# Pollution lab 12

MOHAMED SABBAR

# Total hardness of water

# Background Information

- **Hard water:** is water containing salt of calcium, magnesium and other minerals (like Iron, aluminum, and manganese). These salts require large amounts of soap, or else it may leave sediments of pots when water vapored from these pots

- **Hardness** can be identified as total concentration of calcium (calcium carbonate) in water measured by milligram per liter or ppm.
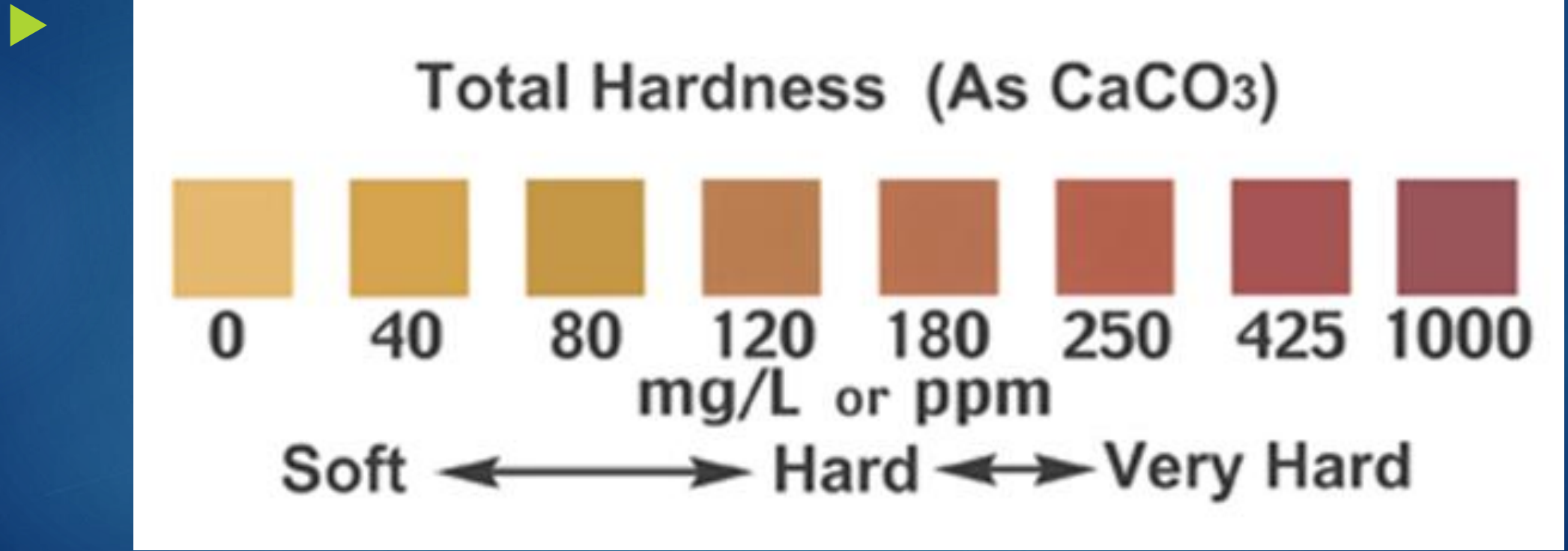
# Background Information

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**Classification of Hard water**

► Hard water can be classified by Brown et al. method (1970) to 3 types:

1. light hardness (0-60 mg/dl)
2. moderate hardness (61-120 mg/dl)
3. severe hardness (121-180 mg/dl)

# Background Information

## Classification of Hard water

Total Hardness (As $CaCO_3$)

0    40    80    120    180    250    425    1000

mg/L or ppm

Soft ⟷ Hard ⟷ Very Hard

# Calculation of total hardness

## Materials:

1. **Buffer solution**: composed of ( $NH_4OH$ , $MgCl_2$ , $NH_4Cl$ and Na )

2. **Inhibitory solution**: composed of ($Na_2S.5H_2O$ , EDTA and D.W.).

3. Indicator: (**Erichrome Black T dye**)

4. EDTA (**Ethylene diaminetetraacetic acid**)

# Calculation of total hardness

## Method:

1. Adjust the pH of 50 ml of water sample by adding few drops of buffer solution with monitoring of pH.

2. Add 1 ml of inhibitory solution

3. Add 0.2 gm of indicator dye.

4. Pipette the solution with **EDTA** solution.

5. Calculate total hardness with the following equation:

$$Total\ hardness\ (mg/l) = \frac{1000 * EDTA\ sol.\ size\ (ml)}{Water\ sample\ size\ (ml)}$$

# Calculation of permanent hardness

1. Take 250 ml of water sample, and boil it for 20-30 min., then leave it to chill, and filter it.
2. Take the filtrate, and complete it 250 ml. by DW
3. Take 50 ml of this water and fellow the previous (1-4 steps) for calculation of total water hardness.

# Calculation of Temporary hardness

**Temporary hardness is calculated mathematically from this equation:**

**Temporary hardness = Total hardness - Permanent hardness**