Resource Recovery and Environmental Management (R2EM)

Department of Chemical Engineering, Polytechnic University of Catalonia – BarcelonaTech, Barcelona, Spain
Web site of scientific production https://futur.upc.edu/R2EM E-mail coordinator: jose.luis.cortina@upc.edu

Keywords: Separation processes, Membrane technologies, Modelling, Risk analysis, Environmental remediation, Nuclear waste characterization, Radionuclides migration, Process and environmental monitoring, Environmental management, Resource recovery, Technologies integration

The Resource Recovery and Environmental Management (R2EM) group is a consolidated SGR group since 1995 with a former name of SETRI. It is composed of researchers from the areas of knowledge of Chemical Engineering and Chemical Sciences and Environmental Technology working primarily in the field of chemical engineering, environmental engineering, applied chemistry.

R2EM group is performing research activity on development of sustainable urban and industrial waste management cycles based on resource recovery approaches, promoting circular solutions of Waste to Product and Waste to Energy. Research also involves efforts on developing environmental remediation solutions for soils and groundwater, process and environmental monitoring and environmental risk assessment.

Evaluation of Processes and Technology for Resource Recovery

Nuclear and Industrial Waste Characterization

Integration of Technologies from Waste to Resource/Energy

Environmental Monitoring, Remediation and Risk Assesment

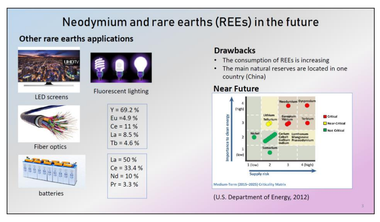
Evaluation of Processes and Technology for Resource Recovery

This research area is devoted to the development and evaluation of new materials and processes to improve separation processes and to provide waste processing routes for added value by-products recovery

Study of separation processes based in:

- Development of new membranes that involves the use of ionic liquids as carriers
- Development of new materials magnetic nanocomposites

These separation techniques are focused to the separation and metal recovery of rare earth elements from secondary sources



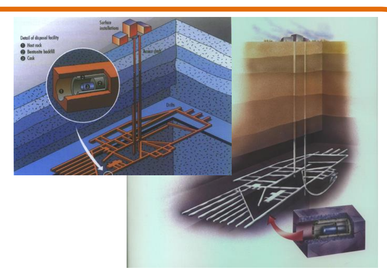
- Other recovery schemes are based in new and low cost waste-based materials such as vegetable waste, biopolymers and reactive resins

Research projects

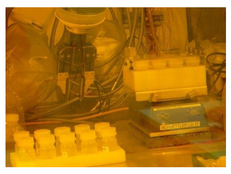
- ➢ **Recycling strategies of wastes containing rare earths: sorption processes by magnetic nanocomposites and liquid membranes for their separation and recovery (CTM2017-83581-R)**
- ➢ **Separation/recovery of rare earth metals by sorption on biopolymers, composites and membrane process (CTM2014-52770-R)**

Nuclear and Industrial Waste Characterization

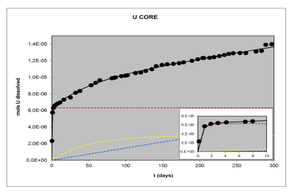
Long-term disposal of spent nuclear fuel requires experimentation under repository relevant conditions as well as the development of characterization tools for prediction of the radioactive waste interaction with the multibarrier system in the proposed Deep Geological Repository (DGR)



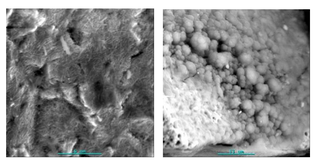
- Study the dissolution of Spent Nuclear Fuel, as well as chemical analogues, under relevant conditions for the geological repository



- Develop conceptual and numerical models for long-term predictions of the contaminants behavior



- Characterize the uranium solid phases and study their stability under repository relevant conditions



- Increase the knowledge of the physicochemical processes that take place in the interaction of Actinides and fission products with mineral phases
- Improve the understanding of the fast and instant release of radionuclides from nuclear fuels for extrapolation to a wide range of European geological disposal scenarios

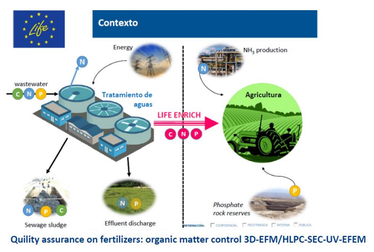
Research projects

- ➢ **Fast / Instant Release of Safety Relevant Radionuclides from Spent Nuclear Fuel (FP7-295722-FIRST NUCLIDES)**
- ➢ **Modern spent fuel dissolution and chemistry in failed container conditions (DISCO Grant Agreement 755443)**
- ➢ **Studies of corrosion and dissolution of chemical analogs of spent nuclear fuel in expected conditions during storage (CODINA) (ENE2017-83048-R)**

Integration of Technologies from Waste to Resource / Energy

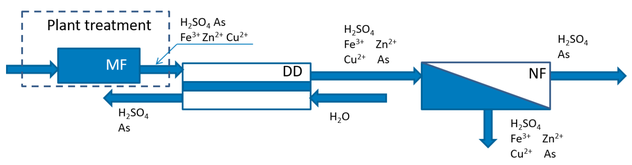
New materials and separation techniques are integrated to provide recovery routes of by-products from waste streams to valuable resource or energy vectors at non end-pipe points

- Integration of liquid-liquid membrane contactors and ion-exchange materials

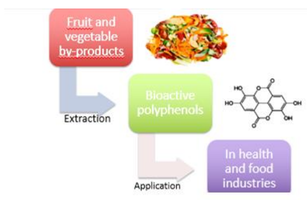


LIFE ENRICH - Enhanced Nitrogen and phosphorus Recovery from wastewater and Integration in the value Chain - LIFE16 ENV/ES/000375

- Integration of pressure and electrical driven membrane processes on the recovery of acid, bases and valuable metals from metallurgical and mining effluents



- Integration of membrane technologies for recovery of valuable components (antioxidants) from agro-food-beverage industry



- Integration on salinity gradient solar pond as an energy storage approach for low temperature heat applications in industrial processes

Resource Recovery from Industrial Process Streams by Membrane Integrated Technologies(R2MIT) (CTM2017-85346-R)

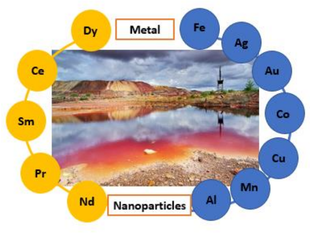
Environmental Monitoring, Remediation and Risk Assesment

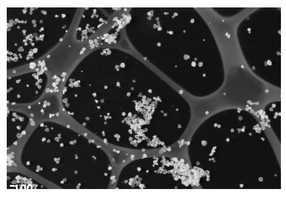
Environmental monitoring and remediation of polluted groundwater, industrial process streams and soils are addressed in developing synthetic routes to prepare and apply new and low cost waste-based materials

Nanomaterials (mainly nanoparticles) represent an important part of this field:

- Study of the reactivity of nanoparticles for the development of new sensors and elimination of contaminants in water
- Stability and mobility of micro and nanoparticles suspensions and analytical methods for monitoring in water

These approaches could be applied to monitoring and removal of metals (ex: As, Cu, Ni, Zn) and other inorganics (F, P and N) and organic matter in water

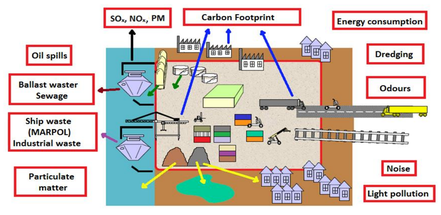




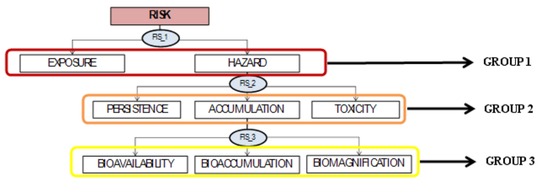
- Monitoring approach is also focused in the development of analytical methods of food residues, emerging contaminant and characterization of Dissolved Organic Matter in collaboration with the Analytical Chemistry Department of the University of Barcelona (UB)

The field of risk assessment is devoted to:

- Evaluation of environmental impacts in ports and development of useful methodologies to assist ports in their environmental management



- Environmental risk assessment of chemical in different environmental compartments: water, soil and groundwater



The current research line are on the development of a new methodology to assess the contribution of ports to climate change and the evaluation of nanoparticles risk in aquatic ecosystems

Research projects:

- ➢ **Simultaneous study of the processes of mobility and reactivity of nanoparticles in porous media for the elimination and recovery of contaminants in waters (NANOREMOV) CGL2017-87216-C4-3-R**
- ➢ **Green synthesis of metallic nanoparticles from acidic mine waters and extracts from agro-food waste (MiniNano) CTM2015-68859-C2-2-R**
- ➢ **Ports observatory for performance indicator analysis (PORTOPIA) (FP7-605176)**