ALTERNATE ALKALINITY METHOD

The P1/P2 back-titration method was mainly developed in an attempt to overcome the limitations of the Pf/Mf alkalinity method. The P1/P2 method also has limitations. The table below lists a comparison of the generally accepted advantages and disadvantages of both methods.

TABLE NO. 1

METHOD	ADVANTAGE	DISADVANTAGE
PfMf	a. Traditional method b. Two titrations, one sample	a. Interference in the Mf titration b. Bicarbonate results normally too high
P1/P2	a. Eliminates interference in Mf titrations	a. Three titrations, three samples b. Caustic measurement critical c. Uses a toxic material (BaCL2)

EQUIPMENT:

PART NO.	DESCRIPTION	QUANTITY
147-54	PH strips, 7.5 – 14	1
153-16-1	25 ml graduated cylinder	1
153-20	5 ml graduated cylinder	1
153-26	poly titration dish	1
153-28	poly stir rod	1
153-34	1 ml pipette	1
153-36	2 ml pipette	1
153-40	10 ml pipette	2
206-02	distilled water 16 fl oz	1
220-00	phenolphthalein ind soln 2 fl oz	1
230-08	N/50 sulfuric acid soln 8 fl oz	1
260-01	N/10 sodium hydroxide soln 16 fl oz	1

275-04	N/50 hydrochloric acid soln 8 fl oz	1
285-07	10% barium chloride soln, neutralized 8 fl oz	1

OPTIONAL:

147-0	Corning model 106 PH meter	

PROCEDURE:

I. TITRATION NO. 1 (DETERMINATION OF Pf)
- A. Measure one or more cm3 of filtrate into the titration dish.
- B. Add two or more drops of the phenolphthalein indicator solution. If the indicator turns pink, add 0.02 normal (N/50) sulfuric acid, drop by drop from a 10 cm3 pipette, while stirring, until the pink color just disappears. If the sample is so colored that the indicator color change is masked, the end point can be taken when the pH drops to 8.3, as measured with a pH meter.
- C. Report Pf as the number of cm3 of 0.02 normal acid required per cm3 of filtrate.

II. TITRATION NO. 2 (DETERMINATION OF P1)
- A. Measure 1.0 cm3 of filtrate into the titration dish. Add 25 cm3 of distilled water to the titration dish.
- B. Add 2.0 cm3 of 0.1 normal (N/10) sodium hydroxide solution and stir well. Measure the pH with the high range pH paper (or pH meter). If the pH is 11.4 or greater, proceed to step II C. If the pH is less than 11.4, add 2.0 cm3 more of 0.1 normal sodium hydroxide solution.
  NOTE: Exact measurement of the sodium hydroxide is necessary to avoid serious errors.
- C. Using the cm3 graduated cylinder, measure 3 cm3 of barium chloride and add to the titration dish. Add 2 – 4 drops of phenolphthalein indicator solution while stirring.
  CAUTION: DO NOT PIPETTE BARIUM CHLORIDE. IT IS EXTREMELY POISONOUS.
- D. Immediately titrate the mixture with the standard 0.02 normal (N/50) hydrochloric acid to the first disappearance of the pink color (or to a pH of 8.3 with a pH meter). The color may reappear after a short time: DO NOT CONTINUE THE TITRATION.
- E. Report P1 as the cm3 of 0.02 normal hydrochloric acid required to reach the phenolphthalein end point.

III. TITRATION NO. 3 (DETERMINATION OF P2)
- A. Omit the filtrate, but otherwise repeat the procedures described in step II A through II E for the determination of P1, using exactly the same quantities of water and reagents in preparing the sample.
- B. Report P2 as the cm3 of 0.02 normal hydrochloric acid required to titrate the blank reagent mixture to the phenolphthalein end point.

IV. CALCULATIONS

When P1 > P2:
OH-, Mg/L = 340 (P1 – P2)

CO_3^{-2}, Mg/L = 1200 [Pf – (P1 – P2)]

When P1 < P2:
HCO_3^{-}, Mg/L = 1220 [Pf – (P1 – P2)]
CO_3^{-2}, Mg/L = 1200 Pf

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