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### RESEARCH

- **Title:**

Study of ionic liquid-based polymeric membranes for the valorization of residual gas streams of industrial processes

- **Description:**

The objective of my research is to develop new polymeric membranes functionalized with ionic liquids for the recovery of gases of interest in the industry, as is the case of hydrogen and carbon monoxide, which are usually found at important concentrations in residual gas streams.

Membrane technology possess several advantages over traditional technologies for gas separation, such as pressure swing adsorption and cryogenic distillation, involving less energy consumption and investment costs, modularity, etc.

On the other hand, the interest in ionic liquids (IL) lies in their unique properties, such as negligible vapor pressure, high thermal stability, and tunability of properties.

In this context, depending on the gas of interest to be obtained (hydrogen or carbon monoxide), different species may be combined with the polymer and ionic liquid, like copper salts, which are able to increase significantly membrane selectivity towards carbon monoxide.

Therefore, the current challenge is focused on the study of the optimal proportion involving type of polymer, type and amount of ionic liquid as well as amount of additive to find mechanically stable and efficient membranes for CO separation.

- **Publications:**

- **Pardo, F.**, Santos, A., Romero, A. Fate of iron and polycyclic aromatic hydrocarbons during the remediation of a contaminated soil using iron-activated persulfate: A column study. *Science of the Total Environment*. 566-567:480-8. (2016).  
DOI: 10.1016/j.scitotenv.2016.04.197.
- Peluffo, M., **Pardo, F.**, Santos A., Romero, A. Use of different kinds of persulfate activation with iron for the remediation of a PAH-contaminated soil. *Science of the Total Environment*. 563-564: 649-656. (2016).  
DOI: 10.1016/j.scitotenv.2015.09.034.

- Santos, A., Rodriguez, S., **Pardo, F.**, Romero, A. Use of Fenton Reagent combined with humic acids for the removal of PFOA from contaminated water. *Science of the Total Environment*. 563–564: 657–663. (2016). DOI: 10.1016/j.scitotenv.2015.09.044.
- **Pardo, F.**, Rosas, J.M., Santos, A., Romero, A. Remediation of a Biodiesel Blend-Contaminated Soil with Activated Persulfate by Different Sources of Iron. *Water, Air, & Soil Pollution*. 226:17. (2015). DOI: 10.1007/s11270-014-2267-4.
- **Pardo, F.**, Peluffo, M., Santos A., Romero, A. Optimization of the application of the Fenton chemistry for the remediation of a contaminated soil with polycyclic aromatic hydrocarbons. *Journal of Chemical Technology and Biotechnology*. 91 (6): 1763-1772. (2015). DOI: 10.1002/jctb.4767.
- **Pardo, F.**, Rosas, J.M., Santos, A., Romero, A. Remediation of soil contaminated by NAPLs using modified Fenton reagent: application to gasoline type compounds. *Journal of Chemical Technology and Biotechnology*. 90 (4): 754–764. (2015). DOI: 10.1002/jctb.4373.
- **Pardo, F.**, Rosas, J.M., Santos, A., Romero, A. Remediation of a biodiesel blend-contaminated soil by using a modified Fenton process. *Environmental Science and Pollution Research*. 21 (21): 12198-207. (2014). DOI: 10.1007/s11356-014-2997-2
- **Congress contributions:**
  - XII Reunión de la Mesa Española de Tratamiento de Aguas. Madrid (Spain), 20-22 June 2016.
  - 13th International UFZ-Deltares Conference on Sustainable Use and Management of Soil, Sediment and Water Resources. Copenhagen (Denmark), 9 -12 June 2015.
  - 13th Mediterranean Congress of Chemical Engineering. Barcelona (Spain). 30 September – 3 October 2014.
  - II International Congress of Chemical Engineering of ANQUE, Madrid (Spain), 1-4 Julio 2014.
- **R&D Projects:**
  - Title: Membrane technology applied to the valorization of a residual gas stream of the carbon black manufacturing.  
Participant entities: Birla Carbon Spain S.L. and University of Cantabria.  
Duration, since 01/02/2017 to 31/12/2018.  
Main researcher: Ana Urutiaga Mendía
  - Title: S2013/MAE-2739 - Characterization, remediation, modelling and risk assessment of contaminated soils.  
Participant entities: Research groups comprising CARESOIL network: INPROQUIMA, HIDROYMAB, GTA, SIAM, LI2GA and MENODES.  
Duration, since 01/10/2014 to 30/09/2018.  
Main researcher: Arturo Romero Salvador

- Title: CTM2013-43794-R – Remediation of contaminated soils with Non-Aqueous phase liquids by In Situ Chemical Oxidation.  
Participant entities: Complutense University of Madrid.  
Duration, since 01/01/2014 to 31/12/2016.  
Main researcher: Aurora Santos López and Arturo Romero Salvador