“Nanocomposites and nanomaterials”

Sorption of plumbum on acid-modified Transcarpathian clinoptilolite

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Lead belongs to the most toxic heavy metals. Taking that into account, constant analytical control of environmental objects and food on the subject of Pb content is required. The water and soil purification from this toxic element is also relevant topic, as well as Pb regeneration from the used technological solutions. The solution of these problems is strongly connected to the usage of effective selective Pb sorbents. Sorption properties of natural zeolites regarding Pb(II) have been the subject of the great research interest in recent years. The characteristics of these nanomaterials are resistance to aggressive environments, high sorption capacity and selectivity, ability to sorb trace amounts of substances, availability and low cost. The sorption properties of the acid-modified Transcarpathian clinoptilolite regarding trace amounts of Pb(II) were investigated by solid phase extraction under dynamic conditions. The maximum sorption capacity of H-zeolite has been observed in slightly alkaline solutions of Pb(II) (pH 8.5). Trace amounts of Pb(II) in such solutions are present mostly in the form of cationic $PbOH^+$ hydroxocomplex (~ 65%). Sorption capacity of the clinoptilolite increases significantly with decreasing concentration of Pb(II) in the solution. This is caused, probably, by the decrease of the amount of $PbOH^+$ and simultaneous increase of polynuclear cation hydroxocomplexes with increasing concentrations of Pb(II) in the solution. The most effectively Pb(II) is sorbed by H-clinoptilolite samples previously calcined at 600°C. Siloxane bonds are formed in the structure of H-clinoptilolite at this temperature, that together with the silanol groups are responsible for the sorption of Pb(II). The tris buffer was used to ensure the stability of pH and ionic strength of the solution and, consequently, to improve metrological characteristics of the Pb(II) preconcentration methods. Under optimal conditions, the maximum sorption capacity of H-clinoptilolite regarding Pb(II) is estimated to be 60mg/g that is 5.5 times higher than the sorption capacity of the natural forms of this zeolite. The most effective desorbent of Pb(II) from the H-clinoptilolite is 1M solution of KCl (pH 4.0), which provides desorption of ≥90% of Pb from the zeolite matrix.