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

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INTRODUCTION

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. 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. 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.

METHODS

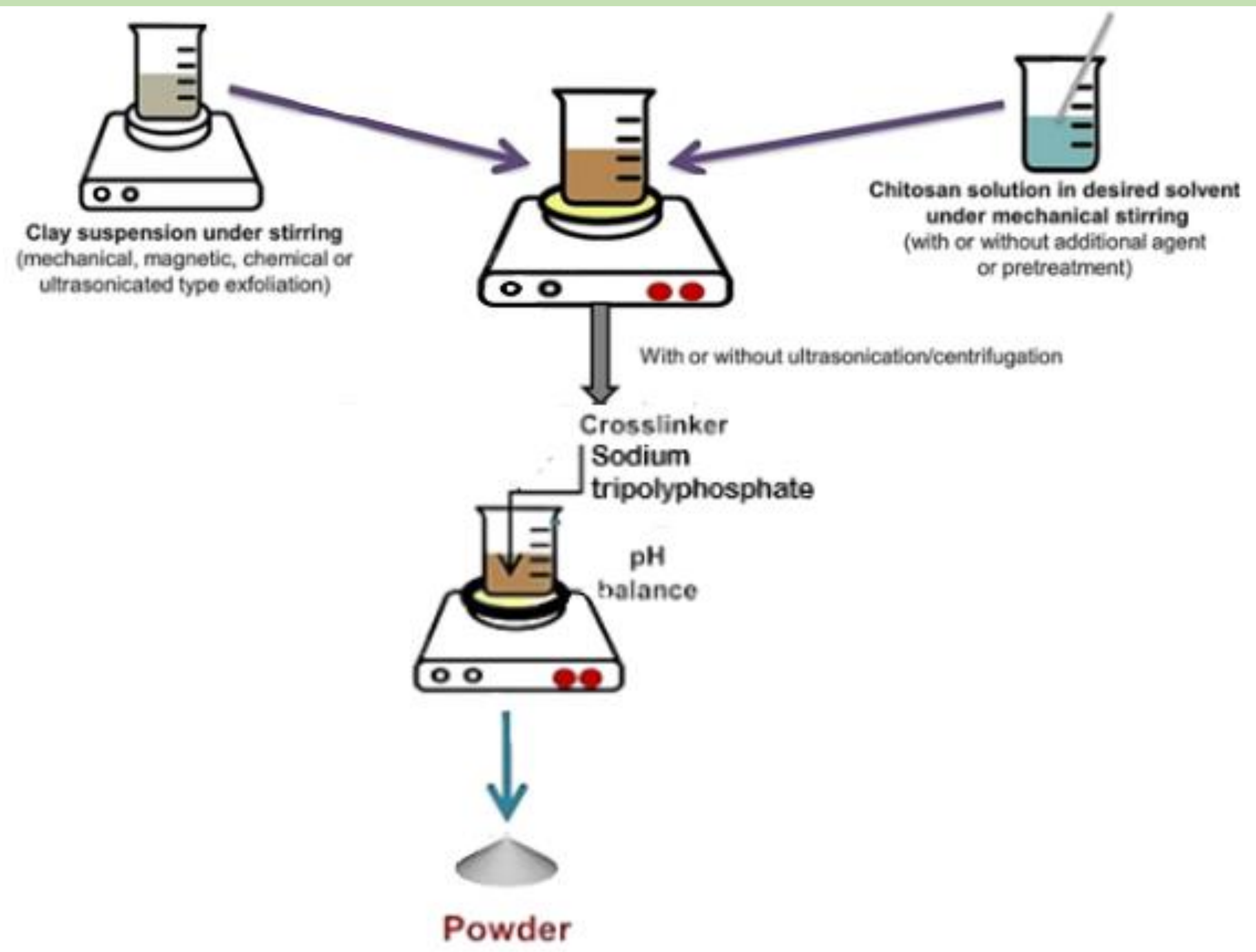
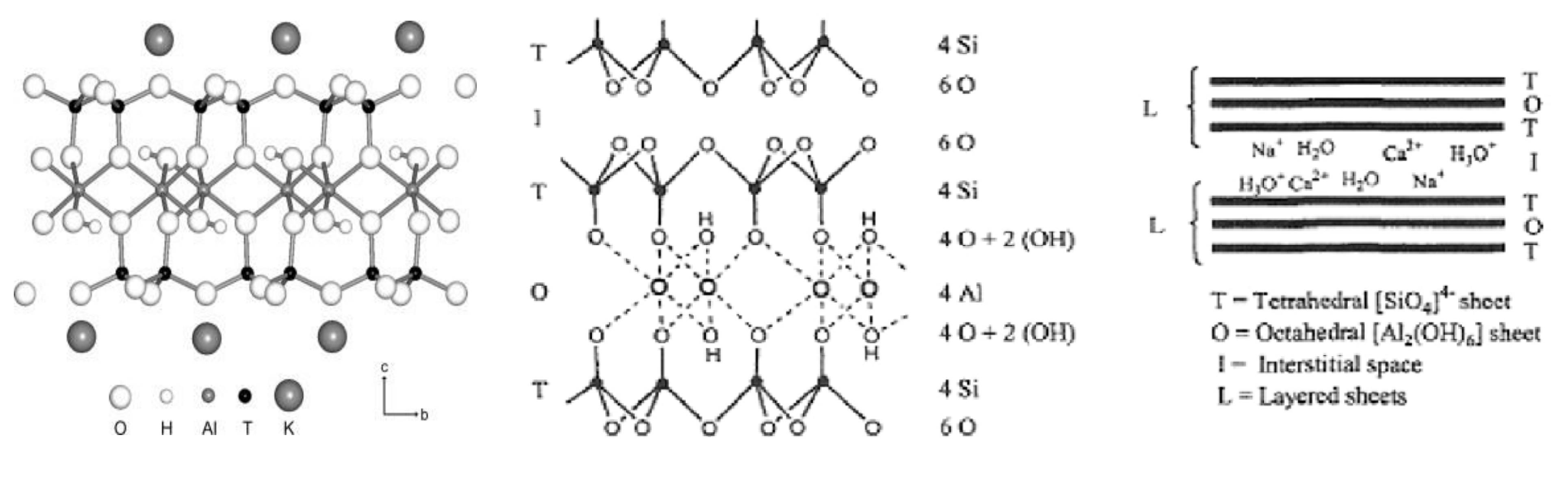


Fig. 1. Preparation of clay-chitosan composite modified by sodium tripolyphosphate.

Chitosan powder was dissolved in 100 ml of an aqueous solution of acetic acid (1%, v/v). Chitosan-clay composites were obtained by mixing the chitosan with clay (20 wt %). 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%).

RESULTS



(a) (b)

Fig. 2. Muscovite (a) and montmorilonite K 10 (b) minerals structures.

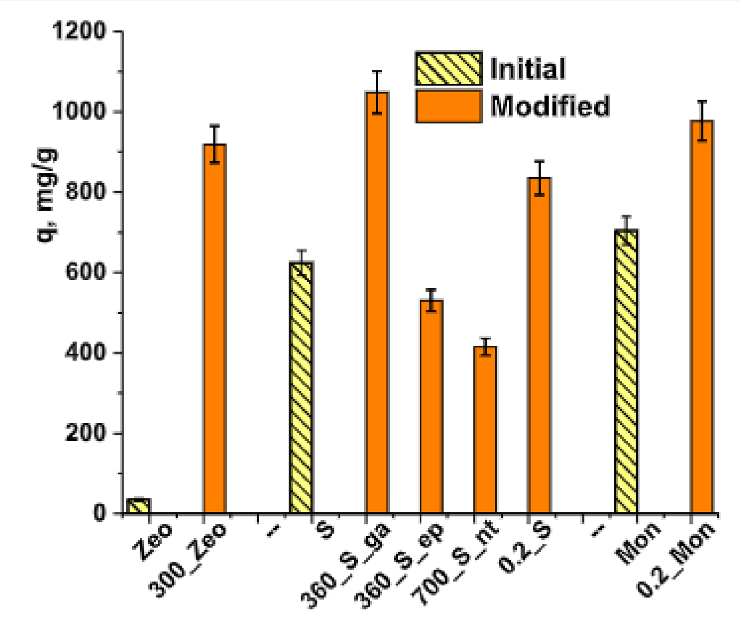


Fig. 3. Initial and modified clay-chitosan composite adsorption capacities for Cs(I).

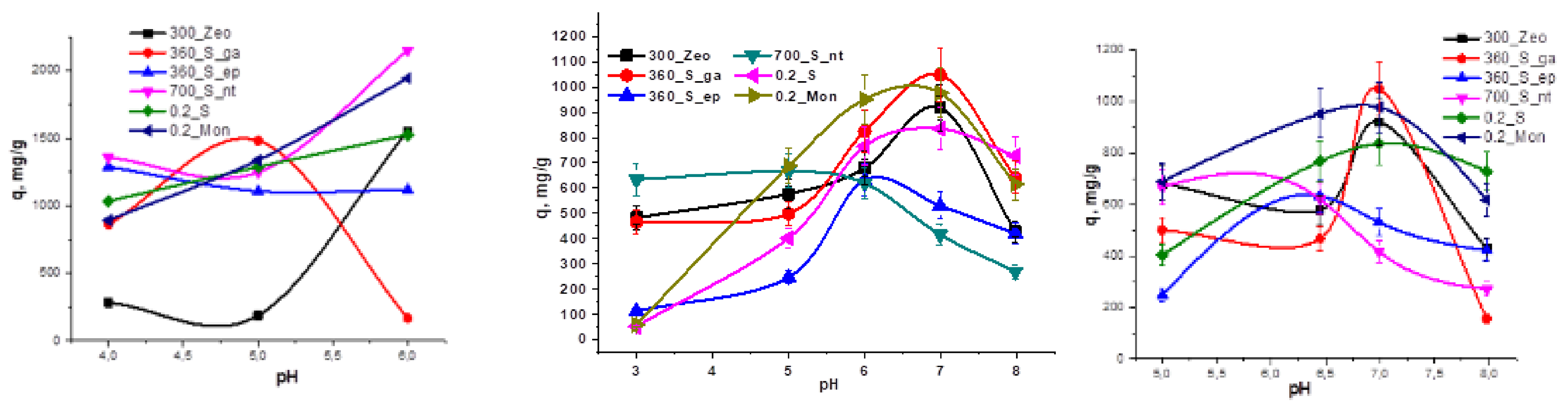


Fig. 4. Clay- chitosan composites adsorption capacities for Cs(I) and Co versus aqueous solution pH.

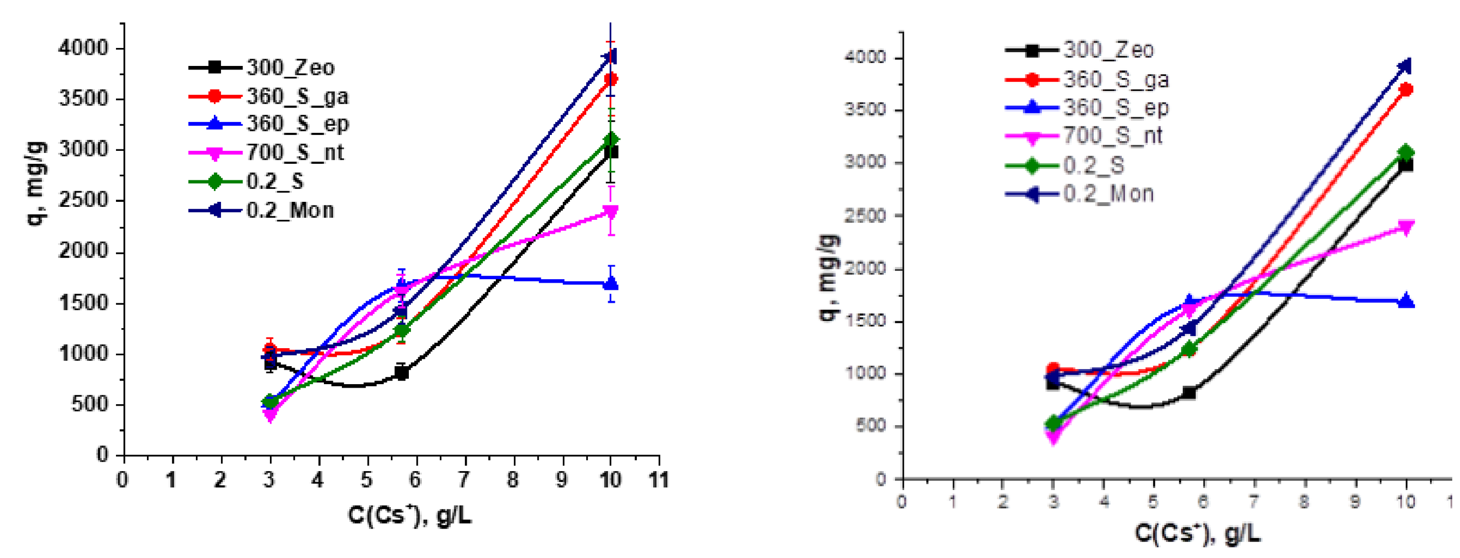


Fig. 5. Clay- chitosan composites adsorption capacities for Cs(I) and versus aqueous solution concentration.

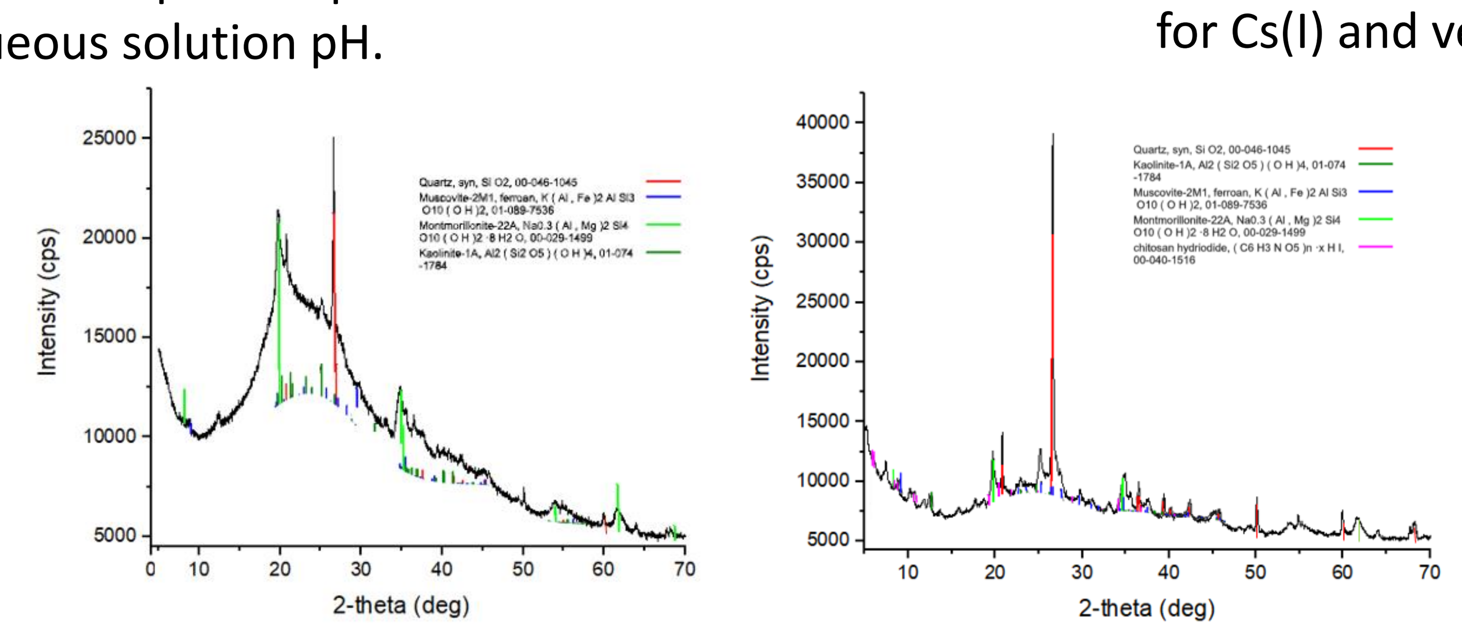


Fig. 6. XRD spectra of clay-chitosan-sodium tripolyphosphate and clay-chitosan composites.

CONCLUSION

Clay-chitosan composites were prepared using different amounts of clay and differently chemically modified. Preliminary adsorption tests of cobalt have been carried out. The obtained results showed that the chitosan-clay composite prepared in aqueous solution pH 7 at initial concentration at 10 g/l adsorbed more Cs.