

Ion-exchange properties of hydrated titanium(IV) phosphates

© Vladimir I. Ivanenko,^{*+} Roman I. Korneikov,
Svetlana V. Aksenova, and Efroim P. Lokshin

*A Federal State Budgetary Institution of Science. I.V. Tananaev Institute of Chemistry and Technology
of Rare Elements and Mineral Raw Materials, Kola Science Centre, RAS (ICTREMRM KSC RAS).*

Akademgorodok, 26a. Apatity, 184209. Murmansk Region. Russia.

Phone: +7 (8155) 57-92-40. E-mail: ivanenko@chemy.kolasc.net.ru

^{*}Supervising author; ⁺Corresponding author

Keywords: titanium(IV) phosphates, inorganic sorbents, toxic metal cations, ion exchange.

Abstract

On the basis of studying of processes of complexformation the conditions of existence of the hydrated Ti(IV) oxohydroxohydrophosphates in aqueous media are defined. The polarization of acidoligand in a field of titanium atom results in rise of mobility of a proton in Ti(IV) hydrophosphate and ability to cationic exchange. The effect of the nature of the sorbed metal cations on the process of substitution of Ti(IV) hydrophosphate protons has been studied. The values of a constant of cationic substitution depend on a degree of hydration of metal cations. The highly hydrated samples can achieve a static exchange capacity, which is close to theoretical and equals the HPO_4 -group content in the sorbent. Methods have been developed for modifying the titanium-phosphate sorbent with Fe(III), Zr(IV) and Nb(V) cations. Modifying is based on forming hetero-polynuclear associates from interacting oxohydroxoacido complexes of transition metals having different acidic-basic properties. Doping increases the sorption constant, thus allowing to employ the sorbents in extracting of cation impurities from more acidic solutions. Heating of the spent sorbents are reliably immobilized as water-insoluble crystalline compounds. The new sorbents can be effectively used for purification of liquid radioactive wastes from radionuclides with high contents of non-radioactive element salts, and also for extraction of toxic metal cations from industrial effluents. The titanyl hydrophosphate $\text{TiOHPO}_4\cdot\text{aq}$ can be used as precursor at synthesis of connections of potassium titanylphosphate group in aqueous solutions.