

## The Activity: Determination of Alkalinity in Acid Mine Drainage

The determination of the alkalinity of a sample of mine water is determined through the use of a titration, or the HACH alkalinity kit provided.

If using the HACH kit, follow instruction included with the kit.

### Materials:

- Sulfuric Acid (0.02N)
- Beakers/Erlenmeyer Flasks
- Burets
- Buret clamps
- Ring stands
- Oven For drying chemicals, or chemicals bought at correct concentration
- Pipettes/graduated cylinder
- Indicators - bromcresol green, metacresol purple or phenolphthalein

### I. Procedure

- A. Fill buret to the top with  $\text{H}_2\text{SO}_4$ , remove all air bubbles from the tip and empty the buret to 0.00.
- B. Record the initial reading from the buret.
- C. Record the concentration of the  $\text{H}_2\text{SO}_4$  solution.
- D. Place 50.0 ml of the sample in a clean beaker or Erlenmeyer flask
- E. Add a clean stir bar and place on stir plate if available, if not, swirl beaker with your hand after each addition of  $\text{H}_2\text{SO}_4$ .
- F. Add 5 drops of indicator, bromcresol green, the solution will be blue if the pH is above 4.5. 1. If the pH is below 4.5 discontinue, there is no alkalinity present.
- G. Titrate slowly with 0.02N  $\text{H}_2\text{SO}_4$  to a pH of 4.5 (light violet gray) being careful to stir thoroughly after each addition.
- H. Allow the pH to reach equilibrium before adding more acid.
- I. When the end point is near, add  $\text{H}_2\text{SO}_4$  dropwise.
- J. Titrate to the endpoint pH of 4.5 (light violet gray).
- K. Record the volume of  $\text{H}_2\text{SO}_4$  added to the sample.

### II. Calculation of Alkalinity

Titration to a pH of 4.5

$$\text{Alkalinity, mg/L CaCO}_3 = [(\text{ml H}_2\text{SO}_4) \times (\text{Normality of H}_2\text{SO}_4) \times (50,000)] / [\text{ml of sample used}]$$

## The Activity: Determination of Acidity in Acid Mine Drainage

The determination of the acidity of a sample of mine water is determined through the use of a titration, or the HACH alkalinity kit provided.

If using the HACH kit, follow instruction included with the kit.

For Titration to be completed, the following items need to be available:

- Sodium Hydroxide (0.02N)
- Sulfuric Acid (0.02N)
- Beakers/Erlenmeyer Flasks
- Burets
- Buret clamps
- Ring stands
- Pipettes/graduated cylinders
- Indicators - phenolphthalein

### I. Procedure (Hot Peroxide)

- A. Fill burets to the top with NaOH and H<sub>2</sub>SO<sub>4</sub>, remove all air bubbles from the tip and empty the buret to 0.00
- B. Record the initial reading from the buret.
- C. Record the concentration of the NaOH and H<sub>2</sub>SO<sub>4</sub> solutions.
- D. Place 50.0 ml of the sample in a clean beaker or Erlenmeyer flask.
- E. Add a clean stir bar and place on stir plate if available, if not, swirl beaker with your hand after each addition of titrant.
- F. Measure the pH of the sample with pH paper, if the pH is above 8.3, discontinue, there is no alkalinity present
- G. If the pH is above 4.0 add standardized H<sub>2</sub>SO<sub>4</sub> in 5ml increments to lower the pH to 4.0 or below. If you have completed the alkalinity, it should give you a feel for the amount of H<sub>2</sub>SO<sub>4</sub>. Test the pH with pH paper.
- H. Add the amount of H<sub>2</sub>SO<sub>4</sub> needed to bring the pH to less than 4.
- I. Add 5 drops of 30% H<sub>2</sub>O<sub>2</sub> to the sample.
- J. Boil for 2-5 minutes.
- K. Cool to room temperature.
- L. Add 5 drops of indicator, phenolphthalein. The solution should be colorless.
- M. Titrate slowly with 0.02N NaOH being careful to stir thoroughly.
- N. Allow the pH to obtain equilibrium before adding more NaOH.
- O. Titrate to the endpoint of a pH of 8.3, pink.

### I. Calculation of Acidity

Titration to a pH of 8.3.

$$\text{Acidity, mg/L CaCO}_3 = [(A * B) - (C * D)] * 50,000 / [\text{ml of sample used}]$$

A = ml of NaOH used

B = normality of NaOH

C = ml of H<sub>2</sub>SO<sub>4</sub> used

D = normality of H<sub>2</sub>SO<sub>4</sub>