

Chemistry Department

Development of Sustainable (Bio)Processes



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(Assistant Researcher, since 2003)

- Since 2011 (Ed. Board of DWT)
- 1993/99 (Acad. Sci., Bulgaria)
- 1998 (Aarhus Univ., Denmark)
- 1995/96 (IMB, Jena, Germany)
- 1993, **PhD** (Moscow State Univ)
- Publishing metrics (**WoK**):
Articles in Journals with IF: 50;
> 550 citations; h-index = 15



Departamento de Química



requimte
rede de química e tecnologia



Objectives

Development of novel clean eco-efficient chemical, biochemical and biological processes and technologies, focusing on membrane-based and integrated process solutions for diverse chemical and bioprocess engineering applications as well as for environmental control and (bio)remediation.

The main on-going research lines are: i) **Membrane separation processes**: theory and practice ii) **Novel solutions for drinking water and wastewater treatment** iii) **Novel membrane (bio)reactors**; iv) **Electro-membrane processing** for removal of ionic pollutants or recovery of valuable charged compounds from complex natural media; v) **Advanced electrochemical oxidation processes**; vi) **Energy generation** from alternative sources (e.g., salinity gradients); vii) **Sustainability** ("Green") metrics and Life Cycle Assessment (LCA).

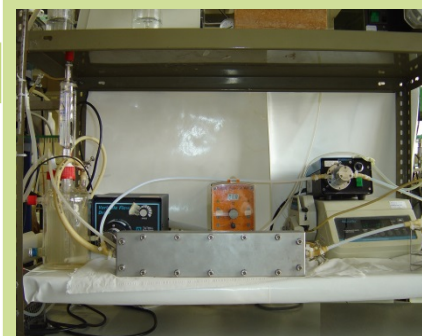
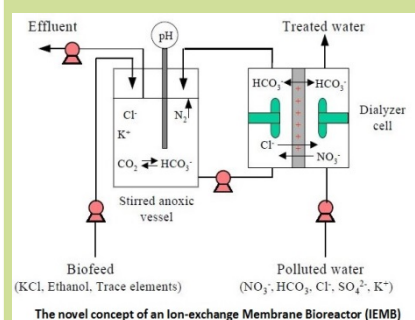
Methodology

Systematic fundamental (theoretical) and applied studies on a specific target problem using the most adequate experimental, analytical (physicochemical, biochemical and biological) and advanced data modelling tools. The methodological approach is generally organized around the following steps:

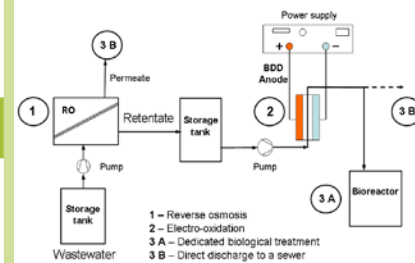
- Laboratory experiments** on fully-automated bench units that allow generating the relevant process-associated data.
- Process simulation** that uses mechanistic and/or multivariate statistical process modelling tools to allow for process description, optimization and control.
- Testing of integrated process schemes** in lab-bench pilots, in which optimum operation points are verified.
- Validation tests** on scaled-up pilot units before process implementation on practice.

Expected Results

- Developing of eco-efficient physicochemical and biochemical processes and integrated clean technologies** that may be adopted with success by oil refineries, chemical and biotechnological plants, water treatment and supply companies.
- The **problems** to be tackled are relevant in the Portuguese national context but, more important, they are quite **relevant worldwide**. For example, the development and implementation of such processes represents a significant **contribution to public health** in regions, where industry is most heavily concentrated and where air, lands and water supplies are commonly contaminated.
- Overall, the acquired knowledge will be valuable for the underlying chemical and biochemical engineering science, which is nowadays increasingly orienting **towards sustainability and supporting "greener" process design and operation practices**.



Schematic drawing of combined membrane/electrooxidation treatment of wastewater containing cytotoxic chemotherapy compounds



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