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Organomineral sorbents based on chitosanferrocyanide for extraction and concentration of Cs-137 from seawater

Tokar E.A, Egorin A.M, Zemskova L.A and **Drankov A.N**
IC FEB RAS, Russia

To date, most of the ongoing and operational nuclear power plants in the Asia-Pacific region are in the coastal zone using seawater for direct cooling, which creates the danger of the release of radioactive substances into the World Ocean in the event of an accident. In this connection, an important technological task is the concentration of Cs-137 from seawater as one of the most dangerous anthropogenic radionuclides for the purposes of radioecological monitoring. The natural content of 137Cs is 3-5 Bq / m3, which is lower than the lower detection threshold with modern radiometric equipment. To solve this problem, most commonly used materials based on ammonium phosphomolybdate, sparingly soluble ferrocyanides Fe, Ni, Co. However, the lack of such materials is the irreversibility of the sorption process, which makes it difficult to obtain high concentration factors for the radionuclide. By means of co-precipitation, mixed ferrocyanide Zn-K and natural biopolymer chitosan in the form of a poly-base, we obtained a new organomineral sorbent, which can be used in the sorption-regeneration cycle using 5M NH_4NO_3 solution as the eluent.The new sorbent made it possible to create an efficient scheme for the concentration of Cs-137 from seawater. At the first stage, the radionuclide is extracted from seawater under dynamic conditions, at a filtration rate of 100 column volumes per hour, the efficiency of radionuclide sorption from seawater exceeds 95%, the sorbent resource is 1600-1900 column volumes. The sorbed radionuclide is then eluted with a solution of 5M NH_4NO_3 under dynamical conditions with an efficiency of 95%. The next step is the additional concentration of Cs-137 with an efficiency of 99% with chitosanferrocyanide sorbents based on mixed ferrocyanide Ni-K with preliminary treatment of the dry NaOH eluate under heating. Using the proposed scheme, the volume of the final radionuclide concentrate can be reduced by 30,000 times compared with the initial amount of filtered seawater. The work was supported by the Russian Science Foundation (agreement No. 14-50-00034) and by means of a grant from British Petroleum Company.

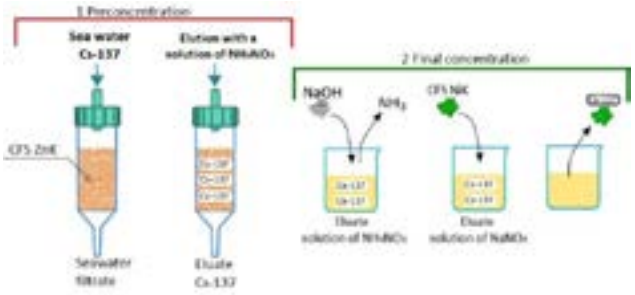

Fig. 1. Two-stage scheme for the concentration of Cs-137 from seawater.

Biography

Tokar Eduard in 2015 defended a bachelor's degree in chemistry. Starting from 2015, he studies at the master's course at the Faculty of Organic Chemistry, Far Eastern Federal University. 2015 Researcher, Department of Elemental Organic Chemistry, Far Eastern Branch of the Russian Academy of Sciences, and Research Associate of the Laboratory of Sorption Processes Institute of Chemistry of the Far Eastern Branch of the Russian Academy of Sciences. In 2017 he graduated from the master's degree in the field of organoelemental chemistry and entered the postgraduate course in chemistry and ecology in the department of nuclear technologies.

d.edd@mail.ru