Experimental Study of the Analysis Method for Paste Content in the Waste Concrete

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1. Introduction

The greatest amount of waste that occurs during the dissolution of nuclear power plants is concrete. In the concrete of the radioactive elements of the cement paste is present in most cases, separating the parts of the aggregate, a radioactive concrete waste volume can be greatly reduced.

The purpose of this study is to obtain the basic data necessary for developing a method of effectively Solidifying cement paste separating the aggregate from the waste concrete and finding a method for inferring the paste content of the waste concrete.

2. Experiments

2.1 Materials

The cement paste was made W/C = 0.40 and cured for 3 months in room temperature. After cured, the paste was crushed to several millimeters using jaw-crusher. And they were dried at 100℃ to remove moistures. Dried powers were mixed with three types of sand up to 100wt.% each 20% at a constant ratio(ISO standard sand, Crushed sand, Sea sand).

2.2 Experiment Methods and Items

In order to get the reference guide for a portion of cement paste in a mortar, we use X-ray fluorescence analysis method (XRF, Rigaku, Japan, ZSX Primus II) and measurements of loss on ignition at 600℃ for 90 min. using the electric furnace.

To estimate cement pastes contents in the mortar, we used CaO content which get from XRF analysis results and weight loss of mixtures.

2.3 Result of Paste Content calculation

The results of the XRF analysis for the sand and mixtures are shown in table 1~2. XRF analysis results showed that there is a good relationship between the measure values of CaO with cement pastes contents in mortars (Fig.1).

For three type of sand, ignition loss of mortar at 600℃ showed few differences but the good relationship for cement paste content (Fig.2).

Table 1. XRF analysis of Sand

No	Sand Type	Chemical Composition(%)		
		CaO	SiO_2	Al_2O_3
1	ISO	0.1	97.7	0.6
2	Crushed	0.9	80.5	7.6
3	Sea	2.9	70.4	12.1

Table 2. Test results for mixtures (paste, sand)

No	Type	Mixture ratio(%)		Results(wt.%)	
		Paste	Sand	CaO	Ignition Loss
1	ISO Standard Sand	-	100	0.1	0.1
2		20	80	9.6	2.5
3		40	60	21.7	5.1
4		60	40	36.1	7.7
5		80	20	49.5	10.5
6		100	-	70.8	13.0
7	Crushed Sand	-	100	0.9	0.4
8		20	80	10.8	2.8
9		40	60	23.7	5.4
10		60	40	34.5	7.9
11		80	20	51.0	10.5
12		100	-	70.8	13.2
13	Sea Sand	-	100	2.9	0.6
14		20	80	14.4	3.0
15		40	60	24.1	5.5
16		60	40	39.5	8.0
17		80	20	55.5	10.5
18		100	-	70.8	13.2

The result according to CaO contents of XRF analysis or weight loss of mixtures at 600℃, we found to predict approximate contents of cement paste in the recycled concrete is possible. And this method will be useful to solidifying process concrete

waste from decommissioning a nuclear plant. If we know cement paste contents in concrete waste, solidified concrete waste would be made more safe and durable by control portions of mixtures(waste, solidifying agent and water etc.)

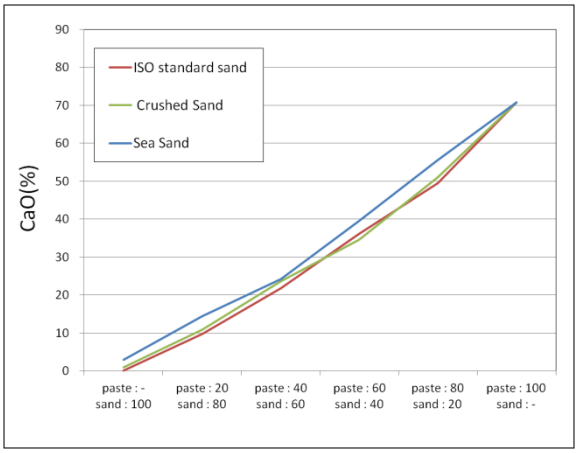

Fig. 1. Analysis of CaO contents of mixtures.

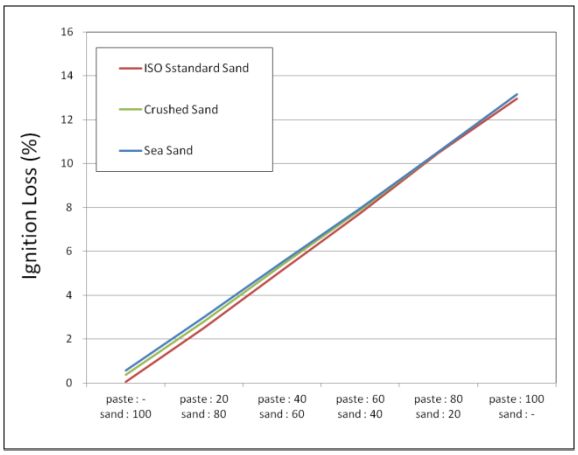

Fig. 2. Analysis of Ignition Loss of mixtures.

3. Discussion and Conclusion

In this study, we used cement paste cured for 3 months and maybe there are some differences in periods of curing time for cement pastes. Therefore it should be considered that periods of curing time could effect on the results of analysis. To make sure this, we prepared specimens cured for 12 months or more, and we will carry same research to get more data.

Fig. 1 and Fig. 2 show there are good relationship CaO contents get from XRF analysis data or weight loss of mortar at 600℃ with cement paste content in the mixtures. Therefore, if we use these analysis methods to estimate approximate cement paste contents in a mortar and apply obtained data in the solidification process for concrete waste that occurs during the dissolution of nuclear power plants, solidifications would be more safe and durable.

ACKNOWLEDGEMENT

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