CESIUM INCORPORATION IN METAKAOLIN-BASED K-GEOPOLYMER

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Recently, considerable attention has been paid to using synthetic zeolites and titanates for cleanup of the waste water containing Cs and Sr radionuclides from Fukushima Daiichi Nuclear Power Plant. It has been considered that geopolymers have high potential for immobilization of Cs- and Sr-loaded zeolites and titanates, but more studies are needed to validate the geopolymers for radioactive waste disposal. The interaction of cesium with metakaolin-based K-geopolymer is studied in this paper. Geopolymers with composition of SiO_2/K_2O: Al_2O_3/K_2O: H_2O/K_2O = 1:1:11 were synthesised and characterised based on ref. [1]. The binding of Cs and release of K in varying CsOH concentration were determined using ICP-AES (Figure 1). At very low concentration, the same amount of K is released for the binding of Cs, but the release of K is much higher than binding of Cs at high concentration of Cs. It is suggested that CsOH solution may promote the dissolution of geopolymer at high concentration. The results of zeta potential measurement indicate that there is no specific adsorption of Cs on geopolymer because the absolute value of zeta potential is increasing slightly with Cs concentration (Figure 2). Thus, the primary mechanism for Cs incorporation in geopolymer is exchange with K.

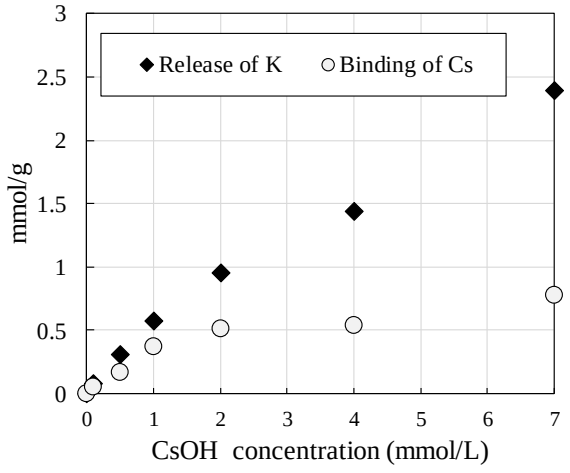

Figure 1 – Binding and release of Cs and K respectively as function of CsOH concentration (the leaching of initial K in the absence of Cs is deducted in each measurement)

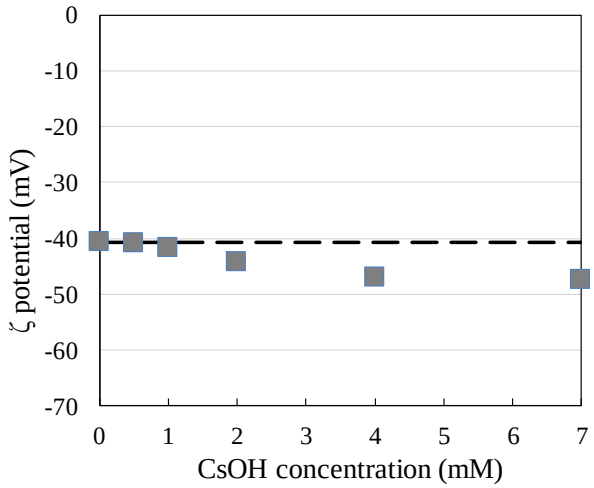

Figure 2 – Zeta potential of geopolymer suspension in CsOH for a constant ionic strength of 10 mM. Ionic strength was adjusted by KNO_3

References

[1] P. Duxson, J. L. Provis, G. C. Lukey, S. W. Mallicoat, W. M. Kriven, and J. S. J. Van Deventer, "Understanding the relationship between geopolymer composition, microstructure and mechanical properties," *Colloids Surfaces A Physicochem. Eng. Asp.*, vol. 269, no. 1–3, pp. 47–58, 2005.