

The Hong Kong Polytechnic University
Department of Civil and Environmental Engineering
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Laboratory Worksheet C13a : **Toxicity Characteristic Leaching Procedure (CRT waste)**.

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Objective : To determine whether a given waste sample is hazardous or not using the Toxicity Characteristic Leaching Procedure.

Introduction

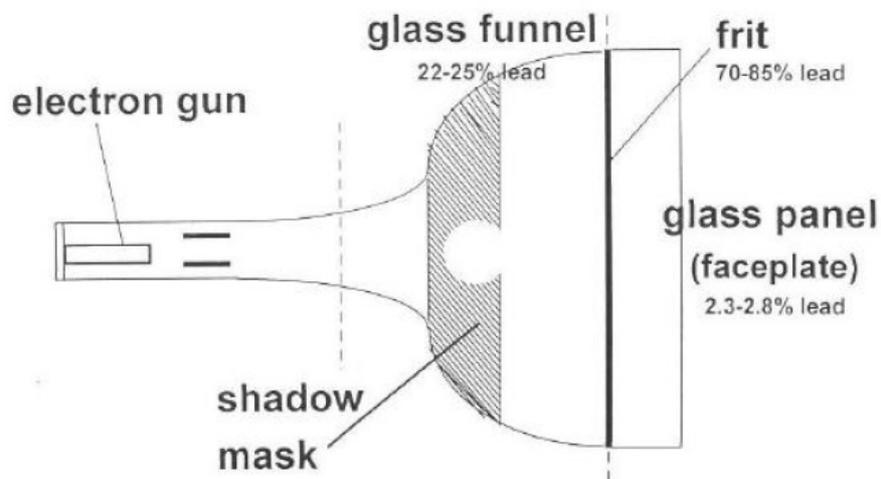
In order to regulate and control hazardous waste, a clear definition of hazardous waste is necessary. Many attempts have been made by government, industry, and the general public to define hazardous waste. The toxicity Characteristic Leaching Procedure (TCLP) is one of the criteria used by the United States EPA for classifying hazardous waste. The test is designated to identify wastes likely to leach hazardous concentrations of particular toxic constituents into the groundwater as a result of improper management. During the procedure, a sample of crushed waste is extracted with acetic acid solution for 18 hours at a 20:1 liquid-to-solid ratio. This manner of extraction attempts to stimulate the leaching actions that occur in landfills. The extract is then analyzed to determine if it possesses certain toxic contaminants. If the concentrations of the toxic constituent exceed the regulatory levels, the waste is classified as hazardous.

Apparatus and Materials

- Glacial acetic acid
- Pipette and pipette filler
- 1 L volumetric flask
- Waste samples
- Hammer
- Analytical balance
- 9.5 mm sieve
- 500 mL wide mouth bottle
- Rotary tumbler that rotates at 29 rpm
- Filtering apparatus
- pH meter
- Atomic absorption spectrophotometer.

Waste Samples

CRT Components



- Sample 1: Crushed CRT funnel glass.
- Sample 2: Crushed CRT panel glass.
- Sample 3: Acid washed CRT funnel glass.
- Sample 4: Acid washed CRT panel glass.

Preliminary Evaluation of Samples

1. Weigh out a small subsample of the waste sample and reduce the subsample to a particle size of approximately 1 mm in diameter or less.
2. Transfer 5.0 g of the treated sample to a 500 mL beaker.
3. Add 96.5 mL distilled water to the beaker and stir vigorously for 5 min.
4. Measure the pH. If the pH is < 5.0, use extraction fluid #1.
5. If the pH is > 5.0, add 3.5 mL 1N HCl. Mix and heat to 50°C for 10 min.
6. Let the solution cool and measure the pH again. If the pH is < 5.0, use extraction fluid #1. Otherwise use extraction fluid #2.

Procedure

Extraction Fluid #1: Dilute 5.7 mL of glacial acetic acid and 64.3 mL of 1N NaOH with distilled water to 1 L using a volumetric flask. This is the extraction fluid. It should have a pH of 4.93.

Extraction Fluid #2: Dilute 5.7 mL of glacial acetic acid with distilled water to 1 L using a volumetric flask. This is the extraction fluid. It should have a pH of 2.88.

1. Crush the given waste sample using a hammer to obtain 20 g or more of crushed sample that passes through a 9.5 mm sieve.
2. Measure accurately 20.0 of the crushed waste and put it in a 500 mL wide mouth bottle and then add 400 mL of the extraction fluid to the bottle. Close the bottle with the screw cap.
3. Put the bottle into the rotary tumbler and rotate for 15 minutes. (The actual extraction should last for 18 hours)
4. Remove the bottle from the rotary tumbler and filter the extract.
5. Measure the pH and metal contents of the extract using the pH meter and the atomic absorption spectrophotometer, respectively.

Calculations

Calculate total and leachable metals of the samples and determine the efficiency of the acid wash treatment.

Questions

1. Compare the result of your extraction with the regulatory limit of TCLP for lead using Table I. Is the waste hazardous or not according to TCLP? Comment on the success of the acid wash process.
2. Discuss briefly on the factors that would affect the TCLP test results.

Reference

1. Hazardous Waste Management, Charles A. Wentz 1989, McGraw-Hill.
2. Method 1311, Test Methods for Evaluation Solid Waste, Volume 1C: Laboratory Manual Physical /Chemical Methods, USEPA.

Table I. Comparison of Regulatory Limits (mg/L) for Various Test Procedures.

Metal	EPT	TCLP	1988 TCLP	California		CGSB
				TTLC	STLC	
Antimony				500	15.00	
Barium	100.0	100.0				100.0
Beryllium				75	0.75	
Cadmium	1.000	1.000	0.066	100	1.00	0.50
Chromium (3+)	5.000	5.000	0.094	2500	560.00	5.00
Chromium (6+)	5.000	5.000		500	5.00	5.00
Cobalt				8000	80.00	
Copper				2500	25.00	
Lead	5.000	5.000	0.180	1000	5.00	5.00
Mercury	0.200	0.200	0.025	20	0.20	0.10
Nickel			0.048	2000	20.00	
Selenium	1.000	1.000	0.250	100	1.00	1.00
Silver	5.000	5.000	0.072	500	5.00	5.00
Thallium				700	7.00	
Vanadium				2400	24.00	
Zinc				5000	250.0	