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# Improvement of radionuclide fixation in cement matrixes during immobilization of liquid radioactive waste

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Cementation provided by mixing of concentrated radioactive waste (RAW) and cement is the most common procedure for immobilization of medium- and low-level radioactive salt-containing waste of radiochemical industry. However, low degree of inclusion of solidified waste in concrete (especially from concentrated salt-containing solutions owing to deterioration of the concrete properties) and noticeable leaching of some fission elements require development of additional barriers at storage of such RAW. Therefore, addition of RAW into the concrete not in the form of solutions but in the form of sorbents saturated with radionuclides can decrease leaching and, in turn, can improve degree of cesium inclusion without decrease in the strength and some other properties of the concrete monolith.
Our studies were aimed at treatment of the solutions with complex chemical composition from the units of RAW concentration and fractionation and of the spent decontamination solutions.
To include radionuclides containing in liquid RAW in the concrete the possibility of using of super-stoichiometric sorption was studied. This method allows increasing saturation with respect to many radionuclides by a factor of 5-20. Chemical treatment of the sorbent preliminarily saturated with cesium provides stronger fixation of given radionuclide in the solid matrix. Inclusion of sorbents saturated with radionuclides in the concrete increases 137Cs content in the solidified matrix by one-two orders of magnitude without any changes in the strength properties of the resulting composites. At the same time, the leaching rate of 137Cs decreases by a factor of 4-5.
Surface treatment of the resulting composites liquid and supercritical CO2 (so-called carbonization procedure) was also studied to improve fixation of radionuclides in the concrete blocks.
Combination of above procedures allows reducing cesium leaching from the concrete blocks by more than two orders of magnitude.

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