PhD Open Days

Development of porous materials for sustainable water purification

Environmental Engineering

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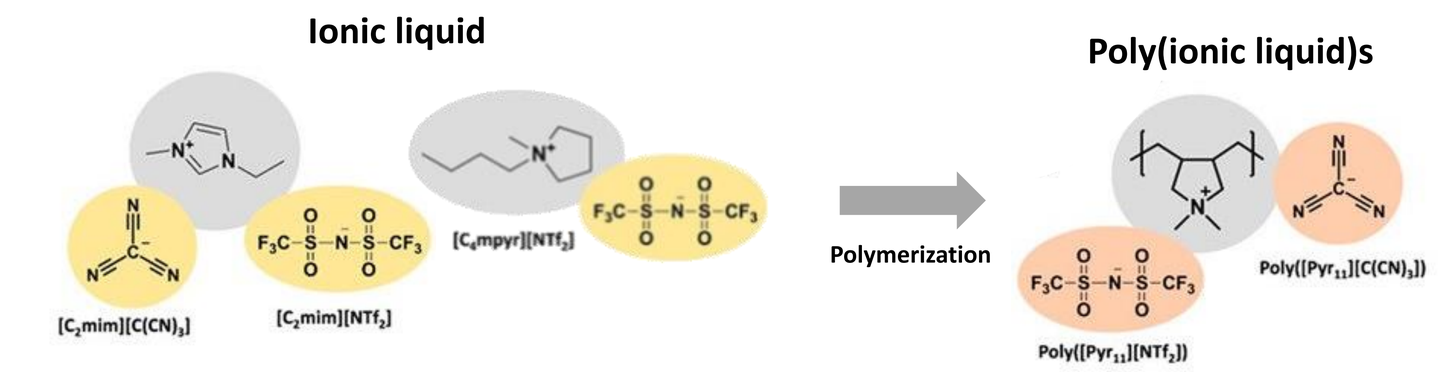
Removal active pharmaceutical ingredients

The worldwide occurrence of active pharmaceutical ingredient (APIs) and their metabolites in water sources, soils, and biota [1] is a major hazard to public health and ecosystems stability. Since APIs have a strong biological response with small dosages, they are a threat even at low concentration. Indeed, 30% to 90% of all oral administrated APIs are excreted as active compounds [2]. Conventional wastewater treatment plants (WWTPs) are not designed to remove APIs and reports on the presence of APIs in drinking water in developed countries were already published [3]. This problem will be tackled in this project through the development of porous materials capable of efficiently adsorbing micropollutants. However, the regeneration and recycle of these adsorbents must be considered, as it is crucial for their large-scale application.

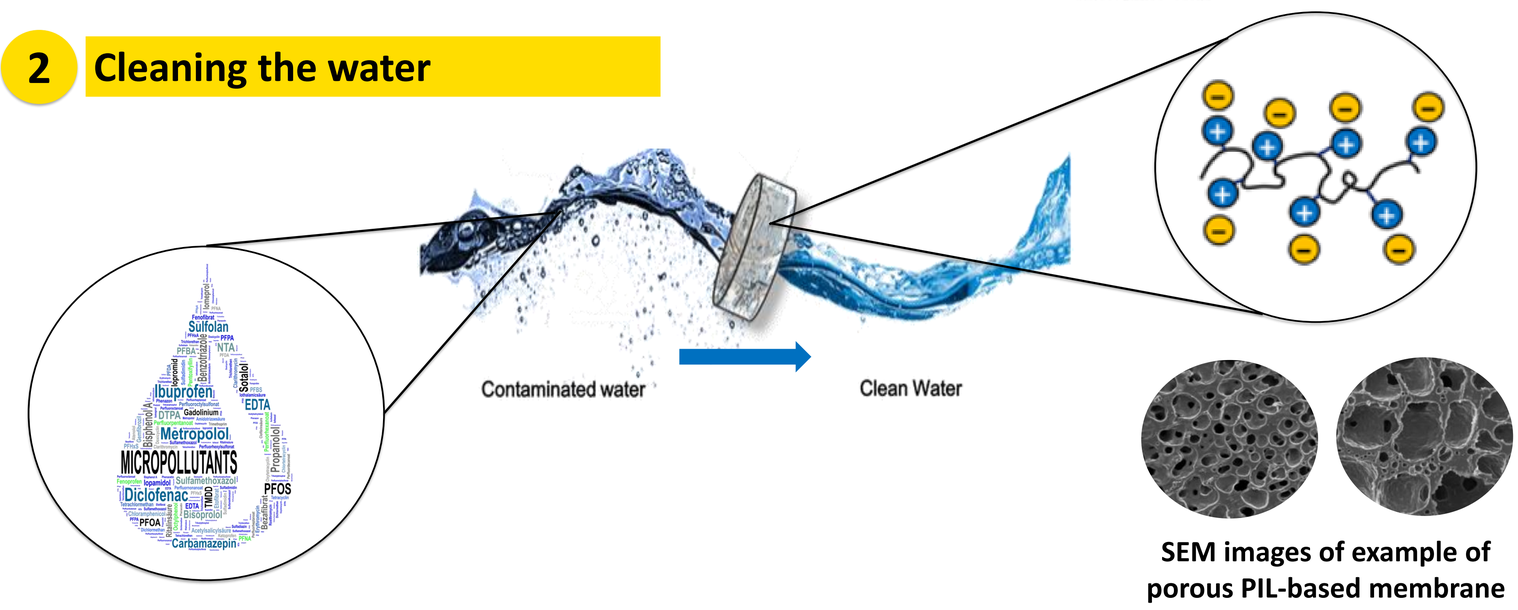
Poly(ionic liquid)s

Poly(ionic liquid)s (PILs), a special class of polyelectrolytes that combine the attractive features of ionic liquids (ILs) with the mechanical properties of polymers, have been playing prominent roles in the design of highly performant smart materials [4]. One unquestionable characteristic of ILs is the tunability of their properties, afforded by the combination of a large array of cations and anions. In addition, PILs offer enhanced mechanical stability, improved processability, durability, and spatial controllability [5]. The development of PILs with enhanced surface area has been key to the application of adsorbent materials in separation and purification processes.

1 Synthesis of poly(ionic liquid)s

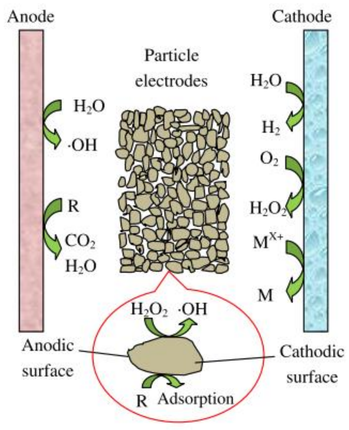


2 Cleaning the water



SEM images of example of porous PIL-based membrane

3 Electrooxidation



Electrooxidation of micropollutants in porous poly(ionic liquid)s

Electrochemical oxidation

Electrochemical oxidation (EO) processes have been considered as environment friendly technologies in WWTPs due to their strong oxidation properties, easy control, and mild reaction conditions. EO displays high efficiency (>80%) to degrade a large range of pollutants like dyes, pharmaceutics, and pesticides [6], with variable voltages depending on the compounds. Nevertheless, these pollutants need to be transferred to an electrolyte solution or concentrated in electrochemically stable adsorbent. In this work, PILs will be used to adsorb micropollutants and tested in 3D electrooxidation. Due to their great electrochemical stability PILs will be able to be recycled and reused.

References

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