Aquatic chemistry – Practical

Lab. No. (5)

Determination the Alkalinity of water sample.

Introduction.

The alkalinity of the water is a measure of its capacity to neutralize acids. The alkalinity of surface water due to presence of hydroxide (OH), carbonate ($CO_3^{=}$) and bicarbonate (HCO_3^-) ions.

Carbonate ion and calcium ion both come from calcium carbonate or limestone. So, water that comes in contact with limestone will contain high levels of both Ca^{2+} and CO_3^{2-} ions and have elevated hardness and alkalinity.

$$CaCO_3 + H_2O + CO_2 \rightarrow 2HCO_3^- + Ca^{2+}$$

The objectives of determination alkalinity are important to describe the bicarbonate hazard of irrigation water is the (RSC) Residual Sodium Carbonate parameter.

RSC = $(CO_3^{2-} + HCO^-_3) - (Ca^{2+}+Mg^{2+})$

CO_3^{2-}, HCO_3^-, Ca^{2+}, Mg^{2+} = Concentration of ions in ($meq.L^{-1}$).

Wilcox (1955) classified the irrigation water into three classes depending on residual sodium carbonate (RSC) as follow:

Water class	**RSC ($mmol_c.L^{-1}$)**
Probably safe	< 1.25
Marginal	1.25-2.5
Unsuitable	> 2.5

Principle.

The alkalinity of water can be determined by titrating the water sample with Sulfuric acid of known values of pH, volume, and concentrations. Based on stoichiometry of the reaction and number of moles of Sulfuric acid needed to reach the end point, the concentration of alkalinity in water is calculated.

For the pH more than 8.3, add phenolphthalein indicator, the color changes to pink color. This pink color is due to presence of hydroxyl ions. If Sulfuric acid is added to it, the pink color disappears i.e. OH^- ions are neutralized. Then add mixed indicator, the presence of CO_3^{2-} and HCO_3^- ions in the solution changes the color to blue. While adding Sulfuric acid, the color changes to red, this color change indicates that all the CO_3^{2-} and HCO_3^- ions has been neutralized. This is the end point.

Procedure .

1. Fill the burette with 0.02N Sulfuric acid and adjust it to zero.
2. Using a measuring cylinder exactly measure 100 mL of sample and pour it into a 250 mL of conical flask.
3. Add few drops of phenolphthalein indicator to the contents of conical flask. The color of the solution will turn to pink. This color change is due to alkalinity of hydroxyl ions in the water sample.
4. Titrate it against 0.02N Sulfuric acid till the pink color disappears. This indicates that all the hydroxyl ions are removed from the water sample. Note down the titter value (V1). This value is used in calculating the phenolphthalein alkalinity.
5. To the same solution in the conical flask add few drops of mixed indicator. The color of the solution turns to blue. This color change is due to CO_3^{2-} & HCO_3^- ions in water sample.

6. Continue the titration from the point were stopped for the phenolphthalein alkalinity. Titrate till the solution becomes red.

7. The entire volume (V2) of Sulfuric acid is noted down and it is accountable in calculating the total alkalinity.

V1= volume of H_2SO_4 is used to titrate in case of Ph.Ph. indicator.

V2 = volume of H_2SO_4 is used to titrate in case of mixed indicator.

Calculation.

PROCEDURE CHART