AN #: 01_008_11_002
Market: Laboratory
Subcategory: Environmental
Product: HI902, HI921

Determining Strong and Total Alkalinity in Water

Description

Alkalinity is a measure of a water sample's ability to resist a pH change when reacted with an acid; and is an important measure of water quality. If a body of water has high alkalinity, it is highly resistant to changes in pH due to acid additions such as acid rain or industrial waste discharge. Conversely, low alkalinity means a body of water is susceptible to rapid pH changes, even from small acid additions. Alkalinity is important in natural waters due to the sensitivity of aquatic life to changes in pH. Generally, aquatic life thrives between pH 6 and 8. If the water pH is moved out of that range due to low alkalinity, fish, amphibians and invertebrate life are subject to stresses including impaired reproduction, inhibited growth, and the invasion of undesirable species.

Titration is the most common method used to measure alkalinity. While simple in theory, multiple variations of alkalinity testing can be performed. Each test variation yields different information about the sample. For example, above pH 8.3, alkalinity is present predominantly as carbonate (CO_3^{2-}) and hydroxide (OH^-) salts. Between pH 4.5 and 8.3, alkalinity is present mostly as bicarbonate (HCO_3^-) salts. At pH 4.5, the buffering capacity of these salts is exhausted, and these forms are almost completely converted to carbonic acid (H_2CO_3). An analyst can determine these various forms of alkalinity by adjusting the titration endpoint, as different alkalinity constituents are present in different proportions depending on pH.

A total alkalinity titration is commonly performed by adding hydrochloric acid titrant to the sample until reaching a pH 4.5 endpoint. The total alkalinity result incorporates contributions from all alkalinity forms (hydroxide, carbonate, and bicarbonate ion). A strong alkalinity test is performed by titrating the sample until a pH 8.3 endpoint. At this pH, alkalinity is converted from carbonate form to bicarbonate form. The strong alkalinity result incorporates alkalinity contributed by some of the carbonate present and hydroxide, but not bicarbonate. Strong alkalinity can only be present if the starting pH is above pH 8.3; otherwise, only weak alkalinity (alkalinity between pH 8.3 and pH 4.5) is present.

Application

An environmental laboratory contacted Hanna Instruments interested in testing strong and total alkalinity quickly and easily. The customer wanted an automatic titrator to reduce the time and monotony associated with manual titrations; this would allow technicians to use their time more effectively on other tasks and increase throughput. The laboratory ran 30 alkalinity samples a day for both strong and total alkalinity. Hanna Instruments suggested the **HI902** Automatic Potentiometric Titrator with **HI921** Autosampler. The laboratory often ran strong and total alkalinity on the same sample, so Hanna Instruments suggested the use of a linked method with the autosampler. The use of linked methods allowed the customer to run multiple analyses on the same sample without interruption.

The customer opted for the 18-beaker autosampler tray on which they loaded one beaker for electrode storage, two beakers for a dip rinse, and 15 beakers for samples. After selecting the appropriate alkalinity methods on the titrator and programming the autosampler sequence, starting the analysis of all samples was as easy as pushing the "Start/Stop" button. After the analysis was complete, a full report on every sample for both methods was automatically generated and stored to the titrator's memory. The customer valued the ease of use and total automation of their linked alkalinity titrations. The use of the HI902 titrator with the HI921 autosampler not only saved them time, but increased their accuracy compared to manual titration. The HI902 and HI921 combination proved to be a perfect fit for the customer's needs.