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ABSTRACT

It is significant to develop sustainable strategies for the selective separation of rare earth from transition metals from fundamental and practical viewpoint. In this work, an environmentally friendly solvent extraction approach has been developed to selectively separate neodymium (III) from cobalt (II) and nickel (II) by using an ionic liquid-based aqueous two phase system (IL-ATPS). For this purpose, a hydrophilic ionic liquid (IL) tetrabutylphosphonate nitrate ($[P_{4444}][NO_3]$) was prepared and used for the formation of an ATPS with $NaNO_3$. Binodal curves of the ATPSs have been determined for the design of extraction process. The extraction parameters such as contact time, aqueous phase pH, content of phase-formation components of $NaNO_3$ and the ionic liquid have been investigated systematically. It is shown that under optimal conditions, the extraction efficiency of neodymium (III) is as high as 99.7 %, and neodymium (III) can be selectively separated from cobalt (II) and nickel (II) with a separation factor of 10^3. After extraction, neodymium (III) can be stripped from the IL-rich phase by using dilute aqueous sodium oxalate, and the ILs can be quantitatively recovered and reused in the next extraction process. Since $[P_{4444}][NO_3]$ works as one of the components of the ATPS and the extractant for the neodymium, no organic diluent, extra etractant and fluorinated ILs are used in the separation process. Thus, the strategy described here shows potential in green separation of