Evaluation of sorbents for potential tratment of NPP severe accident radioactive waste: influence of solution composition

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Fukushima Daichi accident brought up worldwide post-accident measure demands. Therefore UJV Rez, a.s. in the cooperation with CEZ, a.s. and Slovenské elektrarne, a.s. has started to review the concept and potential steps toward designing contaminated water treatment device for potential VVER 440 and VVER 1000 NPP severe accident.

The first important step was to determine of the radionuclide source term and the composition of the solution. The most important contaminants in the coolant solution would be Cs and Sr radioisotopes, altogether with actinides. The volume of treated water is expected to be 3 000 m^3, presuming that the treatment of the contaminated water would start 6 months after the successful stabilization of the accident progression base. The coolant solution would presumably be composed namely of H_3BO_3 (15 g/l), KOH (3,3 g/l), N_2H_4 (0,8 g/l).

The apparatus itself might consist of several columns with sorption specific sorbent materials, dedicated to the radioisotopes to be eliminated. A set of 48 potential sorbent were identified, including commercial, laboratory sorbents and nanomaterials. The selected set of 30 sorbents was tested for their sorption properties, using ^{134}Cs and ^{85}Sr. Batch sorption experiment method was used, using synthetic coolant solution (see above) as a solvent. The synthetic coolant composition, namely content of K, was found to be the most important factor, influencing sorption effectivity.

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