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Preparation and characterization of α-zirconium phosphate as a perspective material for separation of medicinal radionuclides

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Zirconium phosphate (ZrP) has been the subject of research for many years. The interest for this material is based on its outstanding physicochemical properties, both in its amorphous and crystalline phases. It is necessary to unequivocally highlight its extremly high ion-exchange capacity, very good biocompatibility and stability, and good thermal and radiation stability. At the same time, it should be noted that the synthesis of ZrP and its subsequent functionalization is very simple. All of this makes ZrP perspective candidate for a wide range of applications in chemistry, health and nuclear industry, but especially in nuclear medicine area for example as a potentional drug delivery system, ion-exchanger for sources of high purity radionuclides or photovoltaics [1].
Zirconium phosphate, specifically its alpha alotropic modification (α-ZrP), was prepared by refluxing an aqueous solution of oxychloride octahydrate and sodium dihydrogenphosphate monohydrate solution in hydrochloric acid [2]. The prepared α-ZrP was completely characterized using infra red and Raman spectroscopy, X-ray powder difraction, DTA and TG analysis, FEGSEM/SE, TEM/BF 2D-SAED and TEM/EDX analysis. Finally, experiments studying mechanism of sorption on a surface of α-ZrP and characterizing the surface of α-ZrP by its active soprtion sites and functional groups using potentiometric titrations in pH range 2-11 was carried out. The experimental data was analyzed using software FAMULUS.To sum up, it can be said that prepared α-ZrP was completely characterized and sorption mechamism on the surface of this material and its surface characteristics were studied.
The titration curve of ZrP is placed in an area with a predominant negative surface charge. ZrP also has high concentration of functional groups for sorption of cations, indicating a potentially high sorption capacity. From this point of view, ZrP appears as promising and interesting for next studies with various purposes like drug delivery systems or ion-exchangers for separations of medicinaly significant radionuclides such as radioactive pair Ac-225 and Bi-213.

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