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Study of Cesium-137, Cobalt-60, Stroncium-85 species in boric acid solution

Spent fuel is generated during power reactor operation in the form of spent fuel assemblies. Spent fuel assemblies are placed to at-reactor spent fuel pool for cooling, reducing of fission products radioactivity and radiation protection of staff. During storage of spent fuel assemblies radionuclides, both fission and activation origin, get to solution of spent fuel pool. Radionuclides, interacting with products of corrosion, can form radioactive soluble species and suspensions that fall to bottom of spent fuel pool or to hard-to-reach places. Radioactive sediments increase background radiation and staff doses, as well as problems at spent fuel pool decontamination during operation or decommissioning.

Existing treatment facilities for spent fuel pool solutions manage with treatment process partially. More effective treatment methods and technologies for these solutions are required. Radionuclide speciation in solution of spent fuel pool is an important information that is necessary for solving this problem. The aim of this study is to establish speciation of major radionuclides in solution of spent fuel pool.

Disperse species of trace amount radionuclides 60Co, 137Cs, 85Sr are studied in boric acid solutions at concentration 20 g/L (similarly of composition of process media spent fuel pool), distillation water and potassium nitrate solutions 0.1 M at different pH values with use of ultrafiltration method (MWCO 1000 Dalton) and centrifugation. Base methods of investigation were γ–spectrometry and volumetric analysis of boric acid.

Radionuclides are rejected by membrane approximately similarly in boric acid solution at low pH values. In neutral pH range decreased retention of radionuclides is observed, but at high pH values there is increase in retention of radionuclide 60Co. Radionuclide retention is not observed at centrifugation at low pH. Most likely, it is due the formation of pseudocolloidal particles of these radionuclides in boric acid solution at low pH values. Cobalt radionuclide rejects on the membrane and at centrifugation at high pH, because of hydrolysis.

Difference between retention on the membrane and at centrifugation is explained by sizes of the pseudocolloidal particals.

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