DEVELOPMENT AND APPLICATION OF CLAY-CHITOSAN-BASED NANOCOMPOSITES FOR SORPTION OF RADIONUCLIDES

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Nowadays, the main sources of environmental pollution are waste products of the various industrial enterprises. In this regard, the unique properties of natural minerals such as economic availability, ubiquity, chemical stability and their low cost have resulted in an increasing interest in their investigation and widespread application [1,2]. Clays and their minerals are a widespread and cheap material that has been successfully used for decades as an adsorbent for removing toxic heavy metals from aqueous solutions [3]. Clays and their minerals, both natural and modified have been used for environmental protection, industrial and medical applications. Clays often have very high surface area and cation exchange capacity that make them very useful for carrying several kinds of substances [4].

The aim of this study was to prepare clay-chitosan composites as an adsorbent with various clay concentrations and modifications, in order to apply them for sorption of radionuclides.

In this research, chitosan powder was dissolved in 100 ml of an aqueous solution of acetic acid (1%, v/v), using a magnetic stirring plate at 90°C and 150 rpm for 1 hours and then cooling the solution to room temperature. In this study natural clay containing muscovite and two commercial minerals were used. Chitosan-clay composites were obtained by mixing the chitosan with different amounts of clay. The resulting composites were subjected to various chemical modifications. The obtained composites were applied for the sorption of cesium and cobalt. The adsorption of Cs(I) to composites was studied at pH from 3 to 9 at initial concentration of 3 g/L as well as at the Cs initial concentrations of 3, 6 and 10 g/L. Preliminary tests were performed to estimate applicability of nanocomposites for cobalt sorption. Cs(I) solutions were traced with ^{137}Cs, while Co(II) solutions with ^{60}Co. Cs(I) and Co(II) activity concentrations were measured by gamma spectrometry using a HPGe detector (resolution 1.9 keV/1.33 Mev and efficiency 42%). The values of the chitosan-clay composite adsorption capacities varied as follows: from 52 to 482 mg/g at pH 3; from 246 to 688 mg/g at pH 5; from 415 to 1048 mg/g at pH 7; from 369 to 977 mg/g at pH 8 and from 297 to 1073 mg/g at pH 9.

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