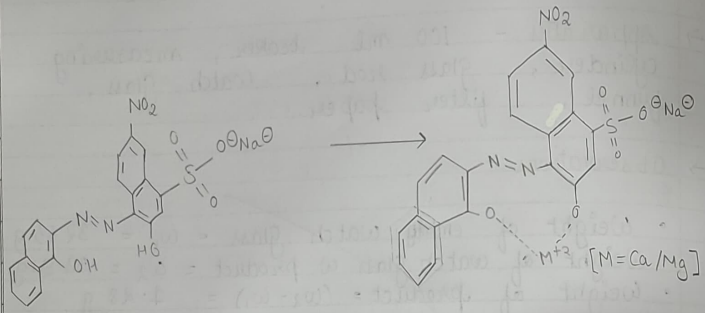
Reaction (i)



Free EBT (Blue) EBT-Metal Complex (red)

Date 10/2/2025

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Experiment - 2

* Estimation of Hardness of Water

→ Objective:- To determine total, permanent & temporary hardness of given water sample by complexometric titration using EDTA sol^n

→ Principle:- The presence of Ca^{+2} & Mg^{+2} ions in water introduces hardness. Hard water consumes lot of soap before forming foam. If hard water is used in a boiler, it results in excessive scaling & sludging which results in loss of efficiency and safety.

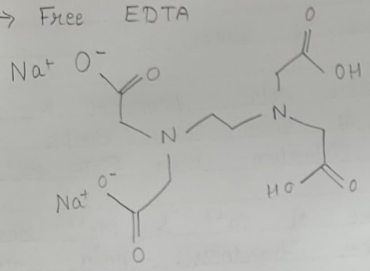
If Ca^{+2} & Mg^{+2} ions are present as bicarbonate salts, they can be easily removed by boiling, as boiling decomposes bicarbonate to insoluble carbonate salts this is called temporary hardness. When Ca^{+2} & Mg^{+2} are present in any other form it is called permanent hardness.

To determine hardness we perform titration. EBT is used as indicator and titration is performed with EDTA Refer to reaction (i).

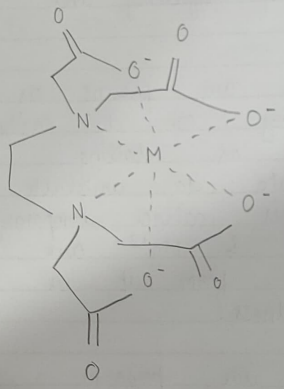
Teacher's Signature

Reaction - 2

→ Free EDTA



→ Metal EDTA Complex



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When EBT is added to hard water, the indicator molecule forms a semi-stable complex with hardness producing metal ions. Complex is wine red in colour. When EDTA is added it forms a colorless stable complex with metal atoms as a result indicator becomes free. Hence end point of this titration is identified by color change. Refer to reaction (i)

Buffer solution is added to keep pH of solution nearly const at pH = 10

→ Observations

(i) Temp Hardness

S.No	Vol of Hard water (ml)	Burette Reading (ml) Initial	Final	Vol of EDTA consumed (ml)	Avg Burette Reading
1	10	37.5	49.6	12.1	
2	10	31.3	44	12.7	12.38
3	10	33	45.3	12.3	

~~Total Hardness = 12886 = 843.3 = 0345.3~~

Teacher's Signature