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RESEARCH

- **Title:** Novel strategies and mathematical modeling of membrane applications.
- **Description:**

Currently, my research lines are focused on the following:

Tissue engineering: biodegradable and biocompatible polymeric membranes and functional composite membranes with high nutrients transport properties are fabricated to be employed as scaffolds for in vitro cell culture and later in vivo implantation.

CO₂ valorization: there is a major concern about CO₂ capture to reduce the effects of this gas on the global climate change. The chemical valorization of the CO₂ pursues the chemical transformation of this compound into valuable products, such as dimethyl ether (DME). The incorporation of a membrane for in-situ water removal in the catalytic packed-bed membrane reactor configuration allows the intensification of the process of DME synthesis and the incorporation of CO₂ to the syngas stream that feeds the system.

Food industry: grapes with high degree of ripeness are desirable to produce wines with highly developed aroma profiles but on the other hand have undesired high alcohol content. The adjustment of the alcohol by membrane contactors is evaluated in a pilot/pre-industrial scale plant to optimize the operation variables that minimize the aroma compound losses during this process.

The mathematical model is used in all these research lines to validate the experimental results and facilitate the decisions making process for future work and the pilot and industrial scale-up.

- **Publications:**

Margallo, M., Aldaco, R., Barceló, A., Diban, N., Ortiz, I., Irabien, A. Life cycle assessment of technologies for partial dealcoholisation of wines (2015) Sustainable Production and Consumption, 2, pp. 29-39

Diban, N., Urtiaga, A.M., Ortiz, I., Ereña, J., Bilbao, J., Aguayo, A.T. Improved performance of a pbm reactor for simultaneous CO₂ capture and DME synthesis (2014) Ind. Eng. Chem. Res., 53 (50), pp. 19479-19487

Diban, N., Ramos-Vivas, J., Remuzgo-Martinez, S., Ortiz, I., Urtiaga, A. Poly(ϵ -caprolactone) films with favourable properties for neural cell growth (2014) *Curr. Top. Med. Chem.*, 14 (23), pp. 2743-2749

Diban, N., Stamatialis, D. Polymeric hollow fiber membranes for bioartificial organs and tissue engineering applications (2014) *J. Chem. Technol. Biotechnol.*, 89 (5), pp. 633-643

Diban N, Urtiaga AM, Ortiz I, Ereña J, Bilbao J, Aguayo AT. Influence of the membrane properties on the catalytic production of dimethyl ether with in situ water removal for the successful capture of CO₂. *Chem Eng J*; 234:140-148 (2013).

Diban N, Aguayo AT, Bilbao J, Urtiaga A, Ortiz I. Membrane reactors for in situ water removal: A review of applications. *Industrial and Engineering Chemistry Research*; 52(31):10342-10354 (2013).

Diban N, Arruti A, Barceló A, Puxeu M, Urtiaga A, Ortiz I. Membrane dealcoholization of different wine varieties reducing aroma losses. Modeling and experimental validation. *Innovative Food Science and Emerging Technologies* (2013).

Diban N, García V, Alguacil F, Ortiz I, Urtiaga A. Temperature enhancement of zinc and iron separation from chromium(III) passivation baths by emulsion pertraction technology. *Industrial and Engineering Chemistry Research*; 51(29):9867-9874 (2012).

Diban N, Haimi S, Bolhuis-Versteeg L, Teixeira S, Miettinen S, Poot A, et al. Development and characterization of poly(ϵ -caprolactone) hollow fiber membranes for vascular tissue engineering. *J Membr Sci*; 438:29-37 (2013).

Diban N, Haimi S, Bolhuis-Versteeg L, Teixeira S, Miettinen S, Poot A, et al. Hollow fibers of poly(lactide-co-glycolide) and poly(ϵ -caprolactone) blends for vascular tissue engineering applications. *Acta Biomaterialia*; 9(5):6450-6458 (2013).

Diban N, Mediavilla R, Urtiaga A, Ortiz I. Zinc recovery and waste sludge minimization from chromium passivation baths. *J Hazard Mater*; 192(2):801-807 (2011).

Diban N, Stamatialis DF. Functional polymer scaffolds for blood vessel tissue engineering. *Macromolecular Symposia*; 309-310(1):93-98 (2011).

R&D PROJECTS

Title: DESARROLLO DE TECNOLOGÍAS INNOVADORAS PARA EL TRATAMIENTO DE CONTAMINANTES PERFLUORADOS EN AGUAS, CTM2013-44081-R

Participant entities: Ministerio de Economía y Competitividad

Duration, since 01/01/2014 to 31/12/2016

Main researcher: Ane Urtiaga Mendía

Number of participants: 8

Title: VALORIZACION SOSTENIBLE DE CONCENTRADOS DE PROCESOS DE DESALACIÓN, EUIN2013-50956.

Participant entities: Ministerio de Economía y Competitividad

Duration, since 14/10/2013 to 13/10/2016

Main researcher: Raquel Ibáñez Mendizábal

Number of participants: 7

Title: NUEVOS NANOMATERIALES FUNCIONALIZADOS BASADOS EN GRAFENO COMO SOPORTES PARA LA REGENERACIÓN DE TEJIDO NERVIOSO, JP03.64669

Participant entities: Universidad de Cantabria/Gobierno de Cantabria
Duration, since 15/04/2015 to 16/04/2017.
Main researcher: Ane Urutiaga Mendía
Number of participants: 4

OTHER RESULTS

- **Congress contributions:**

“Functional Polymer scaffolds for blood vessel tissue engineering” N. Diban, D. Stamatialis. Congreso Advanced Functional Polymers for Medicine 2011, Enschede (Holanda), (15-17 Junio 2011). Poster.

“Biodegradable hollow fiber membranes for tissue engineering application” N. Diban, D. Stamatialis. ICOM2011. Amsterdam (Holanda), (23-29 Julio 2011). Poster.

“Inorganic membranes for in-situ water removal during dimethyl ether (DME) production in a catalytic fixed-bed membrane reactor” N.Diban, A.Ateka, A.M.Urutiaga, I.Ortiz, A.T.Aguayo. 12th International Conference on Inorganic Membranes, Enschede (Holanda), (9-13 Julio 2012). Oral.

“Novel hollow fiber membranes of poly(ϵ -caprolactone) and poly(lactid-co-glycolic acid) for blood vessel regeneration” N.Diban, S.Haimi, L.Bolhuis-Verteeg, D.Stamatialis, Euromembrane 2012. London (UK), (23-27 Septiembre 2012). Poster.

“The use of emulsion pertraction technology as an eco-innovative membrane process for the galvanic industry”. V.García, N.Diban, E.Bringas, R.Ibañez, I.Ortiz, AM.Urutiaga. Euromembrane 2012. London (UK), (23-27 Septiembre 2012). Oral.

“Minimization of aroma compound losses during partial dealcoholization of wine using membrane contactors”. N. Diban, A. Arruti, A. Barceló, M. Puxeu, A. Urutiaga, I. Ortiz, 9th European Congress of Chemical Engineering. The Hague (The Netherlands), (21-25 Abril 2013). Oral.

“Poly(ϵ -caprolactone) scaffolds developed via phase-inversion for tissue engineering”. N.Diban, S. Haimi, L. Bolhuis-Versteeg, S. Teixeira, S. Miettinen, A. Poot, D. Grijpma, D. Stamatialis, 533th WE-Heraeus-Seminar on Advanced Functional Polymers for Medicine (AFPM2013). Bad Honnef (Alemania), 27-29 Mayo 2013. Poster.

“Viabilidad de la desalcoholización parcial de vinos mediante contactores de membrana: efecto sobre las propiedades sensoriales del vino”. A. Barceló, M.

Puxeu, J. Roselló, N. Diban, I. Ortiz, Gienol 2013 Madrid (España), 18-21 Junio 2013. Poster.

"Chemical valorization of CO₂ in a DME catalytic synthesis using a packed-bed membrane reactor with zeolite membranes for in situ water removal". N. Diban, A.T.Aguayo, J. Ereña, A. Urtiaga, I. Ortiz, 11th International Conference on Catalysis in Membrane Reactors (ICCMR11), Oporto (Portugal), 7-11 Julio 2013. Oral.

"Poly(ϵ -caprolactone)/poly(lactic-co-glycolic acid) hollow fiber scaffolds for blood vessel regeneration". N. Diban, S. Haimi, L. Bolhuis-Versteeg, S. Teixeira, S. Miettinen, A. Poot, D. Grijpma, D. Stamatialis, European Society for Biomaterials 2013 (ESB2013), Madrid (España), 8-12 Septiembre 2013. Oral.

"Effect of the partial wine dealcoholization by membrane contactors on its sensory and chemical characteristics". A. Barceló, M. Puxeu, A. Brull, N. Diban, I. Ortiz, XXXIV Reunión Bienal de la Real Sociedad Española de Química, Santander (España), 15-18 Septiembre 2013. Oral.

"Polymeric membranes with high mass transport properties of nutrients for neuronal tissue growth". N. Diban, A. Urtiaga, I. Ortiz, XXXIV Reunión Bienal de la Real Sociedad Española de Química, Santander (Spain), 15-18 September 2013. Poster.

"Nutrients permeability through poly(ϵ -caprolactone) membranes applied for neural tissue engineering". N. Diban, B. Gómez, I. Ortiz, A. Urtiaga, 9th Ibero-American Congress on Membrane Science and Technology (CITEM 2014), Santander (Spain) May 2014. Oral.

"Chemical Valorisation of CO₂ to DME: performance of a PBMR with zeolite membranes for in situ H₂O removal". N. Diban, A. Urtiaga, I. Ortiz, J. Ereña, A. T. Aguayo, II International Congress of Chemical Engineering of ANQUE (ICCE), Madrid (Spain) July 2014. Oral.

"Highly porous membranes of poly(ϵ -caprolactone) for central nervous system regeneration" N. Diban, B. Gómez, S. Remuzgo-Martinez, J. Ramos-Vivas, I. Ortiz, A. Urtiaga, ICOM2014, Sizhou(China), July 2014. Poster.

"Feasibility of the industrial evaporative pertraction for wine partial dealcoholisation" A. Barceló; R. Aldaco; J. Roselló; S. De Lamo; N. Diban; I. Ortiz, 17th World Congress on Food Science and Technology (IUFoST2014), Montreal (Canada), August 2014. Poster.

"Environmental Sustainability Assessment of an Innovative Process for partial dealcoholization of wines", R. Aldaco; N. Diban; M. Margallo; A. Barceló; I. Ortiz; A. Irabien, 9th International Conference LCA of Food (LCA Food 2014), San Francisco (EEUU), October 2014. Poster.

"Simultaneous CO₂ valorization and DME production using a packed-bed membrane reactor with in situ water removal", G. Zarca; N. Diban; A. Urriaga; I. Ortiz; J. Ereña; A. T. Aguayo, AIChE meeting 2014, Atlanta (EEUU), November 2014. Poster.

"Evaluation of transport properties of poly(ϵ -caprolactone) membranes in a bioreactor for tissue engineering" B. Gómez; N. Diban; I. Ortiz; A. Urriaga, 27th European Conference on Biomaterials ESB2015, Krakow (Poland), September 2015, Poster.

"Comparison of poly(ϵ -caprolactone) and polyacrylonitrile membranes in bioreactors for neural tissue engineering", N. Diban; B. Gómez; M. Lázaro-Diez; J. Ramos-Vivas; I. Ortiz; A. Urriaga, Euromembrane 2015, Aachen (Germany), September 2015. Oral.

"Evaluation of nutrient transport properties of poly(ϵ -caprolactone) membranes in a perfusion bioreactor for tissue engineering", B. Gómez; N. Diban; I. Ortiz; A. Urriaga, 10th European Congress of Chemical Engineering ECCE10, Nize (France), September 2015, Oral.