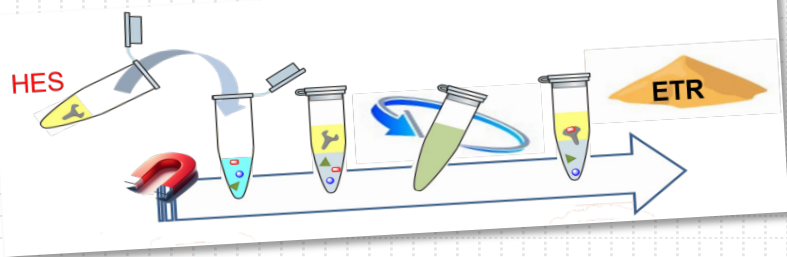




PhD DEFENSE



Baptiste BERNICOT
Ion Separation using self-assembled Molecular systems (LTSM)

Hydrophobic eutectic solvents for rare earth separation processes with low environmental impact



Friday,
November 7,
2025



9:30 AM



Auditorium
ICSM

In an effort to optimize rare earth recycling, which are strategic elements for numerous technologies, this work explores the use of hydrophobic eutectic solvents (HES) as a sustainable alternative to conventional organic solvents, limited by their toxicity and volatility. The combination of decanoic acid (hydrogen bond donor) with various extractants (acceptors) led to the formation of eutectic mixtures exhibiting deviations from ideality, attributed to hydrogen bonding interactions confirmed by infrared spectroscopy. These HES, endowed with favorable physicochemical properties, were evaluated for rare earth extraction in nitric media. The TODGA/decanoic acid system demonstrated an extraction capacity up to 4 times higher than that of a classical solvent for dysprosium (up to 40 g/L), along with a marked selectivity toward iron. These performances were confirmed using leachates from NdFeB magnets, while a life cycle assessment (LCA) further highlighted the reduced environmental impact of this HES for dysprosium extraction. Moreover, investigation of the hydrogen bond donor revealed that the strength of hydrogen bonding interactions significantly affects not only rare earth extraction and selectivity, but also the viscosity and volatility of HES systems. This work confirms the interest and potential of HES as alternative systems in hydrometallurgy, opening new perspectives for the recovery of critical metals beyond rare earths. In addition, a deeper understanding of the interactions and mechanisms involved provides promising insights to guide the design and formulation of new HES tailored for liquid-liquid metal extraction.

Keywords: *Liquid-liquid extraction; Hydrophobic eutectic solvents; Hydrogen bonding; Rare earth recycling; COSMO-RS; Phase diagram; Molecular dynamics; SAXS*



**WE LOOK
FORWARD
TO SEEING
MANY OF YOU!**



UNIVERSITÉ DE
MONTPELLIER

