Study on Metal Ions Treatment From Electro-Decontamination Wastes Using Pilot Scale Equipment

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1. Introduction

The Regenerable Electro Decontamination is easy to regenerate electrolyte by using a precipitation process to remove metal ions. The generated metal precipitates can be converted from oxalate to oxide through a calcination process and treated as a safe compound. In this study, the regenerable electro decontamination process was evaluated by the pilot scale equipment.

2. Experiment

2.1 Experiment method

The liquid waste from electro decontamination was used to regenerate eletrolyte through a waste regeneration process. The experiment was carreid out the following conditions.

Table 1. Process condition

Process	Agent	Con.	Time	Temp.
Reduction	N_2H_4	0.08 M	1 hr	90℃
Precipitation	$C_2H_2O_4$	2.75 M	6 hr	RT
Calcination	-	-	-	300℃

2.2 Equipment

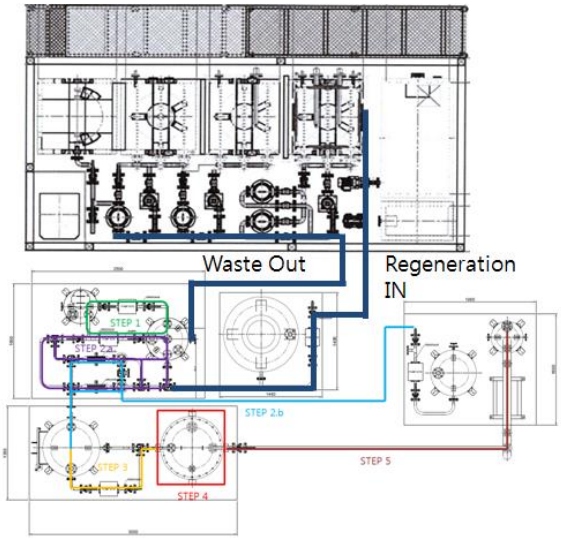

Fig. 1. Lay out of Regenerable Electro Decontamination pilot equipment.

The regenerable electro decontamination pilot equipment consist of two sub system; electro decon pilot and waste regeneration pilot.

As shown in the fig 1, the liquid waste is discharged into regeneration pilot and precipitation process is carried out. After the precipitation, metal precipitates are filtered using the multiple size of filters and calcined by a thermolysis equipment.

3. Results and Analysis

3.1 Metal precipitates analysis

Metal precipitates were sampled and analyzed for

constituents before and after calcination.

The following figures show pre-calcination and post-calcination precipitates.

Fig. 2. Before calcination of metal preciptiates (L).

Fig. 3. After calcination of metal preciptiates (R).

Table 2. FE-EPMA analysis results

Element	Atom(%)	
	Before	After
Fe	39.61	30.82
Ni	6.87	5.25
O	49.38	63.85
Cr	N.D	0.06
C	4.12	N.D

As a result of FE-EMPA analysis, it was confirmed that before precipitates were form of oxalate containing carbon. After calcinations, carbon was not detected in precipitates. The element ratio Metal : O of precipitates after calcination is 1 : 1.7, which is similar to the ratio 1 : 1.5 of Fe_2O_3 and Ni_2O_3. This result shows that precipitates have converted from oxalate to oxide.

3.2 Regenerated Electrolyte analysis

The removal rate of metal ions was analyzed by comparing the metal ions in the electrolyte. The removal rate of Fe ions was about 80% and all of Ni ions were precipitated. In case of Cr ion, It was not precipitated with oxalic acid. So Cr ions concentration was remained.

Table 3. Metal ion concentration in Electrolyte(ICP-OES)

Element	Concentration(ppm)		
	Fe	Cr	Ni
Before	150.24	34.18	20.37
After	27.32	28.35	N.D

4. Conclustion

As a result, most of the results were similar with lab scale tests. With this result, it can be conferred that the regenerable electro decontamination can remove nuclides in the base material and lower the radioactivity level. The liquid waste can be used for a longtime through the regeneration process and the solid waste can be easily treated by removing the chelate agent from the metal precipitates. Through this study, we expect that this process will contribute to not only decontamination but also waste volume reduction.

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