

Safety Analysis of Cementation Including Deliquescent Na Compound for Final Disposal

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1. Introduction

According to acceptance criteria of disposal site, deliquescent Na and its compound not be accepted in humid environments [1]. The representative Na compounds are NaNO_3 , Na_2SO_4 and NaCl , and liquid radwastes including them have to solidify to disposal.

The purpose of this work, in order to dispose cementation of radwastes including Na compounds, evaluate the stability as varying temperature and humidity of disposal site.

2. Materials and Methods

For the experiments, simulated NaNO_3 and KNO_3 were used and Portland cement type 1 was used for the cementation.

The mixture of cement and liquid wastes were mixed following “Testing method for mechanical mixing of hydraulic cement pastes and mortars of plastic consistency” (KS-L-5109, KS). We prepared 3 cementation samples and averaged 3 results per each case.

The temperature and humidity were constantly kept for 12 hours using a thermo-hydrostat. Considering the temperature of disposal site, the experiment temperature varied as 5, 10 and 15°C, the humidity also changed as 100, 80, 70, 50, 30 and 10% per each temperature. We measured extracted salt by the humidity changes.

3. Results and Discussion

3.1 Relationship between NaNO_3 contents and deliquescent



Fig. 1. Picture of cement waste form samples with NaNO_3 and extracted salt.

Fig. 1 shows the picture of cement waste form samples with NaNO_3 and extracted salt from the sample.

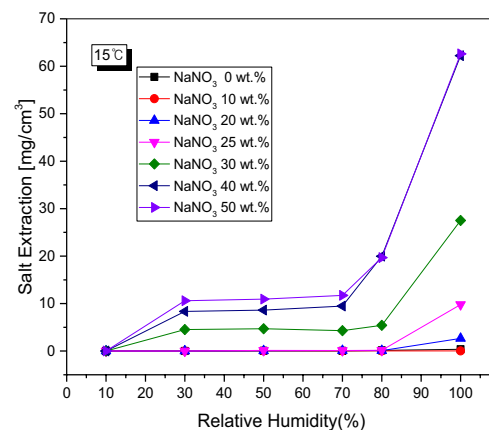


Fig. 2. The amount of extracted salt from cement waste form with different NaNO_3 contents and relative humidity at 15°C.

Fig. 2 shows the amount of extracted salt from cement waste form with different NaNO_3 contents and relative humidity at 15°C. The deliquescent increased after 70% humidity, and it was observed that the higher NaNO_3 contents, the higher deliquescent, and rapidly increased after 100%.

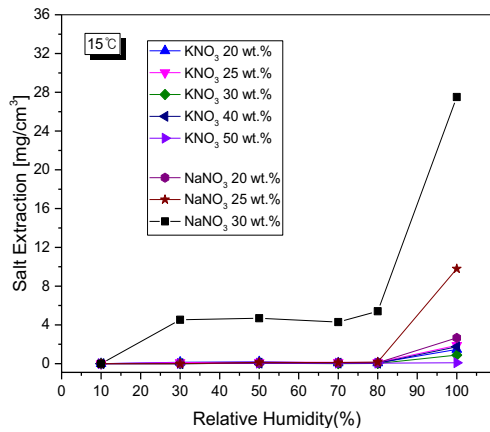


Fig. 3. The amount of extracted salt from cement waste form with different NaNO₃ and KNO₃ contents in varying humidity condition at 15 °C.

Fig. 3 shows the amount of extracted salt from cement waste form with different NaNO₃ and KNO₃ contents, which has no deliquescent, in varying humidity condition. Up to 20wt.% of NaNO₃, the amount of extracted salt is almost same with that of KNO₃ even in 100% humidity, over the 20wt.%, while, the amount of extracted salt is larger than that of KNO₃.

4. Conclusion

According to our results, the cementation of NaNO₃ up to 20wt.% shows no deliquescent properties in disposal site environments. Thus, it has stability for final disposal.

REFERENCES

- [1] Korea Radioactive Wastes Agency, "Safety analysis report of Low-and intermediate-Level Radioactive Waste Disposal Facility", 2008.