

## Compressive Strength of Cement Solidification of Metal Hydroxide Waste

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### 1. Introduction

Numerous uranium soil waste from a uranium conversion facility has been stored in KAERI since 2010. Various studies on decontamination for uranium soil waste have been carried out [1-3]. All radioactive waste is not received at permanent disposal site of KORAD (Korea Radioactive Agency). Radioactive material (concentrated liquid waste, waste resin, waste sludge) generated from the decontamination process has to solidify and pass the integrity test of KORAD for permanent disposal. For permanent disposal, several studies on cement solidification of the radioactive waste have been conducted [4-7].

In this study, to study the characteristics of cement solidification on metal hydroxide waste for permanent disposal, the experiment of solidified cement was conducted. The compressive strength of cement solidification, which was immersed in demineralized water for 90 days was measured and analyzed on the ratio waste to cement and water amount.

### 2. Experiment and Measurement

#### 2.1 Sample Preparation

Table I shows test conditions of cement solidification. According to Table I, water, Portland 1 species, and waste were homogeneously mixed using a Mortar Mixer (HJ-1150). The mixing material is put into a polyethylene mold (ID 50mm, H 120mm) and solidified for 4 weeks. After solidifying the mixing material for 4 weeks, cement solidification was finished. Fig. 1 shows cement solidification process.

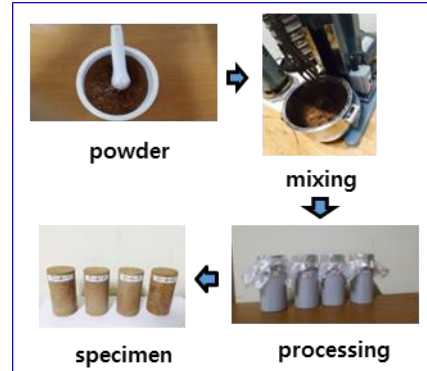


Fig. 1. Cement solidification process.

#### 2.2 Measurement

Fig. 2 shows fracture of cement solidification. The purpose of the compressive strength test for cement solidification is to evaluate durability of cement solidification at a permanent disposal site. The criterion of compressive strength is more than  $34 \text{ kg} \cdot \text{f}/\text{cm}^2$ . The compressive strength of the solidified cement immersed in demineralized water for 90 days was measured and analyzed.

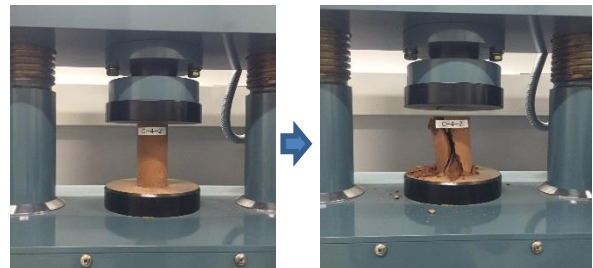


Fig. 2. Compressive strength process.

Table I: Test Conditions

Specimen	Waste(g)	Cement(g)	Water(g)
C-2.0-60	2.0(106.95)	1(53.481)	1.80(96.253)
C-2.0-70	2.0(97.560)	1(48.786)	2.10(102.44)
C-2.0-80	2.0(89.687)	1(44.849)	2.40(107.62)
C-1.8-60	1.8(103.56)	1(57.541)	1.68(96.657)
C-1.8-70	1.8(94.435)	1(52.471)	1.96(102.83)
C-1.8-80	1.8(86.788)	1(48.221)	2.24(108.00)
C-1.6-45	1.6(116.60)	1(72.890)	1.17(85.270)
C-1.6-50	1.6(110.30)	1(68.970)	1.30(89.640)
C-1.6-60	1.6(99.620)	1(62.270)	1.56(97.130)

### 3. Result and Discussion

Table II shows the criteria of integrity test for solidified waste. Fig. 3 shows compressive strength of the solidified cement due to water amount and waste amount. It was determined that the compressive strength of all the solidified cement pass the criterion of integrity test of KORAD. As waste amount increases, compressive strength shows a decreasing trend. In case of the ratio of waste amount to cement amount is same, as water amount increases, compressive strength indicates a decreasing trend.

Table II: Criteria of Integrity Test for Solidified Waste

Test	Test content	Standard	Test method	Criteria
Structural stability	Compressive strength	Hard mat.: KS F2405 Soft mat.: KS F2351	-	Hard mat. $\geq$ 3.44MPa Soft mat. $\geq$ 0.41MPa
	Immersion test	NRC*	After immersion of 90 days	Pass of compressive strength
	Thermal cycle test	ASTM B553	After thermal cycle test	Pass of compressive strength
	Irradiation test	NRC*	Ion exchange: 1.0E+6Gy Exception of ion exchange: 1.0E+7Gy	Pass of compressive strength
Leachability	Leaching test	ANS 16.1	Cs, Sr, Co Nuclide	Leachability index $\geq$ 6
Free water	Object	ANS 55.1	-	Free water < 0.5 %
	Specimen/solid	EPA**	-	Free water < 0.5 %

\* NRC 「Technical Position on Waste Form, Rev.1」

\*\* EPA Method 9095B (Paint Filter Liquid Test)

as water amount increases, compressive strength indicates a decreasing trend.

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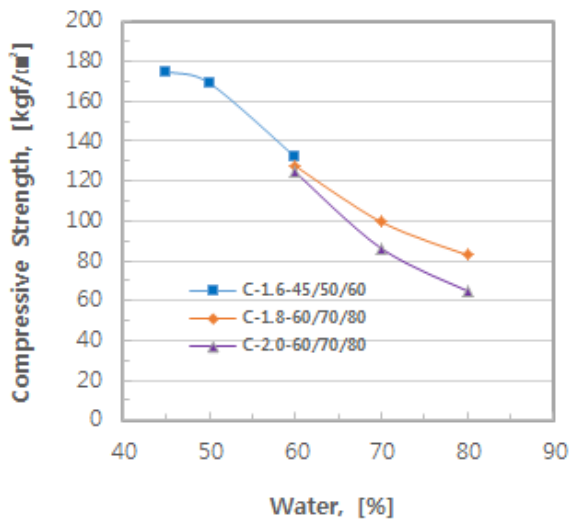


Fig. 3. Compressive strength of cement solidification.

## 4. Conclusion

To study the characteristics of cement solidification on metal hydroxide waste for permanent disposal, the compressive strength of solidified cement immersed in demineralized water for 90 days was measured and analyzed. It was determined that the compressive strength of all the solidified cement pass the criterion of integrity test of KORAD. As waste amount increases, compressive strength shows a decreasing trend. In case of the ratio of waste amount to cement amount is same,