



EXPERIMENT NO : 1

Determination of hardness (Total, temporary & permanent) of water –EDTA method

EXPERIMENT NO. :1

Class: F.Y. B. Tech.

DEPARTMENT: Basic Sciences & Humanity

LABORATORY : Engg. Chemistry

Location:-

PART: I+II

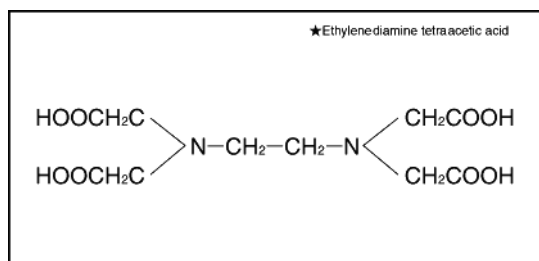
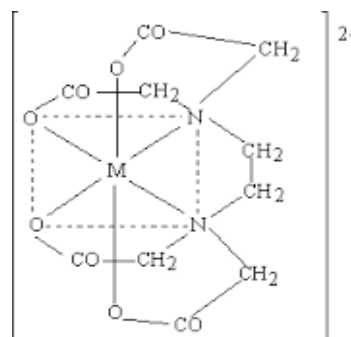
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Aim- Determination of water hardness by complexometric titration.**Apparatus** – Burette stand, conical flask, burette, pipette, Test Tube, measuring cylinder.

Theory- Hardness is defined as soap consuming capacity of water. Hardness of water is due to presence of certain salts of magnesium and calcium and other heavy metal dissolved in it. These salts in water are harmful when water is used for domestic or industrial purpose so for deciding suitability for various purposes estimation of water is necessary. Permanent hardness is due to dissolved sulphates, chlorides and nitrides of calcium and magnesium. Permanent hardness is not removed by boiling.

Temporary hardness is due to dissolved bicarbonates of calcium and magnesium. This can be removed by boiling.

Ethylene diamine tetra acetic acid is powerful complexing agent. EDTA forms complexes with Ca^{2+} and Mg^{2+} ions. EDTA is used in the form of disodium salt due to their greater solubility. The complex molecules formed are called as Coordination complexes which are stable in the pH range 9 to 10. Hence buffer ammonia is added while performing the operation. EDTA reacts with metal ions in a 1:1 ratio. For detecting end point of reaction EcBT indicator is used.

Structure of EDTA**Structure of EDTA**

Metal – EDTA Complex

Procedure-

1. Take 20ml of water in conical flask.
2. 2ml of buffer solution is added to water followed by 2 drops of EcBT.
3. Burette is filled with standard solution of EDTA and initial reading noted. On adding indicator water sample becomes wine red. This is titrated against EDTA from burette until colour changes from wine red to blue. This reading corresponds to total hardness of water. Take 2 or 3 same readings.

4. The same procedure is repeated with 20ml of water sample which is pre boiled and cooled.
5. This titration reading corresponds to permanent hardness.

Observation Table:

Tap Water

S no.	Volume of water	Volume of EDTA		End Point
		IBR	FBR	
1.				
2.				

Boiled Water:

S no.	Volume of water	Volume of EDTA		End Point
		IBR	FBR	
1.				
2.				

Calculations:

1 Mole of EDTA = 1 Mole of CaCO_3

1 Mole 1M of EDTA = 100 mg of CaCO_3

1 ml of 0.01M EDTA = 1mg of CaCO_3

For Total Hardness:

1ml of 0.01M EDTA = 1mg of CaCO_3

For x ml of 0.01M EDTA = x mg of CaCO_3

Hardness of 20ml of hard water = x mg of CaCO_3

Total Hardness in 100 ml of water = $x * 1000/20$ ppm

Total hardness = $x * 50$ ppm

For Permanent Hardness:

For y ml of 0.01M EDTA = y mg of CaCO_3

Hardness of 20ml of hard water = y mg of CaCO_3

Permanent Hardness in 100 ml of water = $y * 1000/20$ ppm

Permanent hardness = $y * 50$ ppm

Total hardness = Temporary hardness + permanent hardness

Temporary Hardness = Total hardness - Permanent hardness

Result-

1. The total hardness of given water sample is found to be _____ ppm.
2. The permanent hardness of given water sample is found to be _____ ppm.
3. The temporary hardness of given water sample is found to be _____ ppm.