

## ***Name of Experimental: Determination of Hardness***

***Purpose of Experimental: Determination of total hardness in drinking water.***

### **Introduction**

The hardness of water is the ability of precipitation of soap i.e. there is no foam because of the existence of Calcium and Magnesium positive ions, in addition to some other ions (Aluminium, Iron, Manganese, and Strontium). There are also negative ions causes hardness too, which are Bicarbonate, Sulphate, chlorides, nitrates, and Silicate. The hardness classified into two types:

#### **1- Temporary Hardness:**

Caused by the existence of carbonate and bicarbonate dissolve in water, it can be removed by heating the solution.

#### **2- The permanent Hardness:**

Caused by the existence of Calcium and Magnesium Ions as Sulphate or Chlorides, it cannot be removed by heating the solution, however, chemicals substances are used such as Sodium Carbonate.

Hardness of water, attributed to the presence of  $Ca^{+2}$  and  $Mg^{+2}$  if as  $HCO_3$  and  $CO_3$  salts in water, it can be removed by boiling the water to convert these anion into  $CO_2$  and  $H_2O$  if as  $SO_4$  or  $Cl$  it will be hard to be removed.

### **The chemicals and Instruments:**

- |  |                                |
|--|--------------------------------|
| 1-Buffer solution.                               | 2- Eriochrome black T pigment. |
| 3-Ethylendiaminetetra acetic acid (EDTA, 0.1 N). |                                |
| 4-Burett.  | 5- Pipet.                      |
| 6-Conical Flask.                                 | 7-Iron Stand.                  |
| 8-Beaker.  |                                |

### **Procedure**

- 1- Place 100 ml of tap water in a 250 ml beaker.
- 2- Heat slowly over a Bunsen burner and then boil gently for 30 minutes.
- 3- Cool the hot water and filter through filtered funnel directly into 250ml conical flask.
- 4- Add 1ml buffer solution pH=10 to 10ml Sample and then add 0.1g of Eriochrome Black-T Indicator.
- 5- Titrate against 0.01M EDTA solution from a burette until color changes from red to blue.
- 6- Add 1ml of (1N) NaOH to 10ml Sample and then add 0.1g of meroxide Indicator and measure the total hardness.

7- Titrate against 0.01M EDTA solution from a burette until color changes from blue to violet and measure the Ca and Mg hardness.

Calculate the permanent hardness of water in terms of ppm CaCO<sub>3</sub>

Determine temporary hardness in terms of ppm CaCO<sub>3</sub>

**Calculation:**

$$\text{Total Hardness of, CaCO}_3, \frac{\text{mg}}{\text{L}} = \frac{\text{Volume of EDTA} * \text{Normality} * 50000}{\text{Volume of Sample}}$$

Note: the molecular weight of Calcium Carbonate = 50.0436

**Discussion:**

- 1- Why Erichrome, black-T is used as indicator in the reactor?
- 2- Why buffer solution of pH=10?
- 3- Determine the amount of MgP+2P alone? How?

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