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Nanozeolites as carriers for radium radionuclides.

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Objectives: The aim of the work was to study the possibility of using nanozeolites as carriers for very perspective therapeutic radionuclides ⊠-emiters 223,224,225Ra. These metals do not form stable complexes so they can hardly be bound to biomolecules via chemical bonds. Zeolites are crystalline aluminosilicates composed of tetrahedral elements that build open framework structures - a system of channels and cages of molecular dimensions [1]. Moreover, these molecular sieves are good ion exchangers with high affinity to mono and divalent cations, therefore radium radionuclides can be easy encapsulated inside the zeolite structure.
Methods: Nanozeolites were synthesized by hydrothermal method [2]. The synthesis was conducted in a temperature controlling magnetic stirrer. Chemical reagents included sodium hydroxide (Chempur), aluminum hydroxide (Aldrich), colloidal silica 45 wt. % suspension in water (Ludox CL-X, Aldrich), fumed silica (Aldrich), distilled water. Aluminate and silicate solutions were mixing together in the molar ratio 5.5 Na2O : 1.0 Al2O3 : 4.0 SiO2 : 190 H2O to obtain faujasite (FAU) or NaX type of zeolite. The influence of silicate source, aging time of precursor sols, rotation rate and temperature on the size of final nanozeolite have been studied.In the preliminary experiments the obtained samples were examined for adsorption of 133Ba which was used as the model for 223,224,225Ra.

Result: The studied nanozeolites exhibited high affinity for both 133Ba. The distribution coefficient value for 133Ba exceeds 104 cm3•g-1. The stability of radiolabelled nanozeolites was studied in various solutions containing: physiological salt, competitive cations (K+, Ca2+), complexing agent (EDTA) or buffer (PBS). The leakage of 133Ba from the nanozeolites was below 0.2%. In the next stage, 224Ra (milked from 228Th/224Ra generator) was absorbed in the nanozeolites. No leakage of activity to the solution after shaking NaX-224Ra with 0.9% NaCl, 0.02 M PBS, 10-3 M KCl, 10-3 M CuSO4 was observed. The only exception was for EDTA (the leakage was above 50%). Thus, in the next step, the same sample was examined in human serum. About 15% of ⊠-radioactivity was found in the solution, which has been attributed to 212Pb - the decay product of 224Ra.

Conclusions: Nanosized zeolites were successfully prepared via hydrothermal synthesis. The nanozeolite NaX exhibits high affinity for 224Ra. In the future experiments nanozeolites of other types, with smaller cages and channels, will be synthesized. The studies on their stability in vitro will be continued.

References

1. Grieken R. V., Sotelo J. L., Menendez J. M., Melero J. A., Microporus and Mesoporous Materials, 39, 135-147, (2000);

2. Zhan B.-Z., White M. A., Robertson K. N., Cameron T. S., Gharghouri M., Chem. Mater., 14, 3636 –3642, (2002).

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