DISPERSIVE SOLID PHASE EXTRACTION AND SEPARATION OF RARE EARTH ON REUSABLE HYDROXAMATE IMMOBILIZED ADSORBENT

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We report application of organo-silica adsorbent with covalently immobilized fragments of hydroxamate (SiO2-BPHA) for dispersive solid phase extractive (DSPE) preconcentration of REE (La3+, Ce3+, Pr3+, Nd3+, Sm3+, Eu3+, Gd3+, Tb3+, Dy3+, Ho3+, Er3+, Tm3+, Yb3+ and Lu3+), Sc and Y cations with respect to various amounts of competing ions. DSPE can be an important substitution for solvent extraction of REEs form recyclable sources such as e-waste. Competitive adsorption of REEs from multielement solution and pH dependence, isotherm and kinetics studies, metal ion recovery and desorption, as well as the adsorbent reusability have been investigated. Mutual separation of REEs from their multielement mixtures is also examined. It has been demonstrated that SiO2-BPHA can be successfully used as adsorbent for removal of REE ions from aqueous solution within 10 min. Sharp changes of REEs recovery has been observed in the pH range 3.3 – 5.0 with no essential metal adsorption at pH < 3.0 and with more than 95% at pH = 5.0. Complete desorption of all REEs to 0.1 mol L-1 acid is observed. Reusability test demonstrates that SiO2-BPHA can be used for quantitative adsorption of almost all REEs (average adsorption of Ce and Pr ions is about 90%) from multielement solution with pH=5.0 without lost in adsorption capacity and selectivity for at least in five consecutive cycles. It has been found that essential (more than 100 times) growth of distribution coefficient with atomic number of REE is observed for multielement solution. In optimal conditions selectivity factor is about 80 of pares Lu/La and Yb/La, and about 60 for pare Tm/La, which indicates high potential of SiO2-BPHA in REEs separation