

PROPOSAL DATA**IP 1 (Name and Surname):** Concepción Sánchez-Moreno González**IP 2 (Name and Surname):** Begoña de Ancos Sigüero**Título**

Nuevos avances en el desarrollo y evaluación de la actividad biológica de zumos de mango procesados por tecnologías emergentes sostenibles

Title

New insights into the development and biological activity evaluation of mango juices processed by sustainable emerging technologies

Acrónimo

BIOACTIMANGO

Duración (años)

4

Palabras clave

Zumo de mango, Fitoquímicos, Compuestos fenólicos, Carotenoides, Tecnologías de procesado, Alta presión hidrostática, Ultrasonidos, Disolventes verdes, Bioaccesibilidad, Actividad biológica, Salud

Key words

Mango juice, Phytochemicals, Phenolic compounds, Carotenoids, Processing technologies, High pressure processing (HPP), Ultrasound assisted extraction (UAE), Green solvents, Bioaccessibility, Biological activity, Health

Resumen

Para dar respuesta a las necesidades de los consumidores y estar en línea con las tendencias y necesidades de la **economía circular** y la **sostenibilidad** en los **procesos alimentarios**, la industria del procesado de frutas apuesta por **tecnologías emergentes no-térmicas** que permiten la producción sostenible de alimentos reduciendo los costes de procesado, el consumo energético, los residuos y mejoran la valorización de los recursos. Además, las tecnologías de procesado y conservación de alimentos denominadas tecnologías emergentes, como la **alta presión hidrostática (APH)**, no sólo permiten la obtención de alimentos seguros, saludables y convenientes, manteniendo su calidad sensorial y organoléptica, sino que pueden llegar a incrementar la extractabilidad de compuestos bioactivos, y por tanto ser utilizadas para la funcionalización de alimentos.

El **mango** es una fruta rica en nutrientes y compuestos bioactivos como polifenoles y carotenoides, encontrándose la mayoría de ellos en altas concentraciones en la piel. Debido a su **rica composición fitoquímica**, numerosos estudios avalan la actividad antidiabética, anticancerígena, antiinflamatorias, antioxidante y antibacteriana de los productos y subproductos de mango, como la piel. Así, la **reutilización y recuperación de la piel de mango**, rica en compuestos fenólicos y carotenoides producida como residuo durante el procesado de zumos para la **obtención de ingredientes funcionales** y el **empleo de tecnologías verdes sostenibles como la extracción asistida por ultrasonidos y el procesado por APH** son aspectos claves del proyecto. En este sentido, el **principal objetivo** es el **desarrollo y evaluación biológica de zumos de mango procesados por alta presión con alto contenido en compuestos fenólicos y carotenoides con efectos antiinflamatorios, antioxidantes, antidiabéticos y antiobesidad para contribuir a mejorar la nutrición y la salud cardiometabólica**. Para lograr este objetivo general, se proponen los siguientes objetivos específicos: investigar el efecto del procesado por APH sobre las características nutricionales y relacionadas con la salud de diferentes formulaciones de zumos de mango obtenidos a partir de mangos

cultivados con prácticas de agricultura orgánica; investigar la bioaccesibilidad y el transporte intestinal de compuestos fenólicos y carotenoides de zumos de mango obtenidos simulando la receta del zumo comercial procesado por APH; investigar la actividad citoprotectora y antiinflamatoria de la fracción bioaccesible obtenida después de una digestión gastrointestinal simulada de zumos de mango procesados por APH; y evaluar el efecto sobre la biodisponibilidad de compuestos fenólicos y carotenoides y la salud cardiometabólica de una ingesta habitual de zumo de mango comercial procesado por APH mediante un estudio de intervención en humanos.

El proyecto es novedoso y ayudará a desarrollar nuevos zumos de mango sostenibles procesados por APH con un alto contenido en compuestos fenólicos y carotenoides con efectos beneficiosos para la salud mediante el uso de un conjunto de innovadoras tecnologías de procesamiento (alta presión hidrostática, extracción asistida por ultrasonidos y solventes verdes). Además, se cubrirá el vacío en el conocimiento científico sobre la evaluación biológica de zumos de mango comerciales procesados por APH, integrándose en la Estrategia Española de Ciencia, Tecnología e Innovación (EECTI) 2021-2027, en los objetivos de sostenibilidad del Programa Horizonte Europa, en el Pacto Verde Europeo, y en las estrategias Farm to Fork y Food 2030, donde la dieta y la nutrición saludables son el eje central.

Summary

To respond to consumer requirements and to be in line with the trends and needs to implement the global *circular economy* and *sustainability* in the *food processes*, the fruit processing industry is committed to *emerging technologies* that enable sustainable food production by lowering processing costs, energy consumption, waste and improving the valorization of the resources. In addition, emerging processing technologies for food, such as *high pressure processing (HPP)*, not only allow obtaining safe, healthy and convenient foods, keeping sensory and organoleptic quality, but may actually increase or improve the extractability of bioactive compounds, and therefore can be used for the functionalization of food.

Mango fruit are rich in nutrients and bioactive compounds such as carbohydrates, dietary fiber, protein, amino acids, lipids, fatty acids, organic acids, vitamins, minerals, polyphenols and carotenoids, most of them found in high concentration in the peel. Based on the diverse and *rich mango phytochemical composition*, several studies support antidiabetic, anticancer, antiinflammatory, antioxidant and antibacterial activities of mango products and by-products such as the peel. Thus, the *reuse and recovery of the peel* rich in phenolic and carotenoid compounds produced as a waste during the processing of mango juices *to obtain functional ingredients* and the *employment of sustainable green technologies such as ultrasound assisted extraction and high pressure processing* are at the core of the project. In this line, the *main objective* of this project is the *development and biological evaluation of high pressurized mango juices with high content of phenolic compounds and carotenoids with antiinflammatory, antioxidant, antidiabetic and antiobesity effects to improve human nutrition and cardiometabolic health*. To achieve this general objective, the following specific objectives are proposed: to investigate the effect of HPP on nutritional and health-related characteristics of different formulations of mango juices obtained from pulp of organically grown fruits; to investigate the bioaccessibility and the intestinal transport of phenolic and carotenoid compounds from mango juices obtained by simulating the recipe of commercial HPP mango juice; to investigate the cytoprotective and antiinflammatory activity of the bioaccessible fraction obtained after a simulated gastrointestinal digestion of HPP mango juices; and to assess the effect on phenolic and carotenoid compounds bioavailability and cardiometabolic health of a usual dietary intake of commercial HPP mango juice by a human intervention study.

The project has a novel approach as it combines different fields of study within the Food Science and Technology and is expected to have a strong impact on the scientific community by creating solid knowledge that will help to develop new sustainable high pressurized mango juices with high content in phenolic compounds and carotenoids with beneficial health effects by using a set of scalable ground-breaking processing technologies (HPP, UAE, and green solvents). In addition, the scientific gap regarding the biological evaluation of commercial mango juices processed by HPP will be filled. The project is integrated in the Spanish Science, Technology and Innovation Strategy 2021-2027, in the sustainability targets of Horizon Europe Program, in the European Green Deal, and in the Farm to Fork and Food 2030 strategies, where healthy diets and nutrition are at the core.

Expected impact of the results – Expected impact on the generation of scientific-technical knowledge in the thematic area of the proposal and social and economic impact

Mango is rich in nutrients and bioactive compounds such as polyphenols and carotenoids, most of them found in high concentration in the peel of the fruit. Based on the diverse and rich mango phytochemical composition, several studies support antidiabetic, anticancer, antiinflammatory, antioxidant and antibacterial activities of mango products and by-products such as the peel. Thus, the reuse and recovery of the peel rich in phenolic and carotenoid compounds produced as a waste during the processing of mango juices to obtain functional ingredients and the employment of sustainable green technologies such as ultrasound assisted extraction (UAE) and high pressure processing (HPP) are at the core of the project. *The initial project hypothesis is in line with the international and national sustainability and circular economy policies in the food production and based on the fact that there is a growing demand by today's consumer for foods obtained by sustainable technologies, free of additives, that present healthy characteristics beyond nutrition, and that are also safe and have an adequate shelf life.* HPP foods meet these conditions and a significant increase in these products is observed in the markets, such as HPP fruit juices, mainly those with high content in bioactive compounds as mango-based juices. In this sense, there are numerous *in vitro* and *in vivo* animal studies that support exceptional health-promoting characteristics of mango products (pulp, peel, seed, juice, extracts, etc.) based on their phytochemical composition, but there are fewer studies assessing the absorption, metabolism, and health-related properties of phytochemicals from commercial mango juices in humans. Consequently, ***this project goes further and proposes for the first time the study of the effects of commercial HPP mango juice consumption on health biomarkers by a human intervention study.*** The project has a novel approach as it combines different fields of study within the Food Science and Technology and is expected to have a strong impact on the scientific community by (1) creating solid knowledge that will help to develop new sustainable high pressurized mango juices containing phenolic compounds and carotenoids with antiinflammatory, antioxidant, antidiabetic and antiobesity effects to contribute to improve human nutrition and cardiometabolic health; and (2) filling the scientific gap of the biological evaluation of high pressurized mango juices.

The project will have a relevant technological and socioeconomic impact since it will provide scientific evidences on the healthy properties of HPP mango juices, having a relevant economic impact not only on the national mango fruit producers but also on the competitiveness of the growing and young Spanish HPP juice industry at the international and national markets. The *scientific communication and internationalization strategy* will focus on promoting the projects scientific actions, to be implemented both during and after the project, including publication of scientific papers, oral and poster presentations at international congress/conferences/workshops, and exchange of PhD, MSc, and BSc students. Regarding the *transfer plan and valorization of results*, the commercial prospects of the research results will be protected through the involvement of the Unit of Knowledge Transfer (UTRIC) at ICTAN, that functions in close coordination with the Deputy Vice-Presidency for Knowledge Transfer (VATC) at CSIC.

General and specific objectives

The main objective of this project is the development and biological evaluation of high pressurized mango juices containing phenolic compounds and carotenoids with antiinflammatory, antioxidant, antidiabetic and antiobesity effects to contribute to improve human nutrition and cardiometabolic health.

To achieve this main goal, sustainability and innovation in food processing without forgetting the nutrition and health effect of high pressure-processed (HPP) mango juices, will be the central core of this study that will be addressed through ***two different approaches: 1) To investigate the effect of high pressure processing on nutritional and health-related characteristics of different formulations of mango juices*** obtained from pulp of organically grown fruits prepared following the formulation of the main and most consumed commercial mango juice available in the market that usually are prepared with 20% of mango puree being the rest water or other fruit juices. Mango juice is obtained by homogenization of the pulp, therefore main nutrients and phytochemicals including fibre should go directly from the fruit pulp to the juice. The effect of adding other fruit juices or liquids such as milk (sometimes used to prepare shakes or smoothies) on the stability, bioaccessibility and biological activity of mango phytochemicals will be carried

out including the effect of the functionalization of the juice with mango peel extracts rich in phenolic and carotenoid compounds. **2) In parallel, the biological activity of the commercial high pressurized mango juice will be evaluated by a human intervention study.**

To achieve this general objective, the following **specific objectives** are proposed:

Objective 1. To investigate the effect of high pressure processing (HPP) on nutritional and health-related characteristics of different formulations of mango juices obtained from pulp of organically grown fruits.

Objective 2. To investigate the bioaccessibility and the intestinal transport of phenolic and carotenoid compounds from mango juices obtained by simulating the recipe of commercial juice processed by HPP.

Objective 3. To investigate the cytoprotective and antiinflammatory activity of the bioaccessible fraction obtained after a simulated gastrointestinal digestion of HPP mango juices.

Objective 4. To assess the effect on phenolic and carotenoid compounds bioavailability and cardiometabolic health biomarkers of commercial HPP mango juice consumption by a human intervention study.

Training program planned in the context of the requested project

Research and Technical Training. The requested PhD student will receive training within a multidisciplinary research group in different areas of Food Science and Technology and Nutrition. The specific planned **research and technical activities** are related with: food processing by non-thermal technologies (HPP, UAE, and green solvents); nutritional and phytochemical characterization through advanced analytical methods; bioaccessibility and intestinal transport of bioactive compounds using an *in vitro* model of GID and an Ussing chamber model; cytoprotective and antiinflammatory activity using cell cultures; and bioactive compounds bioavailability, biological activity evaluation, and metabolomics applied to food science by a human intervention study. **Short research stays in national and international research groups** will be planned according to the project development. The experience acquired in international laboratories will add extra value for the accomplishment of the objectives proposed in this project and will allow the PhD student to obtain the European or International Doctorate Mention. The training program will include the **activities of the PhD Program in Pharmacy from the Complutense University of Madrid (UCM)**. This training will be complemented with **other formation courses** aimed at increasing the PhD student competences organized by CSIC (**Plan de Formación CSIC**) involving annual courses of languages, informatics, science and technology.

Horizontal and Transferrable Training. The requested PhD student will acquire **cross-cutting skills and capabilities**. The student will receive **communication training (oral and written communication skills)** from the research team members: **writing of scientific and divulgation articles, presentation and discussion of results, scientific information organisation and management, preparation and management of research projects, design of experiments, statistics, and exploitation of scientific results, and ethical issues**. The student will present results in the research group through regular meetings in order to monitor the work progress. If possible, the student will attend at least one congress each year. The research and transferrable training program and skills development will contribute to the future career of the PhD student.



CURRICULUM VITAE ABREVIADO (CVA)

Part A. PERSONAL INFORMATION

First name	Concepción		
Family name	Sánchez-Moreno González		
Gender (*)	Female	Birth date (dd/mm/yyyy)	26/04/1972
Social Security, Passport, ID number	52139945A	Six-year research periods	4 research +1 transfer
e-mail	csanchezm@ictan.csic.es	ResearcherID: N-6798-2013	SCOPUS ID: 6604064329
Open Researcher and Contributor ID (ORCID) (*)	0000-0002-2341-9328		

(*) Mandatory

A.1. Current position

Position	Research Scientist – <i>E. Investigadores Científicos de OPIs</i>		
Initial date	19/12/2017		
Institution	Spanish National Research Council <i>Consejo Superior de Investigaciones Científicas (CSIC)</i>		
Department/Center	Department of Characterization, Quality and Safety	Institute of Food Science, Technology and Nutrition <i>Instituto de Ciencia y Tecnología de Alimentos y Nutrición (ICTAN)</i>	
Country	Spain	Teleph. number	+34 915492300
Key words	Functional foods; Bioactive compounds; Phytochemicals; By-products; Biological activity; Inflammation; Oxidative stress; Cardiovascular disease; Bioaccessibility; Bioavailability; Gastrointestinal digestion; Animal models; Human intervention studies; Health biomarkers; Nutritional sciences; Processing and preservation technologies; Non-thermal technologies		

A.2. Previous positions (research activity interruptions, indicate total months)

Period	Position/Institution/Country/Interruption cause
02/12/2011-18/12/2017	Tenured Scientist at Public Research Organisations <i>E. Científicos Titulares de OPIs</i>
15/06/2005-01/12/2011	Tenured Scientist at Spanish National Research Council (CSIC) <i>E. Científicos Titulares del CSIC</i>
01/12/2003-14/06/2005	Ramón y Cajal Research Contract – CSIC, Madrid, Spain
01/10/2003-30/11/2003	Postdoctoral Contract Research Project Community of Madrid
01/10/2001-30/09/2003	Postdoctoral Fellowship MECD/Fulbright – Jean Mayer USDA-HNRCA, Tufts University, Boston, Massachusetts, USA
01/01/2001-01/09/2001	Postdoctoral Fellowship Research Project Community of Madrid – CSIC, Madrid, Spain
01/09/2000-31/12/2000	Contract Research Project CICYT – CSIC, Madrid, Spain
30/08/1999-20/11/1999	Predocctoral Stay at Foreign Research Center – Jean Mayer USDA-HNRCA, Tufts University, Boston, Massachusetts, USA
07/09/1998-28/11/1998	Predocctoral Stay at Foreign Research Center – University of California, Davis, California, USA
01/09/1996-31/08/2000	Predocctoral Fellowship Community of Madrid – Instituto del Frío, Spanish National Research Council (CSIC), Madrid, Spain
01/04/1996-31/08/1996	Predocctoral Fellowship Research Project UE – Instituto del Frío, Spanish National Research Council (CSIC), Madrid, Spain
01/10/1995-31/03/1996	Internship Stay – Centro de Investigaciones Biológicas (CIB), Spanish National Research Council (CSIC), Madrid, Spain

A.3. Education

PhD, Licensed, Graduate	University/Country	Year
PhD in Pharmacy	Complutense University of Madrid (UCM)	2000
BSc in Pharmacy	Complutense University of Madrid (UCM)	1995



Part B. CV SUMMARY (max. 5000 characters, including spaces)

Concepción Sánchez-Moreno González earned a BSc degree in Pharmacy from the UCM in 1995 and a PhD degree in Pharmacy (Biochemistry) from the UCM in 2000. Her PhD Thesis was awarded with the PhD Extraordinary Award by the UCM (2001). Currently, she is **Research Scientist and Group Co-Leader at the Department of Characterization, Quality and Safety [Research Group: Quality and Functionality of Plant Foods-BIOACTIVEG], ICTAN, CSIC**.

The main **Research Lines and Objectives** has been focused on the chemical and biochemical characterization of plant foods (fresh and processed) and their components by advanced analytical methods [HPLC-DAD, LC-MS (QTOF), LC-MS/MS, GC-MS (ion trap), GC-MS (Q-quadrupole), and capillary electrophoresis, among others]; the study of the biological activity and functionality of plant foods, including bioaccessibility and bioavailability studies, by using *in vitro* studies (simulated gastrointestinal digestion and cell culture) and *in vivo* studies (animal models and human intervention studies), and the evaluation of health-related biomarkers (oxidative stress and inflammation biomarkers) and nutri-metabolomic studies; the design of new foods and functional ingredients by high hydrostatic pressure and minimal processing techniques, including the valorization of by-products and the search for new sources of bioactive compounds; and the study of the effect of food processing and preservation technologies on bioactive compounds, their bioaccessibility and bioavailability, by means of *in vitro* and *in vivo* studies.

As a result of this research activity, the **Scientific Research Production Indicators** are near to **100 articles** in SCIE-JCR journals; 42 book chapters; 22 articles in other journals; participation in **45 research projects** funded in competitive regional, national and international, including European calls, and in **7 research contracts** with private companies; more than 120 contributions to congresses, conferences and/or workshops. She has **h-index: 47 (WoS) – 48 (Scopus)** with **more than 9000 Total Citations, Average Citations per Publication: 84, 70% Publications in Q1 and 50% Publications as first, last or corresponding author. 26 publications have been cited more than 100 times.** She has **5 six-year research periods [Evaluation of the Research Activity (6-year period)-Sexenios, 4 in Chemistry, 1 in Transfer of Knowledge and Innovation]**.

She has carried out different **Stays in Internationally Recognized Centers**: (1) **Fulbright Visiting Postdoctoral Scientist at Nutrition and Neurocognition Laboratory, Jean Mayer USDA-Human Nutrition Research Center on Aging (HNRCA), Tufts University, Boston, MA, EEUU (2 years-October 2001-September 2003, postdoctoral research stay)**; (2) **Department of Food Science and Technology, University of California, Davis, CA, EEUU (3 months, September-November 1998, predoctoral research stay)**; (3) **Phytochemical Laboratory, Jean Mayer USDA-HNRCA, Tufts University, Boston, MA, EEUU (3 months, September-November 1999, predoctoral research stay)**. It is worth to mention that she was awarded with the **Postdoctoral Marie Curie Individual Fellowship (MSCA-IF) at Danish Veterinary and Food Administration, Institute of Food Safety and Toxicology, Søborg, Denmark (January 2002-December 2003)**; and the **Postdoctoral Fellowship from Community of Madrid at Instituto del Frío-CSIC, Madrid, Spain (December 2001-November 2004)**; both fellowships were awarded but not enjoyed by incompatibility with the Postdoctoral Fellowship MECDFulbright.

She has **extensive Experience in Supervision and Mentoring Activities**: Doctoral Thesis, Advanced Studies Diplomas (DEAs), Final Master's Thesis (*TFM*), Final Bachelor's Thesis (*TFG*), JAE Intro, Academic External Practices, and other types of national and international graduate and postgraduate students. Moreover, she has been **Advisor to the Coordinator of Food Science and Technology Area of the National Evaluation and Foresight Agency (ANEP) [Adjunto al Coordinador del Área de Ciencia y Tecnología de Alimentos de la Agencia Nacional de Evaluación y Prospectiva (ANEP)]** from January 2014 to June 2018. She has extensive **Experience in R+D Projects and Fellowship Programs Evaluation**: ANEP (different project calls and Juan de la Cierva and Ramón y Cajal programs); Andalusian Knowledge Agency, Regional Government of Andalucía; Fellowship Program Obra Social la Caixa (Area: Life Sciences); National University of Colombia; FONCyT; European Commission: Independent Expert Evaluator, Independent Expert Reviewer (External Reviewer) and Vice Chair-Cross-reader (panel review) (FP7, H2020, Horizon Europe). She has been member of several doctoral thesis committees and she has ample **Experience in Dissemination Activities**: project + Investigators, European Researchers' Night; broadcasting on Spanish Television; radio interview in Cadena COPE; interview in the web Profes.net; participation in different editions of the Science and Technology Week.

Part C. RELEVANT MERITS (sorted by typology)

C.1. Publications

1. C Balderas, B de Ancos, C **Sánchez-Moreno**. 2023. Bile acids and short-chain fatty acids are modulated after onion and apple consumption in obese Zucker rats. *Nutrients*, 15(13), 3035. *Impact Factor (IF): 5.9 (Q1-Food Science & Technology)* (2022 JCR Science Edition).



- GA Ojeda, MM Vallejos, SC Sgroppo, **C Sánchez-Moreno**, B de Ancos. 2023. Enhanced extraction of phenolic compounds from mango by-products using deep eutectic solvents. *Heliyon*, 9(6), e16912. IF: 4.0 (Q2-Multidisciplinary Sciences).
- C Balderas, J Angulo, A Sevilleja-Ortiz, C Peiró, S Vallejo, P Dongil, B de Ancos, **C Sánchez-Moreno**. 2022. Onion and apple functional ingredients intake improves antioxidant and inflammatory status and vascular injury in obese Zucker rats. *Antioxidants*, 11(10), 1953. IF: 7.0 (Q1-Food Science & Technology).
- GA Ojeda, SC Sgroppo, **C Sánchez-Moreno**, B de Ancos. 2022. Mango 'criollo' by-products as a source of polyphenols with antioxidant capacity. Ultrasound assisted extraction evaluated by response surface methodology and HPLC-ESI-QTOF-MS/MS characterization. *Food Chemistry*, 396, 133738. IF: 8.8 (Q1-Food Science & Technology).
- C Colina-Coca, D González-Peña, B de Ancos, **C Sánchez-Moreno**. 2017. Dietary onion ameliorates antioxidant defence, inflammatory response, and cardiovascular risk biomarkers in hypercholesterolemic Wistar rats. *Journal of Functional Foods*, 36, 300-309. IF: 5.6 (Q1-Food Science & Technology).
- D González-Peña, L Giménez, B de Ancos, **C Sánchez-Moreno**. 2017. Role of dietary onion in modifying the faecal bile acid content in rats fed a high-cholesterol diet. *Food & Function*, 8(6), 2184-2192. IF: 6.1 (Q1-Food Science & Technology).
- D González-Peña, D Dudzik, A García, B de Ancos, C Barbas, **C Sánchez-Moreno**. 2017. Metabolomic fingerprinting in the comprehensive study of liver changes associated with onion supplementation in hypercholesterolemic Wistar rats. *International Journal of Molecular Sciences*, 18(2), 267. IF: 5.6 (Q1-Biochemistry & Molecular Biology).
- D González-Peña, A Checa, B de Ancos, CE Wheelock, **C Sánchez-Moreno**. 2017. New insights into the effects of onion consumption on lipid mediators using a diet-induced model of hypercholesterolemia. *Redox Biology*, 11, 205-212. IF: 11.4 (Q1-Biochemistry & Molecular Biology).
- D González-Peña, D Dudzik, C Colina-Coca, B de Ancos, A García, C Barbas, **C. Sánchez-Moreno**. 2016. Multiplatform metabolomic fingerprinting as a tool for understanding hypercholesterolemia in Wistar rats. *European Journal of Nutrition*, 55(3), 997-1010. IF: 5.0 (Q2-Nutrition & Dietetics).
- D González-Peña, D Dudzik, C Colina-Coca, B de Ancos, A García, C Barbas, **C Sánchez-Moreno**. 2015. Evaluation of onion as a functional ingredient in the prevention of metabolic impairments associated to diet-induced hypercholesterolaemia using a multiplatform approach based on LC-MS, CE-MS and GC-MS. *Journal of Functional Foods*, 19, 363-375. IF: 5.6 (Q1-Food Science & Technology).

C.2. Congresses [more than 120 contributions to congresses, conferences and/or workshops]

- B de Ancos, R Sacristán, M González, **C Sánchez-Moreno**. High pressure-assisted extraction of phenolic compounds from mango by-products. Poster presentation. **28th AIRAPT and 60th EHPRG International Conference on High Pressure Science and Technology**. 23-28 July 2023; Edinburgh, United Kingdom (UK).
- B de Ancos, GA Ojeda, SC Sgroppo, E Rodríguez-Rodríguez, B Olmedilla-Alonso, **C Sánchez-Moreno**. Green extraction of phenolic compounds and carotenoids from pulp and peel of mango criollo by ultrasound assisted extraction with deep eutectic solvents. Poster presentation. **XXII Congress EuroFoodChem**. 14-16 June 2023; Belgrade, Serbia.
- C Sánchez-Moreno**, I Belda, L Giménez, B de Ancos. Valorization of mango by-products as a source of valuable phenolic compounds by using green technologies. Poster presentation. **15th World Congress on Polyphenols Applications 2022**. 28-30 September 2022; Valencia, Spain.

C.3. Research projects

- PID2023-147025NB-I00**. New Insights into the Development and Biological Activity Evaluation of Mango Juices Processed by Sustainable Emerging Technologies. Ministry of Science, Innovation and Universities. **PIs: C Sánchez-Moreno González**, B de Ancos Siguero. 250.000,00 €. **ToP: Principal Investigator**.
- COOPB23076 (Programa CSIC de Cooperación Científica para el Desarrollo I-COOP)**. Valorization of an Agri-food By-product and Indigenous Microorganisms: Design of Differentiated Dietary Supplements for Prevention of Metabolic Syndrome. Ministry of Science, Innovation and Universities. January 2024-December 2026. 24.000,00 €. **PI: B de Ancos Siguero**. Type of Participation (ToP): Researcher.
- RED2022-134388-T (Redes de Investigación 2022). Malta Consolider Team**. Ministry of Science and Innovation. 1 June 2023-31 May 2024. 15.000,00 €. **PI: FJ Manjón Herrera**. ToP: Researcher.
- PID2019-107980RB-I00**. Valorization of Mango and Apple By-products and Wastes as Source of Cytoprotective and Antiinflammatory Encapsulated Bioactive Compounds. Ministry of Science and Innovation. 1 June 2020-29 February 2024). 133.100,00 €. **PIs: B de Ancos Siguero, C Sánchez-Moreno González**. **ToP: Principal Investigator**.



5. **AGL2016-76817-R**. Effect of Plant Functional Food Ingredients on Inflammatory Response, Oxidative Stress Biomarkers, Cardiovascular Parameters and Gut Health in Obesity. Ministry of Economy, Industry and Competitiveness. 30 December 2016-31 December 2020). *PIs*: **C Sánchez-Moreno González**, B de Ancos Siguero. 145.200,00 €. **ToP: Principal Investigator**.
6. **AGL2013-46326-R**. Influence of the Matrix and Processing in the Metabolism and Prebiotic Effect of Natural Phenolic Compounds in a Dynamic Gastrointestinal Model. Ministry of Economy and Competitiveness. *PIs*: B de Ancos Siguero, **C Sánchez-Moreno González**. 1 January 2014-31 December 2016. 121.000,00 €. **ToP: Principal Investigator**.
7. **AGL2010-15910**. Antiinflammatory, Antioxidant, and Hypolipidemic Properties of Processed Onion as Functional Food Ingredient. Role of Organosulfur Compounds and Their Metabolites. Ministry of Science and Innovation. *PI*: **C Sánchez-Moreno González**. 1 January 2011-31 December 2013 (extended until 31 December 2014). 108.900,00 €. **ToP: Principal Investigator**.
8. **S2009/AGR-1469**. Design and Validation of Active Ingredients for the Development of Functional Foods (ALIBIRD). Community of Madrid. Programme of activities of R & D between groups of Research of the Community of Madrid in Technology. *PI*: G Reglero Rada. 31 May 2010-30 May 2014. 837.967,50 € whole project (225.400,00 € *GROUP BIOVEG-BIOCELL CSIC*). **ToP: Researcher**.
9. **CSD2007-00063**. New Functional Food Ingredients to Improve Health (FUN-C-FOOD). Ministry of Education and Science. Programme CONSOLIDER-INGENIO 2010. *PI*: FA Tomás-Barberán. 1 October 2007-30 September 2012 (extended until 31 December 2013). 5.797.000 €. **ToP: Researcher**.

C.4. Contracts, technological or transfer merits

C.4.1. Technical support contracts, R&D contracts

1. **Technical Support Contract 20203489**-Analysis of total pectins and minerals (Mn and K) in 9 samples of banana from the Canary Islands in degree 6 of ripeness and from three different growing areas (25 September 2020-9 November 2020, 2.990,00 €); **20203488**-Analysis of total fiber, soluble fiber and insoluble fiber in 9 samples of banana from the Canary Islands in degree 6 of ripeness and from three different growing areas (25 September 2020-9 November 2020, 2.850,00 €); **20202705**-Analysis of vitamin C of banana from the Canary Islands in two degrees of ripeness (3-24 July 2020, 2.975,00 €). Asociación de Productores de Plátanos de Canarias (ASPROCAN). *PIs*: B de Ancos Siguero, **C Sánchez-Moreno González**. **ToP: Principal Investigator**.
2. **Research and Development (R&D) Contract 20164841**. Study for the Application of Freezing in the Table Olive Processing. *Contract included in the CDTI Project: Development of New Techniques of Cultivation and Processing for the Optimization of Table Olives*. IDI-20160997 (TOP PROCESS). Ángel Camacho Alimentación SL (ACA SL). *PI*: MD Álvarez Torres. 12 September 2016-11 September 2018. 101.204,40 €. **ToP: Researcher**.
3. **Technical Support Contract 20152943**. Nutritional Study of Fresh Pear variety Ercolini with Protected Designation of Origin Pera de Jumilla. Asociación para el Desarrollo Comarcal del Nordeste de la Región de Murcia. *PI*: **C Sánchez-Moreno González**. 10-30 November 2015. 10.406,65 €. **ToP: Principal Investigator**.
4. **Technical Support Contract 20081354**. Application of High Pressure Processing Technology to Fresh Fruit and Development of Ready-to-Eat Fruit Salads Treated by High Pressure. Industrias Alimentarias de Navarra SAU (IAN). *PI*: B de Ancos Siguero. 16 September 2008-31 December 2009. 58.601,73 €. **ToP: Researcher**.

C.4.2. Transfer merits

1. **1 six-year research period (Evaluation of the Research Activity (six-year period)-*Sexenio*) in Transfer of Knowledge and Innovation**. Period 2011-2017.

C.4.3. Awards of investigation

1. **Awards of Investigation from Community of Madrid “Miguel Catalán” 2010**. Modality: Researches Aged less than 40 Years, Science Area. Consejería de Educación, Community of Madrid. December 2010 (BOCM No. 32, 8 February 2011).
2. **Young Award 2007 (X Edition) in Science and Technology**. Fundación General of Complutense University of Madrid. 29 November 2007.
3. **Awards of Research and Innovation from Castilla-La Mancha 2006: Young Investigator Award “Ibn Wafid de Toledo” to the Scientific Career and Contributions in the Field of Nutrition and Plant Food Science and Technology**. Consejería de Educación y Ciencia, Junta de Comunidades de Castilla-La Mancha. 1 February 2007 (DOCM No. 30 – Fasc. II, 9 February 2007).
4. **Award to the Scientific Career from Real e Ilustre Oficial Colegio de Farmacéuticos de Sevilla** (12 November 2004), **from Asociación Benéfico-Docente “Profesor Vicente Callao”** (20 November 2003). **Academia Iberoamericana de Farmacia**.

CURRICULUM VITAE ABREVIADO (CVA)

Part A. PERSONAL INFORMATION

First name	BEGOÑA		
Family name	DE ANCOS SIGUERO		
Gender (*)	Female	Birth date (dd/mm/yyyy)	01/07/1959
Social Security, Passport, ID number	51341790V		
e-mail	ancos@ictan.csic.es	URL Web	
Open Researcher and Contributor ID (ORCID) (*)	0000-0002-8890-7525		

(*) *Mandatory*

A.1. Current position

Position	Research Scientist		
Initial date	09/06/2009		
Institution	Spanish National Research Council (CSIC)		
Department/Center	Characterization, Quality and Safety (DCCS)	Institute of Food Science, Technology and Nutrition (ICTAN)	
Country	Spain	Teleph. number	915492300
Key words	Plant derived foods; high-pressure processing; bioactive compounds; functional foods; bioaccessibility; bioavailability; metabolites; biomarkers; HPLC-MS, intervention studies.		

A.2. Previous positions (research activity interruptions, indicate total months)

Period	Position/Institution/Country/Interruption cause
2019-2024	Scientific vice director of ICTAN
2015-2019	Department head (DCCS) at ICTAN
2010-2015	Worker representative on the ICTAN board
2009-	Research Scientist at ICTAN, CSIC, Spain
2000-2009	Tenured Scientist at Instituto del Frío, CSIC, Spain
1999-2000	Interim Tenured Scientist at Instituto del Frío, CSIC, Spain
1998-1999	Research contract at Instituto del Frío, CSIC, Spain
1997-1998	Stays in foreign centers UK and Belgium (6 months)
1992-1997	Postdoctoral grants and research contract at Instituto del Frío, CSIC, Spain, and maternity leave
1990-1991	Research contract at Autonomous University, Madrid, Spain
1987-1989	Technician contract at Gancedo y Rubio leather company, Spain, and maternity leave
1986-1987	Assistant professor of Autonomous University, Madrid, Spain
1984-1986	Predoctoral grant (CAICYT) of Autonomous University of Madrid, Spain
1983-1984	Research contract at Instituto de Investigaciones y Desarrollo Químico y Biológico (Pharmaceutical Company), Spain.

A.3. Education

PhD, Licensed, Graduate	University/Country	Year
PhD in Organic Chemistry	Autonomous University of Madrid (UAM)	1991
Bachelor in Organic Chemistry	Autonomous University of Madrid (UAM)	1983

(Include all the necessary rows)

Part B. CV SUMMARY (*max. 5000 characters, including spaces*)

Begoña de Ancos, Chemistry. Ph.D., is a Research Scientist at the Institute of Food Science and Technology and Nutrition (ICTAN-CSIC). She began her research career in the area of organic chemistry working in the synthesis of pharmaceutical products with different biological



activity (antidepressants, anti-cancer, anti-inflammatories, etc.), in the Department of Organic Chemistry at the Autonomous University of Madrid and in pharmaceutical companies (1987-1992). Since 1992, she continued her scientific career in the area of Food Science and Technology at the ICTAN-CSIC, in Madrid, Spain. In the last 25 years, her work has focused on the following research lines: a) Chemical and biochemical characterization of plant foods and their components by advanced analytical methods; b) Study of the biological activity of plant foods (by using cell and animals models, and human intervention studies); c) Study of the effect of food processing technologies on bioactive compounds, their bioaccessibility and bioavailability (by means of *in vitro* and *in vivo* studies); d) Obtaining of new functional foods and ingredients by the application of non-thermal technologies, mainly high-pressure processing (HPP). Her training was completed with stays in two different European Research Centers: 1) Scholl of Biological Sciences, University of Liverpool, England; 2) Department of Food and Microbial Technology, Catholic University of Leuven, Belgium. She is now the researcher responsible of the BIOACTIVE group in the ICTAN-CSIC. The BIOACTIVE group was a pioneer in studying the effect of HPP on nutrients, bioactive compounds and health-related biomarkers, highlighting the possibility of functionalizing plant foods through HPP processing. She has participated in 31 research projects financed by national and regional public entities (Spanish Ministry of Science and Innovation and Madrid Community) and 10 research international projects, 6 of them was EU-funded projects. She has led 4 of the national projects. Also she has participated in 16 research contracts with industries of the agri-food sector. She has signed **107 publications (index H: 44; 5780 citations)**: 102 articles in international peer reviewed journals of SCI (78% Q1), 33 book chapters in internationally renowned publisher and 14 articles of science dissemination. She has signed more than 100 communications in national and international scientific conferences: 10 and 24 invited talks in national and international conferences, respectively. She has belonged to various organized workshops and congress committees. She has also been project evaluator for national and international science activity agencies (ANEP, AEI, AAC, FONDECYT, FONCYT Research Flanders Foundation, EU-Commission, etc.). Dra. de Ancos is the Spanish National representative in the C2 Commission, Food Science and Engineering, of the International Institute of Refrigeration (since 2012). She has supervised 6 PhD Thesis, numerous Grade and Masters projects, Juan de la Cierva postdoctoral contract, CSIC JAE-INTRO grants, and numerous foreign professors and students staying at the BIOACTIVE group. Highlighting her teaching experience in different Masters and lectures for PhD students in national (UCM de Madrid, UPV de Vitoria, UPC de Cartagena) and international universities: Autónoma de Chihuahua (Méjico), Bio-Bio, Concepción (Chile) and Corrientes (Argentina).

Part C. RELEVANT MERITS

C.1. Publications (some selected in the period 2017-2024)

1. **De Ancos**, B., Cilla, A., Sánchez-Moreno, C., Cano, M.P. (2017). Influence of orange cultivar and mandarin postharvest storage on polyphenols, ascorbic acid and antioxidant activity during gastrointestinal digestion. *Food Chemistry*, 225, 114-124.
2. González-Peña, D., Dudzik, D., García, A., **De Ancos**, B., Barbas, C., Sánchez-Moreno, C. (2017). Metabolomic fingerprinting in the comprehensive study of liver changes associated with onion supplementation in hypercholesterolemic Wistar rats. *International Journal of Molecular Science*, 2, 267.
3. Fernández-Jalao, I., Sánchez-Moreno, C., **De Ancos**, B. (2017). Influence of food matrix and high-pressure processing on onion flavonols and antioxidant activity during gastrointestinal digestion. *Journal of Food Engineering*, 213, 60-68.
4. Fernández-Jalao, I., Sánchez-Moreno, C., **De Ancos**, B. (2019). Effect of high-pressure processing on flavonoids, hydroxycinnamic acids, dihydrochalcones and antioxidant activity of apple 'Golden Delicious' from different geographical origin. *Innovative Food Science and Emerging Technologies*, 51, 20-31.
5. **De Ancos**, B., Rodrigo, M.J., Sánchez-Moreno, C., Cano, M.P., Zacarías, L. (2020). Effect of high-pressure processing applied as pretreatment on carotenoids, flavonoids and vitamin



C in juice of the sweet oranges 'Navel' and the red-fleshed 'Cara Cara'. *Food Research International*, N^o. 109105.

6. Fernández-Jalao, I., Balderas, C., Sánchez-Moreno, **De Ancos, B.** (2020). Impact of an in vitro dynamic gastrointestinal digestion on phenolic compounds and antioxidant capacity of apple treated by high-pressure processing. *Innovative Food Science and Emerging Technologies*, 66. N^o 102486.
7. Cilla, A, Rodrigo, M.J., **De Ancos, B.**, Sánchez-Moreno, C, Cano, M.P., Zacarías, L., Alegría, A., Barberá, R. (2020). Impact of high-pressure processing on the stability and bioaccessibility of bioactive compounds of Clementine mandarin juice and its cytoprotective effect in Caco-2 cells. *Food & Function*, 11, 8951-8962.
8. Fernández-Jalao, I.; Balderas, C.; Calvo, M.V.; Fontecha, J.; Sánchez-Moreno, C.; **De Ancos, B.** (2021) Impact of high-pressure processed onion on colonic metabolism using a dynamic gastrointestinal digestion simulator. *Metabolites*, 11, 262.
9. Ojeda, G.A., Sgroppo, S.C., Sánchez-Moreno, C., **De Ancos, B.** (2022) Mango 'criollo' by-products as a source of polyphenols with antioxidant capacity. Ultrasound assisted extraction evaluated by response surface methodology and HPLC-ESI-QTOF-MS/MS characterization. *Food Chemistry*, 396, 133738.
10. Ojeda GA., Vallejos M.M., Sgroppo S., Sánchez-Moreno C., **De Ancos B.** (2023). Enhanced extraction of phenolic compounds from mango by-products using deep eutectic solvents. *Heliyon*, 9, e16912.
11. Balderas, C., **De Ancos, B.**, Sánchez-Moreno, C. (2023). Bile acids and short-chain fatty acids are modulated after onion and apple consumption in obese Zucker rats. *Nutrients*, 15(13), 3035.
12. Rodríguez-Rodríguez, E., Herrero-Lodares, C., Sánchez-Prieto, M. Olmedilla-Alonso, B., Sánchez-Moreno, C., **De Ancos Siguero, B.** (2024). Sustainable extraction methods of carotenoids from mango (*Mangifera indica* L. 'Kent') pulp: Ultrasound assisted extraction and green solvent. *Food Chemistry* 450, 139253.

C.2. Congress

1. Fernández-Jalao, I., Sánchez-Moreno, C., **De Ancos, B.** Influence of food matrix and high-pressure processing on onion flavonoids and antioxidant activity during gastrointestinal digestion. IV International ISEKI Food Conference. July 2016. University of Natural Resources and Life Sciences (BOKU), Viena, Austria. Invited oral presentation.
2. Ojeda, G., Sgroppo, S., Sanchez-Moreno, C., **De Ancos, B.** Optimization of ultrasound assisted green solvent extraction of polyphenols from mango 'criollo' by-products. 14th World Congress on Polyphenols Applications. September 2021. International Society of Antioxidants. Interactive on-line Congress. Oral-poster presentation.
3. Sánchez-Moreno, C., Belda, I. Gimenez, L. **De Ancos, B.** Valorization of mango by-products as a source of valuable phenolic compounds by using green technologies. 15th World Congress on Polyphenols Applications. September 2022. International Society of Antioxidants. Valencia, Spain. Poster.
4. **De Ancos, B.**, Ojeda, G., Sgroppo, S., Rodríguez-Rodríguez, E., Olmedilla-Alonso, B., Sánchez-Moreno, C. Green extraction of phenolic compounds and carotenoids from pulp and peel of mango 'criollo' by ultrasound assisted extraction with deep eutectic solvents. XXII Congress EuroFoodChem. June 2023. Faculty of Chemistry, University of Belgrade, Belgrade, Servia. Poster.

Member of the Organizing Committee of International Congresses

1. Jornada Internacional de Gestión de la Calidad, Logística y Aspectos del Consumidor en la Cadena de Producción y Comercialización de Frutas y Hortalizas Frescas y Procesadas. **Org:** Instituto del Frío, CSIC, Madrid. **Financ.** Proyecto UE-Fair-98-3903. **Date:** 12/05/2000.
2. Workshop Emerging Technologies for the Food Industry. **Org:** Instituto del Frío-CSIC, Madrid. **Financ:** Programa CYTED XI.15. **Date:** From 11/03/2002 to 13 /03/2002.
3. Workshop Innovative Applications of Nonthermal Technologies in Foods: Technology, Safety, Health and Consumer". Nonthermalfood2008. **Org:** Instituto del Frío-CSIC, Madrid. **Financ:** CSIC, IFT, EFFoST. **Date:** From 19/11/2008 to 22/11/2008.
4. VIII International Postharvest Symposium (IPS16). **Org:** Universidad de Cartagena and International Society of Horticultural Science (ISHS). **Financ:** MINECO/ISHS. **Date:** Cartagena. From 21/06/2015 to 24/06/2016.

C.3. Research projects

1. **RTA04-171-C2-2.** Optimización de la calidad y seguridad de frutos tropicales mínimamente procesados producidos en Canarias. Lobo, G (IP Coordinated Project). **De Ancos, B. (IP Subproject 2)**. Financing: Subprograma Nacional de Recursos y Tecnologías Agrarias en Coordinación con las Comunidades Autónomas. From 12/2004 to 12/2007. 46.760 €.
2. **AGL-2006-12578-C02.** Mejora de la calidad nutricional de bebidas mixtas de zumos de frutas, leche y soja mediante la aplicación de tecnologías no-térmicas. **De Ancos, B (IP Coordinated project and IP Subproject 1)** Financing: Plan Nacional de Ciencia y Tecnología de Alimentos. From 10/2006 to 09/2009. 81.070,00 €.
3. **CONSOLIDER nº 25506.** Nuevos Ingredientes Funcionales para Mejorar la Salud, FUN-C-FOOD. Tomás-Barberá (IP). **De Ancos, B (Team member)**. Financing: INGENIO 2010 Convocatoria Consolider 2007. Instituto del Frío-CSIC. From 2007 to 2011. 5.797.000 €.
4. **S2009/AGR-1469 (ALIBIRD).** Diseño y validación de ingredientes activos para el desarrollo de alimentos funcionales. Reglero, G. (IP). **De Ancos, B (Team member)**. Financing: Consejería de Educación, Área de Tecnologías Agroalimentarias, Comunidad Autónoma de Madrid. From 18/12/2009 to 17/12/2013. 175.950 euros.
5. **AGL2010-15910.** Propiedades antiinflamatorias, antioxidantes, e hipolipidémicas de cebolla procesada como ingrediente funcional. Papel de los compuestos organosulfurados y sus metabolitos. Sánchez-Moreno, C (IP1), **De Ancos, B. (Research team)**. Financing: Plan Nacional de Recursos y Tecnologías Agroalimentarias. Instituto del Frío-ICTAN-CSIC. From 12/2010 to 12/2013. 108.900 €.
6. **AGL2013-46326-R.** Influencia de la matriz y el procesado en el metabolismo y efecto prebiótico de compuestos fenólicos naturales en un modelo gastrointestinal dinámico. **De Ancos, B. (IP1)** and Sánchez-Moreno, C. (IP2). Financing: Plan Nacional de Ciencia y Tecnología de Alimentos. ICTAN-CSIC. From 01/01/2014 to 31/12/2016. 121.000 €.
7. **CYTED ref: 113RT0480.** Producción artesanal de hortalizas de IV y V gama: inocuidad y valor funcional (Hortyfresco). Programa Iberoamericano de Ciencia y Tecnología para el Desarrollo (CYTED). 24 grupos. IP: Victor Escalona (Universidad de Chile). **De Ancos, B. (IP Spanish group)**. From 01/2013 to 12/2016. Financing 100.000 €.
8. **AGL2016-76817-R.** Efecto de ingredientes funcionales vegetales sobre respuesta inflamatoria, biomarcadores de estrés oxidativo, parámetros cardiovasculares y salud gastrointestinal en obesidad. Sánchez-Moreno, C. (IP1) and **De Ancos, B. (IP2)**. Financing: Plan Nacional de Ciencia y Tecnología de Alimentos. ICTAN-CSIC. From 30/12/2016 to 29/12/2019. 145.200 €. Extended to 06/2020.
9. **PID2019-107980RB-100.** Valorización de subproductos y descartes de mango y manzana como fuente de compuestos bioactivos encapsulados con efecto citoprotector y antiinflamatorio. **De Ancos, B. (IP1)** and Sánchez-Moreno, C. (IP2). Financing: Agencia Estatal de Investigación. Programa Estatal de I+D+i Retos de la Sociedad. ICTAN-CSIC. From 01/06/2020 until 31/05/2023. Financing: 133.100 €. Extended until 29/02/2024.
10. **I-COOPB23076.** Revalorización de un subproducto agroalimentario y microorganismos autóctonos: Diseño de suplementos dietarios diferenciados para prevención de síndrome metabólico. **De Ancos, B (IP CSIC)**. From 12/2023 to 12/2025. Financing: 24.000 €.

C.4. Contracts, technological or transfer merits

1. Desarrollo industrial de productos hortícolas de V Gama en envases doypack y puesta a punto de proceso de congelación de productos hortícolas congelados. **Participantes:** Contract with Lagunas de Sanchonuño SL.11/2001-03/2003. 36.000 €. Team member.
2. Integración de tecnologías de procesado mínimo y atmósferas modificadas que permitan obtener productos derivados de cebolla de alta calidad y elevada vida útil de comercialización. Contract with **Ajos La Veguilla**. 09/2008 - 08/2010. 50.000 €. Principal investigator 2.
3. Investigación para la aplicación de las altas presiones hidrostáticas sobre fruta fresca y desarrollo de ensaladas así tratadas listas para su consumo. Contract with **Industrias Alimentarias de Navarra**. 09/2008 - 12/2009. 21.744 €. Principal investigator 1.
4. Desarrollo de un sistema integrado de manejo de la aceituna de mesa recolectada mecánicamente. **Proyecto CDTI: IDI-20160997 (TOP PROCESS)**. Apoyo tecnológico with **Interaceituna**. 10/2011-10/2012. 21.240 €. Team member.
5. Estudio para la aplicación de la congelación en el procesado de aceituna de mesa. Contract with Ángel Camacho Alimentación S.L. 09-2016 - 09-2018. 83.640 €. Team member.
6. **Patente ES-2154588_A1:** Procedimiento para la obtención de zumo de cítricos estabilizados mediante alta presión. Cano, M.P., Hernández, A. y **De Ancos, B.** Nº 009900897. Priority country: España. Applications date: 01/04/2001. Grant date: 19/04/2002.