

Extraction mechanism of Gd³⁺ by BTMPPA

The extraction behavior of Gd(III) from acidic nitrate-acetate medium by bis(2,4,4-trimethylpentyl)phosphinic acid (BTMPPA, H₂A₂) in toluene either alone or in combination with trioctylphosphine oxide (TOPO, B) has been investigated as a function of contact time, concentrations of Gd³⁺, H⁺, NO₃⁻ and Ac⁻ (acetate) in the aqueous phase, the concentration of H₂A₂ and TOPO in the organic phase and temperature. Dependencies of H⁺, BTMPPA, TOPO and Ac⁻ concentrations on extraction ratio suggest that the extracted species are [Gd(Ac)(HA₂)₂·H₂A₂] and [Gd(Ac)A₂·HA·2B] for without and with TOPO, respectively at lower loading, while GdA₃ is extracted at higher loading in both cases. The synergistic effect of TOPO is observed only at higher TOPO concentrations region. The equilibrium constants are evaluated to be 10^{-0.63} and 10^{-2.79} for the system without and with TOPO, respectively. The La(III)/Gd(III) separation factors are found to be 348 and 393 for the system without and with TOPO, respectively. The temperature dependence of the extraction data from acidic nitrate-acetate gives the enthalpy of extraction, 56 kJ/mol. The loading capacity for 100 g BTMPPA is found to be 17.89 g Gd(III).