Instruction Sheet

Technical Bulletin 517 – Total Alkalinity Measurement in Natural Waters

Background Information

Alkalinity measurement is important in the control of water and wastewater treatment. In a sample, alkalinity is defined as the quantitative ability to react with (neutralize) a known quantity of standard acid. Many commonly occurring materials, such as carbonate, bicarbonate, phosphates, and hydroxides, increase alkalinity in natural waters.

Conventional Ways to Measure Alkalinity

Alkalinity is measured commonly by titration, using either a burette or the drop count technique. A sample is titrated with an acid solution, which neutralizes the alkaline species present. The endpoint is determined by observing a color change or by titrating to a pH value of 4.5, using a pH electrode as an indicator. The volume of titrant required to change the color to reach the endpoint is then used to calculate total alkalinity. Both methods have limitations. Sample color or turbidity affects the operator's ability to detect the color change. Use of a burette or dropper is tedious and time-consuming.

Fast and Easy Alternative to Measure Alkalinity

The Thermo Scientific Orion total alkalinity test kit simplifies routine alkalinity measurement. Save time by eliminating additional equipment setup, tedious titrations and calculations. The total alkalinity test kit is ideal for field use. Results are unaffected by sample color or turbidity, and the kit does not require tedious drop counting.

- Direct readings of 0 to 225 ppm as $CaCO_3$
- No titration needed
- No special equipment needed
- No interferences from color or turbidity
- Ideal for field determination

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How The Total Alkalinity Test Kit Works

The principle of operation for the total alkalinity test kit is the same as the conventional titration. A reagent composed of several acids reacts with the alkaline species in the sample. As a result, the pH of the sample changes. The observed pH reading after the addition of the reagent varies directly with the total alkalinity, see **Figure 1**. Each pH reading corresponds to a unique value for alkalinity, expressed in ppm as $CaCO_3$.

Using your own pH electrode and pH meter, measure total alkalinity directly. Just calibrate for pH as usual, add the total alkalinity reagent and read total alkalinity in ppm as $CaCO_3$ from the conversion wheel included in the kit.

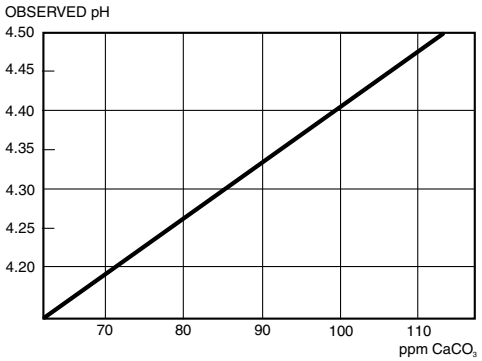

Figure 1 – Total Alkalinity Test Kit Observed pH vs. ppm $CaCO_3$

Total Alkalinity Test Kit Instructions

Find the expected sample concentration range using **Chart 1** and use the indicated volumes of sample and total alkalinity reagent. If pH must be reported, measure and record the pH of the sample prior to reagent addition. Follow the instructions below for measurement of total alkalinity.

1. Calibrate the pH electrode and meter using pH 7 and pH 4 buffers, according to the meter user guide.
2. Use a pipette or graduated cylinder to measure 100 mL of sample into beaker.
3. Pipette the appropriate amount of total alkalinity reagent into the sample and mix the solution well. See **Chart 1**.
4. Measure the resulting pH of the sample.
5. Using the indicated side of the total alkalinity conversion wheel, find the resulting pH value and read total alkalinity of sample in ppm as $CaCO_3$.

Chart 1

Expected Sample Concentration	Standard Volume	Reagent Volume	Expected Value
0 to 25 ppm	1 mL	1 mL	4.64 ± 0.05
0 to 225 ppm	10 mL	10 mL	4.41 ± 0.05

Measure the total alkalinity standard/control every 10 samples or daily as a verification of measurement. See the **Use of Total Alkalinity Standard/Control** section.

Use of Total Alkalinity Standard/Control

Use the total alkalinity standard/control daily, or after every ten samples, for verification of proper measurement.

Chart 2

Range	Sample Volume	Reagent Volume	Wheel Side	Accuracy
Low level 0 to 25 ppm	100 mL	1 mL	Blue	± 0.5 ppm
Full 0 to 225 ppm	100 mL	10 mL	Gray	± 5 ppm
Greater than 225 ppm	10 mL diluted to 100 mL with distilled water	10 mL	Gray (multiply results by 10)	± 5 ppm

1. Carefully pipette the appropriate volume of 1,000 ppm standard/control into a clean 100 mL volumetric flask and dilute to the mark with deionized water. Mix the solution well.

2. Transfer the solution to a clean beaker and add the appropriate volume of total alkalinity reagent. Mix the solution well.

3. Calibrate the pH electrode and meter using pH 7 and pH 4 buffers, according to the meter user guide.

4. Measure the pH of the control. See **Chart 2** for expected values.

If the pH value of the control is not within the range:

1. Recalibrate the pH electrode and meter using fresh buffers. The electrode slope should be 92% to 102%.

2. Prepare a fresh control.

3. Check the alkalinity of the deionized water. Any alkalinity in the water used for diluting the standard will contribute to the total alkalinity measured in the control:

    a. Measure the total alkalinity of the deionized water, using the low level procedure, and multiply the result by 0.9. This value, AH_2O, is the contribution to the total alkalinity from the deionized water.

    b. Carefully pipette 10 mL of 1,000 ppm standard/control into a clean 100 mL volumetric flask, dilute to mark with deionized water, and mix the solution well.

    c. Transfer the solution to a clean beaker, add 10 mL of total alkalinity reagent, and mix the solution well.

    d. Measure the pH of the solution and use the gray side of the conversion wheel to read the total alkalinity, A.

    e. Determine the alkalinity of the control, Ac, using the following formula:

    $Ac = A - AH_2O$

    The value should be 100 ± 5 ppm.

Ordering Information

Cat. No.	Description
700010	Total alkalinity test kit, includes total alkalinity reagent, 1 x 475 mL bottle; alkalinity standard/control, 1 x 475 mL bottle; and total alkalinity conversion wheel. Average of 80 tests per kit.
700011	Total alkalinity reagent, 4 x 475 mL bottles
700012	Alkalinity standard/control, 1 x 475 mL bottle

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