

Chemistry Department

## Adsorption Science and Technology

Research Unit of Adsorption Separation and Process Engineering

Collaborators:

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1 Post-Doc; 2 Master students; 2 BI's



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Assistant Researcher with teaching duties (FCT/UNL, Aug 2009)

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Post-Grad, Enterprise Management (ISCTE, 2004)

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## Objectives

The research is focused on the development of novel adsorption processes that use alternative solvents and adsorbent materials. Combined competences for experimental and computational work are a focal point.

The work is multidisciplinary since it covers i) materials science, ii) chemical engineering, iii) process development and iv) modeling and molecular simulation fields.

The target applications are primarily gas storage, separation and purification of effluents with economic and environmental interest.



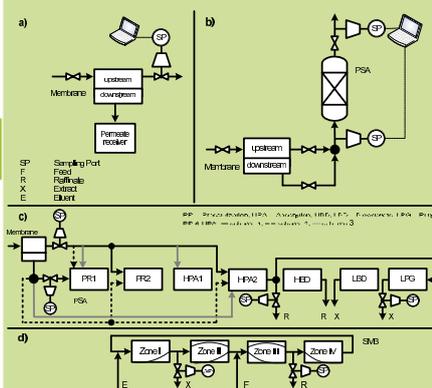
## Methodology

**Materials:** Activated Carbons (ACs); Zeolites (4A, 5A, 13X); Monoliths; Clays; Carbon Nanotubes (CNTs); Metal-Organic Frameworks (MOFs); Ionic Liquids

**Target Gases/Mixtures & Intervention Areas:** Natural Gas & odorants; Alkanes & Alkenes; Off-gas, biogas & syngas streams; recovery, purification and cleaning of gases such as CO<sub>2</sub>, N<sub>2</sub> and H<sub>2</sub>

**Methods:**

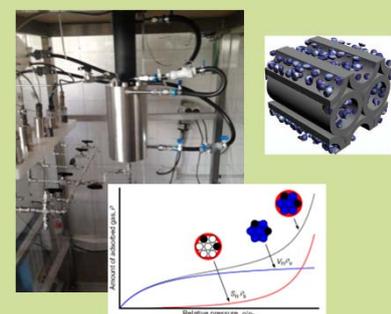
- i. Sorption equilibrium and kinetics through high-precision gravimetry
- ii. Inlet/outlet stream analysis by online quadrupole mass spectroscopy
- iii. Integration between computational modeling (process & GCMC) / control & optimization / experimental data



## Expected Results

Development of novel 'Green' Adsorption Separation Processes:

- i. Pressure swing adsorption (PSA): separation according to the species' molecular characteristics and affinity for an adsorbent, which preferentially adsorbs the target gas at high pressure. The cyclic process then swings to low pressure in order to desorb and regenerate the solid.
- ii. Simulated moving-bed (SMB): HPLC variant used for difficult separations; is brought about by a valve-and-column arrangement that is used to lengthen the stationary phase indefinitely.
- iii. PSA/Membrane hybrid systems; Pressure swing/SMB processes



Funding:

Active: EXCL/QEQ-PRS/0308/2012 (member); PTDC/AAC-AMB/108849/2008; (PI); PTDC/EQU-EQU/102949/2008 (member); industry Hampen Træforarbejdning A/S (Denmark)

Ended: PTDC/CTM/104782/2008 (member)