SYNTHESIS OF GEOPOLYMER FOAMS FOR DECONTAMINATION OF LIQUID NUCLEAR WASTE

Svetlana Petlitckaia, CEA, DEN, DE2D, SEAD, Cements and Bitumen waste Conditioning Laboratory, F-30207 Bagnols-sur-Cèze, France
svetlana.petlitckaia@cea.fr
Arnaud Poulesquen, CEA, DEN, DE2D, SEAD, Cements and Bitumen waste Conditioning Laboratory, F-30207 Bagnols-sur-Cèze, France
Yves Barré, CEA, DEN, DE2D, SEAD, Laboratory of supercritical process, F-30207 Bagnols-sur-Cèze, France

Key Words: monolithic foams, blowing agent, copper hexacyanoferrate, cesium decontamination

Liquid radioactive waste is produced in the nuclear industry and has to be treated to firstly minimize their impact on environment and secondly to propose an ultimate confinement matrix. One way to decontaminate these waste is to synthesize inorganic monolithic filters that are less sensitive to radiolysis phenomena than organic ones. Geopolymer cements are good candidates to fulfill these specifications since intrinsically they are mesoporous with high specific surface area [1] and compatible with specific grafting agents which allow to trap selectively radionucleides of interest (especially the cesium) [2]. For this purpose, a monolithic geopolymer with good mechanical resistance and hierarchical porous network (tailored open macroporosity) was synthesized.

From this geopolymer foam, the precipitation of copper hexacyanoferrate into the porous network has been performed in order to trap selectively the cesium. The functionalized foams were characterized and the trapping capacity of Cs was assessed. After having determined the sorption kinetics, sorption isotherms were performed and the maximum sorption capacity, Q = 120 mg/g, was measured. Tests in a radioactive environment were also carried out in order to validate the performance of the material in real conditions (traces of Cs in fresh water). The results show that the functionalized material is capable of selectively trapping Cs with a distribution coefficient K_d of 2.37 10^5 ml/g. The results demonstrate remarkable potential of this innovative material for Cs removal from liquid nuclear waste.

[1] Steins, P., A. Poulesquen, O. Diat, and F. Frizon, Structural Evolution during Geopolymerization from an Early Age to Consolidated Material. Langmuir, 2012. 28(22): p. 8502-8510.
[2] Poulesquen. A, A. Gerenton, D. Lambertin, T. Piallat, F. Frizon, Y. Barré, A. Grandjean, Procédé de préparation d'une mousse de géopolymère fonctionnalisée, ladite mousse fonctionnalisée et ses utilisations », Brevet, FR 15/53868.