

ALKALINITY AND ACID NEUTRALIZING CAPACITY 6.6

Alkalinity and the acid neutralizing capacity (ANC) are determined using identical electrometric procedures involving the acidimetric titration of a sample; the only difference is that the alkalinity sample is filtered, but the ANC sample remains unfiltered. The terms alkalinity, ANC, and carbonate alkalinity are used in this manual as follows:

- ▶ **Alkalinity** applies to the acid neutralizing capacity of solutes in a water sample, reported in equivalents per liter (or milliequivalents or microequivalents). Alkalinity, thus, consists of the sum of titratable carbonate and noncarbonate chemical species in a **filtered water sample** (filter membrane of 0.45- μm or less pore size).
- ▶ **ANC** applies to the acid-neutralizing capacity of solutes plus particulates in an **unfiltered water sample**, reported in equivalents per liter (or milliequivalents or microequivalents). (The ANC value would be equivalent to alkalinity for samples without titratable particulate matter.)
- ▶ **Carbonate alkalinity** represents the acid-neutralizing capacity of carbonate solutes ($\text{HCO}_3^- + 2m\text{CO}_3^{2-}$, where m is moles), reported either in equivalents per liter (or milliequivalents or microequivalents) or in milligrams per liter as a carbonate species, and titrated on a **filtered water sample**. In many aqueous systems, alkalinity is controlled by carbonate chemistry and most commonly is attributable to bicarbonate (HCO_3^-) and less frequently to carbonate (CO_3^{2-}).

Alkalinity: the capacity of solutes in an aqueous system to neutralize acid.

Acid Neutralizing Capacity (ANC): the equivalent sum of all bases or base-producing materials in an aqueous system that can be titrated with a strong acid to an equivalence point.

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Alkalinity is used routinely in checking the charge balance of a solution and to gain insights on the evolution of aqueous systems. Alkalinity and ANC provide information on the suitability of water for uses such as irrigation, determining the efficiency of wastewater processes, determining the presence of contamination by anthropogenic wastes, and maintaining ecosystem health.

Alkalinity is determined on a filtered sample.

Any substance in the water sample that reacts with the strong titrant acid can contribute to the water's acid neutralizing capacity.

- ▶ Important noncarbonate contributors include organic ligands (especially acetate and propionate) and ions of hydroxide, phosphate, ammonium, silicate, sulfide, borate, and arsenate (Hem, 1985).
- ▶ Except for unusual natural waters and waters significantly affected by human activity, noncarbonate ionized contributors generally are not present in large enough quantities to affect alkalinity or ANC determinations.
- ▶ Particulate matter can be an important contributor, and must be filtered from samples to be titrated for the alkalinity determination.

TECHNICAL NOTE: Alkalinity and ANC are independent of exchange with carbon dioxide and other atmospheric gases. However, atmospheric gas exchange can alter concentrations of individual species, such as bicarbonate. Also, aeration of a sample during filtration can cause mineral precipitation on the filter—this alters alkalinity, especially in water systems closed to the atmosphere under ambient conditions.