Cs^+ SELECTIVITY OF LAYERED PHOSPHATES

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ABSTRACT

$H^+/M_A{}^+$ ion exchange reaction of layered γ-titanium and γ-zirconium phosphates $M_TM_AH(PO_4)_2{\cdot}nH_2O$ was examined, where M_A is an alkali metal and M_T is Ti or Zr. They showed remarkably high ion exchange selectivity for Cs^+ and Rb^+ in acidic media. The selectivity for Na^+ was rather low and Li^+ exchange hardly occurred. The H^+ ion exchange of both γ-phosphates with Cs^+ and Rb^+ apparently occurred in two steps. The first step occurred at a pH value around 2.0 to form a monobasic structure, $M_TM_AH(PO_4)_2{\cdot}nH_2O$. The ion exchange reaction with Cs^+ and Rb^+ was accompanied in the first step by dehydration. The second step occurred at pH around 8.0 to form the dibasic structure, $M_T(M_APO_4)_2{\cdot}nH_2O$ and the interlayer space of both γ-phosphates swelled again. The crystal lattice collapsed gradually corresponding to further progress of the ion exchange reaction with Cs^+ and Rb^+ and finally an amorphous phase appeared. According to an ^{133}Cs NMR study, Cs^+ was found to be rather restricted and the results were compared with those of layered synthetic mica. The high Cs^+ and Rb^+ selectivity was ascribed to the dehydration process and strong interaction of these ions with the host lamella layers. The high selectivity of two γ-phosphates for Cs^+ in acidic media suggested the potentiality as promising materials for the recovery of cesium from radioactive waste.