to biomass into polyols. Multifunctional liquid polyols rich in hydroxyl groups can be used as starting materials in polymer products (e.g. PU foams, films or adhesives; epoxy resins) which are widely used in many fields as structural, cushion, insulation, electrical, and packaging materials.

From 2008 to now, the researcher has been acquiring know-how about these topics thanks to the work developed in the Biorefinery Processes Group at the University of the Basque Country. The postdoctoral grant got in 2008, the research contracts in 2011 and the Juan de la Cierva contract in 2012 have allowed to develop all his scientific career. Moreover, the research stays carried out in seven different countries have helped to get specific challenges and improve his knowledge in fields as biomaterials, catalysis, bio-processes, click-chemistry or wood modification.

Nowadays, the researcher works in the CNRS (France), one of the most recognized institutions around the world, as advanced researcher applying the know-how acquired directly to find industrial solutions.

Resumen del Currículum Vitae:

The researcher was graduated in Chemistry at the University of Cordoba in 2003. He obtained his PhD in Chemical Engineering (Cum Laude) in 2008 from UCO under the supervision of Professor Luis Jiménez focused in the use of palm oil residues as alternative raw material for pulp and paper.

After that, the researcher stayed in the Polytechnic Institute of Grenoble (France) under the supervision Professor Naceur Belgacem, for changing his vision about pulp and paper industries to biorefinery industries using of all the components of the lignocellulosic biomass to produce high added value products, energy and/or biomaterials.

In November 2008, the researcher got a postdoctoral grant funded by University of the Basque Country under the direction of Dr. Jalel Labidi. Research stays in the University of Cordoba working in tasks of a national project, University of Aveiro (Portugal) under supervision of Professor Alessandro Gandini about direct conversion of biomass and lignin into polyols and University of Gabes (Tunisia) about date seeds for polyol production.

From December 2010 to December 2011, he was working as postdoctoral researcher with 2 post-doctoral contracts in the University of the Basque Country. Research stays in the University of Cordoba under supervision Dr. Rafael Luque about the production and characterization of metal catalysts used in lignin depolymerisation and University of Piacenza (Italy) funded by the national cooperation project Italy-Spain (Acciones Integradas 2009) to study the extraction and purification of hemicelluloses from grape stalks to produce high added value products.



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From January 2012 to December 2014, the researcher worked under the Juan de la Cierva grant (JCI-2011-09399) funded by the Economy and Competitiveness Ministry in the University of the Basque Country under the direction of Dr. Jalel Labidi. Research stays in University of Alicante under supervision of Dr. Alfonso Jiménez where new methods to synthesise composites from renewable sources were developed, National University of Cordoba (Argentina) about studies of cellulose functionalization with capsaicin and University of Pelotas (Brazil) as visitant researcher funded by a grant of the program **Science Without Borders** of Brazilian Government about production of antioxidants, biocomposites and polyols from lignin.

The researcher has published 60 scientific papers in high impact journals in the field of Chemical Engineering mainly (H-factor = 18, R-factor = 24.2 and G-factor = 26 and almost 800 citations); he has collaborated in 27 R&D&I projects funded in competitive calls (task leader in 2 European FP7 projects) and 4 R&D&I projects with companies; he has co-directed 1 doctoral thesis (awarded) (2 ongoing), 4 master project thesis and 3 final career projects. He is member of the management committee in Action Cost FP1105. He has presented 46 communications in national and international congresses (6 upon invitation of FP7 programme).

Moreover, from 2013, the researcher is one of the founders of the Spin-off **Ma+D** in the University of the Basque Country. The spin-off is result of the know-how acquires in his scientific career and it has been awarded with two important prizes.

Currently, the researcher works in the highly recognized CNRS (France) as advanced researcher collaborating in two important national projects about cellulose and lignin.



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Nombre: SERRANO RUIZ, JUAN CARLOS

Referencia: RYC-2015-19230

Área Científica: Tecnología Química

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Título:

Catalytic conversion of biomass into advanced biofuels and valuable chemicals

Resumen de la Memoria:

I initiated my research career in 2000 when I was awarded publicly funded Collaboration and Intercampus fellowships. In 2001, I started my PhD at the University of Alicante (FPI studentship). I performed two 3-months research stays (University of Wisconsin-Madison in 2002, and University of Poitiers in 2004) both of them resulted in several SCI publications. My doctoral work finished with 9 SCI publications (6 of them as a first author, 4 in Journal of Catalysis). After a postdoctoral stay at the Institute of Physical Chemistry (Rocasolano) (CSIC), in 2008 I was awarded a MEC/Fulbright fellowship to conduct my own research on catalytic conversion of biomass derivatives within Prof. James Dumesic's group. I developed several pioneer works on catalytic upgrading of biomass sugars (glucose) and acids (lactic acid, levulinic acid) into advanced biofuels and valuable chemicals. My prolific research stay in Dumesic's group finished with 19 publications (13 in SCI journals, 6 book chapters) and 1 international patent licensed, with particular emphasis on a paper published in Science (one of the 30 biggest chemical breakthroughs of the year according to magazine Chemistry World) and two hot papers in Green Chemistry (one of them cover paper). In January 2010 I joined the Advanced Materials Laboratory (LMA) at the Univ. of Alicante where I initiated a new line of research on biomass conversion giving rise to 8 SCI research articles (3 reviews in high impact journals, 5 research papers) and 1 book chapter. In September 2011 I was offered a research position at the University of Córdoba to lead the biomass conversion unit within the Nanoscale Chemistry and Biomass Waste Valorization Group. My main tasks were the design and implementation of new catalytic routes for the valorization of a variety of biomass and waste feedstocks resulting in 16 publications including a hot paper in Green Chemistry. Finally, in October 2012, I was offered a Senior Researcher position at Abengoa Research resulting in 5 SCI research papers, 1 book chapter, 3 national patents under revision and several European Projects (FP7 and H2020 calls) as a PI. In summary, the number and quality of my publications (57 in total, 50 % of them as a first or corresponding author; 85 % in SCI journals and 5 book chapters), communications to scientific conferences (30, 17 oral), books (only editor of 4 books on biomass conversion), and patents (1 licensed world patent, 3 more under revision) clearly demonstrate my capacity to lead novel research lines on catalytic biomass conversion. I accumulated more than 2500 citations so far (2300 within the last 4 years), with an h index of 25. I performed 4 research stays abroad (Argentina, US, France) and perform lecturing tasks on biofuels in several Master and Doctoral programs. I have participated as a PI in 4 European projects from both FP7 and H2020 programs and I have signed research contracts from international companies as PI. I presented my work in more than 30 international conferences, most of them as oral contributions, including invited talks in industry and one plenary lecture.

Resumen del Currículum Vitae:

1. Scientific contributions of the candidate: The evolution of my research abilities, as shown by the number and quality of my publications (57 in total, 50 % of them as a first or corresponding author; 85 % in SCI journals and 5 book chapters), communications to scientific conferences (30, 17 oral), books (only editor of 4 books on biomass conversion), and patents (1 licensed world patent, 3 more under revision) clearly demonstrate my capacity to lead novel research lines on catalytic biomass conversion and to go significantly beyond the state of the art in this field. Remarkably, the 85 % of papers in SCI journals are, in order of impact factor, in the Q1 leading group in each of their respective scientific areas (JCR, remaining 15 % in Q2). I accumulated more than 2500 citations so far (2300 within the last 4 years), with an h index of 25 (Google Scholar, January 2016). I presented my work in more than 30 international conferences, most of them as oral contributions.
2. Participation in international activity: I did 4 research stays abroad 3 pre-doctoral (9 months, Argentina, US and France) and one postdoctoral (2 years, University of Wisconsin-Madison) the latter under a MEC/Fulbright fellowship. I have participated as a PI in 4 European projects from both FP7 and H2020 programs. I have signed research contracts from international
3. Other CV merits: special award to best academic records in 2000 (University of Granada), Collaboration and Intercampus fellowships awarded by MEC and AEI, respectively. FPI grant and MEC/Fulbright fellowships. 5 years of experience as a regular reviewer of international scientific journals on Biofuels, Catalysis and Green Chemistry, including revision of the book Handbook of Biofuels: processes and technologies for the Chemistry World magazine. Lecturer of the subject "Biofuels" as a part of the Master on Solar and Renewable Energies, University of Elche, Spain, Terms 2010-present. Lecturing tasks in doctoral course Advances in Biorefineries of International Doctoral Programme in Bioproducts Technology PaPSaT, Aalto University, Finland, May, 2012. Member of the Editorial Board of "The Scientific World Journal".
4. Capacity of the candidate to lead his research line: I supervised two PhD students, Mr. Christian Gaertner and Mr. Dong Wang



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during my postdoctoral stay at University of Wisconsin Madison. I supervised the research work on glycerol conversion to fuels and chemicals of a Master student (Laura Pastor) in 2010. I am currently director of the PhD Thesis of Mr. Javier Moya at Abengoa Research.

I have 50 % of my research papers as a as a first or corresponding author. I am the only editor of 4 books on advanced biofuels production and catalytic conversion of biomass platform molecules. I have written (as a first author) 4 reviews on catalytic routes for biomass conversion into LHF in high impact journals such as Energy and Environmental Science (IF: 20), Chemical Society Reviews (IF: 33) and Annual Reviews (IF: 8.6) that have accumulated almost 600 citations within the last 5 years. One of the reviews was selected as a key scientific article by Renewable Energy Global Innovations, the World's leading source of renewable energy research news. Several of my works have been featured on a large number of internet magazines. My paper in Science was selected as one of the biggest breakthroughs in Chemistry in 2008.



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Nombre: ALBO SÁNCHEZ, JONATHAN
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Área Científica: Tecnología Química
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Título:

Development of carbon dioxide capture and utilisation technologies for climate change mitigation

Resumen de la Memoria:

The research carried out by the candidate focuses on the development of innovative Carbon Capture and Utilisation (CCU) technologies, aimed at mitigating CO₂ impacts from fossil fuels and promoting the transition to a low-carbon economy. Specifically, the candidate addressed research on the separation of CO₂, then its transformation to value-added chemicals and currently, the integration of separation and transformation of CO₂ using sunlight, as described hereafter:

(i) Separation of CO₂

During his PhD studies (2009-2012) at University of Cantabria and a research stay at New University of Lisbon (Portugal), he integrated membranes and ionic liquids (ILs) to overcome the drawbacks of the common amine-based CO₂ separation process. This includes the use of:

- Membrane contactors: The technical feasibility for the non-dispersive absorption of CO₂ by using hollow fibre membrane contactors and ILs is demonstrated. Mass transfer at macro-and-micro level for different operation conditions and module configuration is evaluated.

- Supported Ionic Liquid Membranes (SILMs): High CO₂ solubility ILs and then, ILs containing metals in their anion are immobilized in polymers to develop novel stimuli-responsive membranes to modulate CO₂ permeation with an external magnetic field.

After the PhD defence, he received a postdoctoral fellowship from the Japan Society for the Promotion of Science (2013) to expand knowledge in the synthesis and evaluation of new membrane materials at Hiroshima University (Japan). The study includes:

- Inorganic-based SILMs: Inorganic supports with thermal/mechanical stability are synthesized by sol-gel (with controlled thickness and pore size) and evaluated for SILMs. These materials show potential for CO₂ capture at post-combustion high temperatures.

- Thin-film composite (TFC) membranes: Interfacially polymerized membranes are synthesized and evaluated for gas separation. The effect of their bi-modal structure (dense and loose regions) and the pre-treatment procedure applied to separation performance is analyzed.

(ii) Transformation of CO₂

From January 2014 to date, he holds a Juan de la Cierva postdoctoral position at University of the Basque Country and he completed a research stay at University of Alicante. The study proposes the conversion of CO₂ into value-added chemicals by:

- Electrochemical reduction (ECR): The study includes the performance evaluation of Cu₂O/ZnO and Cu-based MOFs for ECR of CO₂ to methanol at mild conditions. This technology permits to store intermittent renewable energy, reduce CO₂ emissions and provide high-density energy reservoirs.

- Photocatalytic conversion: The reaction of CO₂ and H₂O to form valuable products by directly using sunlight. The work includes the development of effective photocatalytic and photoelectrocatalytic reactors for CO₂ transformation.

(iii) Integration of CO₂ separation-transformation

Currently, the candidate aims at coupling the separation and conversion of CO₂ into value-added chemicals in a new generation of highly active photo-induced membrane-based devices to effectively separate and convert CO₂ from post-combustion streams in continuous operation.

Dr. Albo authored 54 publications (2 submitted), 25 of them in SCI high impact journals, and more than 50 contributions to international conferences, as a result of his participation in 11 European and national projects

Resumen del Currículum Vitae:

Dr. Albo graduated in Environmental Science in 2006 (awarded Extraordinary Prize) at Rey Juan Carlos University, performing the final project at the Institute of Technology, Sligo (Ireland). Later, he received a Leonardo da Vinci scholarship, which he completed at METLA Research Institute (Finland) to evaluate the effects of climate change. He started his PhD in Chemical and Process Engineering in 2009 at the University of Cantabria (UC) in the framework of an ERANET project, focusing on the development of innovative membrane-based processes for CO₂ capture. During his PhD, he was guest researcher at the Laboratory of Membrane Processes of the New University of Lisbon (Portugal) funded by MEC. The results were recognized with Solvay Award for Best MSc thesis. In July 2012, Dr. Albo defended his thesis (Cum Laude and International Mention). Due to the quality and applicability of the work developed, the candidate received in 2013 the prestigious SENER Award for Best PhD thesis in engineering and the Extraordinary Doctorate Award at UC. After the dissertation defence, he conquered in 2013 a postdoctoral fellowship granted by the Japan Society for the Promotion of Science to support his research on new membrane materials for gas separation at Hiroshima University (Japan). From January 2014, he joined the Department of Chemical Engineering at University of the Basque Country thanks to Juan de la Cierva postdoctoral programme, to develop cost-effective processes for the chemical conversion of CO₂. It is noteworthy that Dr. Albo actively collaborated in the excellence network Sustainable chemical



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valorisation of CO₂ funded by MINECO. During 2014, he completed a research stay at the Institute of Electrochemistry of the University of Alicante. Last February 2015, his work has been recognized with Juan María Parés research award.

As a result of his scientific activity, Dr. Albo has reported a total of 54 publications (2 submitted) in a short period of time, which demonstrated the potential of the candidate, including 25 scientific articles in SCI peer-reviewed high impact journals (14 as first author), 5 articles in journals with ISSN, 3 book chapters and 21 contributions to conference proceedings with ISBN. His work has received a total of 332 citations. He disseminated his results in more than 50 international conferences (17 oral presentations and 1 Keynote presented by him). He also gave 2 invited lectures at Research Institute of Innovative Technology for the Earth in Kyoto (Japan) and Hiroshima University. He has participated in 11 competitive research projects (2 European, 6 national and 3 regional projects) funded by public and private entities. Besides, he supervised 6 final degree projects, 2 Master and 1 PhD theses in the chemical engineering field. Currently he mentors an additional PhD thesis. He also participated in teaching activities (80 hours), Summer Courses and OpenCourseWare. Dr. Albo is also frequent reviewer for 15 SCI high impact journals in his topic, abstract reviewer for international conferences and has been project evaluator for international research agencies. He is member of RSEQ, RSC, ISE and AQUIQAN. Overall, the work conducted by Dr. Albo has significantly contributed to develop CCU technologies for climate change mitigation. The applicant has proven independency and strong motivation for a research career



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Nombre: GONZALEZ PLAZA, MARTA
Referencia: RYC-2015-17516
Área Científica: Tecnología Química
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Título:

CO2 capture by adsorption: materials and process development

Resumen de la Memoria:

Dr. Marta González Plaza has developed her research activity in the areas of Energy, Process Engineering and Environment. Along her research career, she has demonstrated her ability to conduct high quality research. She has a strong publication record with 36 research articles published in peer-reviewed scientific journals and 1 review chapter, and she has an author index of 23, which is an external indicator of the high impact of her research among the scientific community. She has repeatedly demonstrated the ability to adapt to new research environments, where she has built strong collaborations, and she has shown the capability of planning and conducting research independently.

In the early stage of her career, developed at INCAR-CSIC, she worked on the reduction of emissions in the industry, energy and transport sector, by developing two parallel research lines: Co combustion and co-gasification of biomass with fossil fuels and CO2 capture by adsorption. During her PhD she did 2 research stays at the University of Nottingham, where she studied the influence of oxidative treatments on the adsorption properties of CO2. Her PhD thesis focused on the development and surface modification of adsorbents for post combustion capture applications.

Eager to complete her formation, Dr. Marta González Plaza joined the Laboratory of Reaction and Separation Engineering (LSRE) where she was responsible for the development of adsorption technologies for the separation of propane and propylene in the gas phase using MOFs as adsorbents in the framework of the FP7 MACADEMIA project. At LSRE she expanded her research interests towards the design, modelling and simulation of adsorption technologies in a highly qualified and competitive environment, under the guidance of one of the world's leading scientists in that field: Professor Alirio Egidio Rodrigues.

In the later stage of her research career Dr. Marta González Plaza has specialized in the research line of CO2 capture by adsorption at INCAR-CSIC. Her objective is to reduce the cost of the capture process by taking an overall approach: from adsorbent development to process design and optimization. The research activities that she has carried out in this line are: development of adsorbents from low value products; synthesis of resin-based adsorbents; modification of the surface chemistry of the adsorbents with the aim of improving their capture performance; study of the equilibrium and kinetics of adsorption of CO2 of hundreds of adsorbents; design and development of flexible adsorption units to evaluate the adsorbents for different applications; evaluation of the cyclic performance of the adsorbents; evaluation of the influence of other gas components on CO2 capture; modelling of the adsorption process; validation of the mathematical model with experimental results; and design and optimisation of the CO2 capture process. Dr. Marta González Plaza is a leading researcher in the field of CO2 capture by adsorption. She has published 24 research articles in peer-reviewed scientific journals and 1 review chapter within this research line (76% of them as leading author); 3 of them are considered Highly Cited Papers in the fields of Engineering (2) and Materials Science (1) and 1 of them is also considered a Research Front by Essential Science Indicators (ESI).

Resumen del Currículum Vitae:

Dr. Marta González Plaza is a devoted young researcher that has gained the recognition of the scientific community. Objective indicators of the high quality of her research are her author h index, 23, with over 1700 citations, and the fact that Essential Science Indicators considers 5 of her research articles Highly Cited Papers in the fields of Engineering, Chemistry, and Materials Science, and 2 of them Research Fronts. Up to date she has participated in 15 research projects at the international, national and regional level, inventoried 1 patent, published 36 research articles in peer-reviewed scientific journals (3 more are under peer review) and 1 review chapter, and sent 36 communications to international (27) and national (9) conferences.

Dr. Marta González Plaza graduated in Chemical Engineering by the University of Oviedo after being awarded with a SOCRATES/ERASMUS Fellowship of 9 months at Strathclyde University, in Glasgow. In 2005 she got a pre-doctoral research fellowship in the framework of the European project AGAPUTE to conduct research at INCAR-CSIC. Shortly afterwards she gained a 4-year competitive fellowship from the Professional Insertion Itinerary Programme (I3P) of CSIC aimed at the completion of PhD thesis with interest for the Industry Sector. During her PhD she got 2 grants to do research stays at the University of Nottingham (4 months lapse). She obtained her PhD in Chemical Engineering by the University of Oviedo with the double mention of European Doctorate and Cum Laude in 2009 with the Thesis entitled: Development and surface modification of adsorbents for post-combustion CO2 capture.

In 2009 Dr. Marta González Plaza joined the Laboratory of Separation and Reaction Engineering at the Faculty of Engineering of the



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University of Porto (LSRE-FEUP), in Portugal, awarded by a post-doctoral fellowship in the framework of the FP7 European project MACADEMIA under the supervision of Professor Alirio Rodrigues, who is a renowned scientist in the field of Separation Processes. During 24 months she had the opportunity to specialize in the design, modelling and simulation of adsorption technologies in a highly qualified, competitive and international environment.

In 2011 Dr. Marta González Plaza joined the Energy Processes and Emissions Reduction group (PrEM) at INCAR-CSIC, where she continues her activity in the research line of CO₂ capture. In 2012 she was awarded with a 3-year competitive fellowship from the JAEDOC programme of CSIC, aimed at the specialization of PhDs with the project titled: Development of carbon materials with applications in the area of energy. Currently she holds a contract under the FP7 European project HiPerCap. Apart from the research activities directly related with the development of the project, she leads the authorship of high-impact research articles in peer reviewed scientific journals, collaborates with local and international researchers in national and international projects, supervises younger researchers, attends conferences and workshops, participates as invited-speaker in postgraduate courses and seminars, prepares funding proposals, participates in scientific dissemination activities, and collaborates as invited reviewer for high impact scientific journals.