

Personal data		Data of the CV		11/04/2016
Name and surname	SARA GONZÁLEZ GARCÍA			
DNI number	33.538.139E	Years	34	
Research identification numbers	Researcher ID	16303623400		
	Orcid code	0000-0002-2553-0863		

Academic formation

Academic background	University	Year
Degree on Chemical Engineering	Santiago de Compostela	2005
PhD on Environmental and Chemical Engineering	Santiago de Compostela	2009

General indicators of the scientific productivity

My scientific production encompasses 71 peer-review SCI publications (48 as first author): 60 publications on Q1 journals, 9 publications on Q2 journals, 2 publications on Q3 journals, 3 non-SCI papers, 4 book chapters and 55 contributions to international conferences (27 oral presentations). My current h-index is 19 (Scopus, 11/04/2016). Total citations/year (source: Scopus; 11-04-2016): <2011 (37 citations), 2011 (55 citations), 2012 (122 citations), 2013 (147 citations), 2014 (210 citations), 2015 (274 citations).

Extended detail of the research career of the candidate

After completion my degree in Chemical Engineering (2005) by the University of Santiago de Compostela (USC), I began my Ph.D. at the Group of Environmental Engineering and Bioprocesses in the Department of Chemical Engineering of the USC under the supervision of the professors Dr. Gumersindo Feijoo and Dr. M^a Teresa Moreira. I carried out my Ph.D. funded by MEC via FPU fellowship (2006-2010) on the application of Life Cycle Assessment (LCA) methodology in industrial processes derived from lignocellulosic feedstocks in order to determine their environmental sustainability from an industrial ecology perspective. My thesis project was framed in two European integrated projects: BIORENEW (White Biotechnology for added value products from renewable plant polymers: Design of tailor-made biocatalysts and new industrial bioprocesses) and AQUATERRE (Integrated European Network for biomass and waste reutilization for Bioproducts). The aim of BIORENEW project was the sustainable production of non-food added value bioproducts obtained from renewable polymers such as lignin and cellulose introducing enzymes in the production processes under a lignocellulosic biorefinery concept. The use of enzymes instead of chemicals as industrial catalysts and renewable raw materials instead of petrochemical polymers as raw material allowed these industrial sectors (mainly wood based factories such as paper pulp and fibreboards mills) to increase their sustainability. In order to demonstrate their sustainability, I had to analyse the whole production chains of lignocellulosic products such as ECF/TCF pulp, dissolving pulp, specialty paper pulp, bitumen nanoemulsions, lignosulphonates and high density fibreboards from the production of raw materials (e.g. forest processes to produce the roundwood) to final waste disposal. In this context, I carried out a research stay at The Forestry Research Institute of Sweden (Uppsala, Sweden) - the central research body for the Swedish forestry sector- under the supervision of Dr. Staffan Berg, the pioneer researcher in Europe in the quantification of energy consumption and environmental impacts associated with the forest operations as well as in the application of LCA in the analysis of forestry operations.

However, not only wood based processes were analysed in my thesis but also other lignocellulosic processes considering flax and hemp as raw materials. In this sense, I paid attention to second generation biofuels and non-woody specialty paper pulp production processes, which was partially developed in the AQUATERRE project, whose main aim was the promotion of the cooperation between research centres, business and other stakeholders in Europe devoted to the research, development and application of biomass to biofuel production and valorisation as well as to promote the creation of a network for improving biomass and waste reutilisation. In this topic, I carried out my second predoctoral research stay at the Institute of Environmental Sciences in the Department of Industrial Ecology of Leiden University (Leiden, The Netherlands) under the supervision of Dr. Gjaltp Huppel, one of the developers of Life Cycle Assessment methodology and LCA methods commonly used by LCA practitioners.

In parallel to my thesis and since one of the wood based processes environmentally analysed was the TCF kraft pulp production, I participated in a pilot research study in collaboration with the Textile and Paper Engineering Department of the Universitat Politècnica de Catalunya and ENCE focused on the enzymatic TCF bleaching sequence using laccase and mediators (1-hydroxybenzotriazole, violuric acid, syringaldehyde and methyl syringate). My role was the evaluation of 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. Results from this study were published in a SCI international peer-review journal (Water Research).

As result of my participation in both projects I established relationships with international industrial partners such as pulp and paper mills (Domsjö in Sweden, ENCE and CELESA in Spain and, Ahlstrom in Switzerland), panel mills (Wood Kplus and Funder Max in Austria), biotechnology industries (Novozymes in Denmark) as well as research partners (INRA and CTP in France, CSIC in Spain).

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 and I concluded my Ph.D. with 12 papers published in SCI international peer-review journals (Scandinavian Journal of Forest Research, Science of the Total Environment, Journal of Cleaner Production, Renewable and Sustainable Energy Reviews, International Journal of Life Cycle Assessment, Resources, Conservation & Recycling, Biomass & Bioenergy and Journal of Industrial Ecology).

Immediately after my Ph.D., I carried out a post-doctoral research stay for 3 months at the European Forest Institute under the direction of Dr. Marcus Lindner, senior researcher and Head of Programme: Forest Ecology and Management. In this stay, I analysed 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. ToSIA is also a software tool that analyses the environmental, economic, and social impacts (the three pillars of sustainable development) of changes in forest production chains, using a consistent and harmonised framework from the forest activities (cradle) up to the end-of-life (grave) of wood based products. During this stay in Finland, I met Dr. Blas Mola-Yudego, associate professor at the School of Forest Sciences in the University of Eastern Finland (currently, research professor at the Norwegian Forest and Landscape Institute) and we created a new research line that considers the environmental impacts of the production of woody feedstocks for industrial purposes mainly affected by changes on cultivation practices and regimes. This line was expanded with the incorporation of Dr. Ioannis Dimitriou, associate professor at the Swedish University of Agricultural Sciences, paying special attention to new commercial crops as a source of raw material for bioenergy uses. As a result of this research collaboration started in 2009, we have four papers published in SCI international peer-review journals (Journal of Cleaner Production, Science of the Total Environment, International Journal of Life Cycle Assessment and Renewable Energy) and we have set a permanent network of collaboration.

After my post-doctoral research stay in Finland, I returned to the Department of Chemical Engineering of the USC for 9 months (January - September 2010) and my research was focused on three lines, all of them related with environmental sustainability assessment and the development of cleaner and more efficient processes considering lignocellulosic feedstocks as main raw material: i) Second generation bioethanol due to the potential of being environmental friendly transportation fuel as well as one of the most important consciousness is the fact that world's fossil fuels supply is not limitless so the use of biomass resources as an energy source could help to mitigate climate change and fossil fuels dependence. Specifically, I simulated and environmentally assessed the bioethanol production chain at industrial scale considering the use of acacia biomass (*Robinia pseudoacacia* L.), alfalfa stems (*Medicago sativa* L.) and Ethiopian mustard stems (*Brassica carinata*) by means of a biochemical process including enzymatic hydrolysis and simultaneous saccharification and fermentation; ii) Green products: since forest-based industries make up one of the most important and dynamic industrial sectors in Europe as well as considerably contribute with environmental impacts mainly due to high energy requirements and the use of petroleum based chemicals, the attention was paid on a representative woody product that is, hardboard. The research was carried out in collaboration with the Kompetenzzentrum Holz - WOOD Carinthian Competence Centre (Austria) and the conventional hardboards production process was modified by means of the substitution of the phenol-formaldehyde resin with a green strategy using bio-based phenolic materials in combination with phenol-oxidizing enzymes (laccase) and obtaining a green hardboard with similar properties (MoR, MoE and Internal bond) which is available in the market. The improvement on the environmental profile of hardboards was demonstrated as well as the optimum dose of green bonding agent was identified from an environmental perspective; and iii) Ecodesign: the knowledge regarding the environmental impact of the materials typically used in specific industrial sectors is a key factor to enable companies to improve their products and production processes from an environmental point of view and thus, accelerate their introduction into the emerging market for green products. Therefore, I developed, thanks to my participation in two regional projects, my knowledge on environmental strategies combining LCA methodology with EcoDesign or Design for the Environment (DfE) applied to the furniture industry in collaboration with the team managed by Dr. Joan Rieradevall I Pons and Dr. Xavier Gabarrell from the Institute of Environmental Science and Technology (ICTA) of Universitat Autònoma de Barcelona. As result of these research lines at the Department of Chemical Engineering of USC, 11 papers were published in SCI international peer-review journals (Biofuels, Bioproducts & Biorefining, Renewable & Sustainable Energy Reviews, Journal of Cleaner Production, Science of the Total Environment, International Journal of Life Cycle Assessment and Environmental Engineering & Management Journal). The research line based on ecodesigning industrial products initiated in collaboration with ICTA still continues and the DfE concept has been extended to other industrial sectors supported by two new regional projects and one recent publication in the Journal of Industrial Ecology.

In July 2010, I was awarded with a competitive two-years post-doctoral fellowship (Spanish Scientists Mobility programme Estancias de movilidad posdoctoral en centros extranjeros del Programa Nacional de Movilidad de Recursos Humanos de Investigación - Plan Nacional de Investigación Científica, Desarrollo e Innovación Tecnológica 2008-2011) to develop a project entitled "The role of Wood based materials to mitigate the Climate Change. Biomass for Biofuels or Materials?". Thus, I got a post-doctoral position for 15 months at the prestigious Department of Life Sciences in the Imperial College London (United Kingdom) and for 9 months at the Department of Environment and Planning in the University of Aveiro (Portugal). I joined the Imperial College in September 2010 under the supervision of Dr. Richard J. Murphy, senior researcher, and my research

was focused on two main areas: the use of plant-based materials for bioenergy (specifically poplar) and the environmental evaluations using LCA methodology. During this post-doctoral position, I collaborated in the European project EnergyPoplar on conducting environmental LCA of second generation biofuel production from poplar (*Populus sp.*) feedstock in order to evaluate the sustainability benefits available from optimised biomass production and supply chains, paying attention on poplar biomass production systems. In addition, alternative biomass sources were also evaluated as potential lignocellulosic sources in Europe: willow (*Salix spp.*) and eucalypt (*Eucalyptus globules L.*). Moreover, during my stay in London, I started collaboration with the research team conducted by Dr. Javier Dufour, associate professor at the Department of Chemical and Energy Technology (Rey Juan Carlos University) in the analysis of energy production systems from selected biomass sources which allowed me to develop my knowledge and better understanding of the lignocellulosic biomass gasification, one of the most promising technologies for the conversion of biomass into electricity, heat and/or chemical compounds using a short rotation coppice (willow) as raw material. In addition, I created a new research line in collaboration with Dr. Marco Fiala, associate professor at the Department of Agricultural Engineering of University of Milan (Italy), which still continues, based on anaerobic digestion systems using animal waste and energy crops as feedstocks (detailed below). The work carried out within my fellowship project at the Imperial College London resulted on seven papers published in SCI international peer-review journals (*Journal of Cleaner Production*, *Science of the Total Environment*, *International Journal of Life Cycle Assessment*, *Applied Energy*, *Renewable & Sustainable Energy Reviews* and *Biomass & Bioenergy*) and two oral presentations in international conferences.

In January 2011, I joined the Department of Environment and Planning in the University of Aveiro for 9 months under the supervision of Dr. Luis Arroja and my research was focused on two main areas: one related with my fellowship project, where I analysed Portuguese cork oak (*Quercus suber L.*) woodlands due to their important economic contribution to the Mediterranean region and framed in the European project ECOTECH-SUDOE as well as European annual energy crops for anaerobic digestion purposes and a second line dealt with food sector (framed in the competitive project ECODEEP), specifically dairy sector, which was a totally new research line for me and was the starting point of a new collaborative research line, which continues at present. Four different dairy products production chains were analysed and environmental improvement strategies were proposed for consideration. The work carried out during this post-doctoral stay resulted on six papers published in SCI international peer-review journals (*Journal of Cleaner Production*, *Science of the Total Environment* and *International Journal of Life Cycle Assessment*) and two oral presentations in international conferences.

In October 2012, I returned to the Department of Chemical Engineering of the USC for 6 months (October 2012 – March 2013) and I started to work in two European projects: Bambo (Sustainable production of biologically active molecules of marine based origin) and Biofoambark (Bark valorization into insulating foams and bioenergy). In the Bambo project, I collaborated in the analysis of different marine systems (*Haematococcus pluvialis*, *Tetraselmis suecica* and *Phaeodactylum tricornutum*) to attain a holistic evaluation of the production of potential bioactive molecules with pharmaceutical and food applications (red antioxidant carotenoid astaxanthin, polyunsaturated fatty acids and eicosapentaenoic acid). Three papers published in SCI international peer-review journals (*Journal of Cleaner Production* and *Science of the Total Environment*) and two additional publications published later in 2014 in *Science of the Total Environment* and *Bioresource Technology* are result from my research activity in this project. My experience in environmentally analysing new industrial systems framed in marine biotechnology using either macro- or micro-algae still continues and I am involved in the research team of several proposals in European projects (ERA-MBT and H2020 programmes).

In the Biofoambark project, my role was focused on performing a life cycle analysis for tannin-based foams using various scenarios of the technology and chain supplies as well as establishing the most competitive technologies and supply chains for European tannin foams based on sustainability and techno-economic criteria. Although I continue working on this project, five papers were published in SCI international peer-review journals (*Journal of Cleaner Production* and *Science of the Total Environment*). Moreover, I was awarded with a competitive fellowship from Galician government in March 2013 (programme Axudas de apoio á etapa inicial de formación posdoutoral do Plan galego de investigación, innovación e crecemento 2011-2015 - Plan I2C) for 36 months at the Department of Environment and Planning in the University of Aveiro in order to work in a fellowship project focused on the identification and quantification of the environmental burdens derived from wood based industrial processes from a biorefinery perspective framed in the Biofoambark related activities. Thus, I joined Department of Environment and Planning from April 2013 to April 2014 since I was awarded with a Juan de la Cierva fellowship in October 2013 (reference JCI-2012-11898) with a qualification 100/100 in the area Chemical Technology, which allowed me to return to the USC for 36 months and to consolidate the research line developed throughout my post-doctoral positions. The research line established with Dr. Luis Arroja in 2012 dealt with food sector also continued during this time (and continues) with the overriding aim of introducing more efficient processes in food sector, paying attention to pork and broiler chicken – two of the most extensively consumed food products in the world.

From September 2013, I am involved in two European projects: LIVEWASTE and ManureEcoMine, where I am developing my knowledge on LCA evaluations into anaerobic digestion processes using animal manure (pig slurry, cattle manure, etc), organic fraction of municipal solid wastes and/or sewage sludge as feedstocks. I am co-director of two doctoral thesis framed within both European projects and focused on demonstrating the environmental feasibility of two eco-innovative technologies of organic waste management into bioenergy and other potential co-products such as green fertilisers. Moreover, this research line allows me to continue with the

research line created with Dr. Marco Fiala and the Department of Agricultural Engineering of University of Milan (Italy), mainly on energy crops (maize, wheat and triticale) cultivation and their further conversion into bioenergy by means of anaerobic mono- and co-digestion. Three papers were published up to date in SCI international peer-review journals (Journal of Cleaner Production, Science of the Total Environment and Renewable Energy) and a mobility plan of Ph.D. students has been promoted between our departments by Dr. Marco Fiala and me.

Moreover, I am currently involved in three industry-funded projects: i) quantification of carbon footprint of a unique and innovative milk developed by Feiraco as a result of cows' balanced diet; ii) the development of intelligent solutions of green logistic (SIGSOL) in collaboration with Kaleido Logistics and iii) the Zero Emissions City project, participating in the development of an evaluation system of greenhouse gas emissions at real time as result of energy consumption in activities carried out in a city (in this case, Santiago de Compostela) in order to introduce the concept of Smart City.

Finally, I was involved in other different international, national and regional projects from 2005 which gave me the opportunity to work with different European recognised researchers and research centers as well as I participated in other 10 industry-funded contracts (companies such as Abertis, Centro de Difusión Tecnológica de la Madera y Mueble de Cataluña, Fundación para el Fomento de la Calidad Industrial y el Desarrollo Tecnológico de Galicia, Sociedad Estatal para el Desarrollo, Diseño e Innovación, Empresa Nacional de Innovación, Fundación Observatorio Español de Acuicultura, ARCOS HERMANOS S.A., Andreu World, Boreal Calzados, Ecoalf, Finsa, Santa & Cole). Results derived from these participations are numerous papers published in SCI journals and the Design for Recycling Award 2013 in Catalonia granted by the Catalanian Government as result of the ecodesign project of the knife "Nueva Serie 900 ARCOS". In relation with the ecodesign topic, I am co-director of one doctoral thesis focused on solving problems related with sustainable development of wood based industrial sectors considering ecological values and operating methods such as Design for the Environment.

In July 2015, I was awarded with a Ramón y Cajal (reference RYC-2014-14984) with a qualification 100/100 in the area Chemical Technology, occupying the first position (total fellowships in the area: 4). Thus, I am member of the Department of Chemical Engineering from USC as RyC member from 01/01/2016.

Moreover and also in July 2015, I was awarded by the BBVA Foundation with one of the grants (63 grants in multiple research areas between 1949 applications) for the development of a 1 year research project (*Innovación y Sostenibilidad ambiental de Residuos Alimentarios Urbanos en Smart Cities*) under the BBVA programme *2015 Edition of the BBVA Foundation Grants for Researchers and Cultural Creators*.