Experiment 8: Water Purification: Hardness Estimation by EDTA Method and its Removal using Ion-exchange Resin

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Titration-I: Standardization of EDTA

Table:

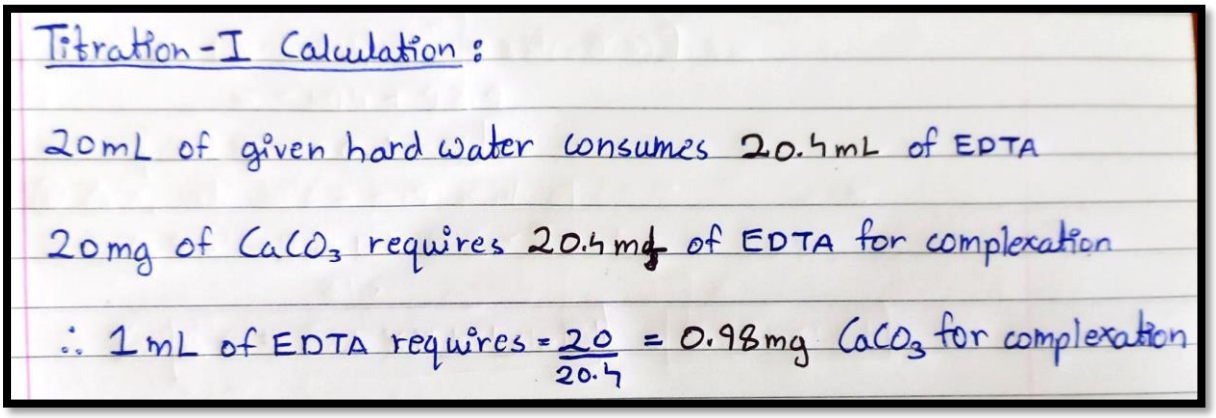
S. No.	Volume of standard hard water (mL)	Burette reading (mL)		Volume of EDTA (V_1, mL)
		Initial	Final	
1	**20**	**0**	**20.4**	**20.4**
2	**20**	**0**	**20.4**	**20.4**
3	–	–	–	–
Concordant titer value				**20.4**

Calculation:

20 mL of given hard water consumes V_1 mL of EDTA

20 mg of $CaCO_3$ requires V_1 mL of EDTA for complexation

∴ **1 mL of EDTA** requires = **20/V_1** mg = **0.98 mg** $CaCO_3$ for complexation



Titration-II: Estimation of total hardness of hard water sample

Table:

S. No.	Volume of sample hard water (mL)	Burette reading (mL)		Volume of EDTA (V_2, mL)
		Initial	Final	
1	**20**	**0**	**8.2**	**8.2**
2	**20**	**0**	**8.2**	**8.2**
3	–	–	–	
Concordant titer value				**8.2**

Calculation:

From Titration 1, we have the following relation:

∴ 1 mL of EDTA requires = 0.98 mg $CaCO_3$ for complexation

From Titration 2,

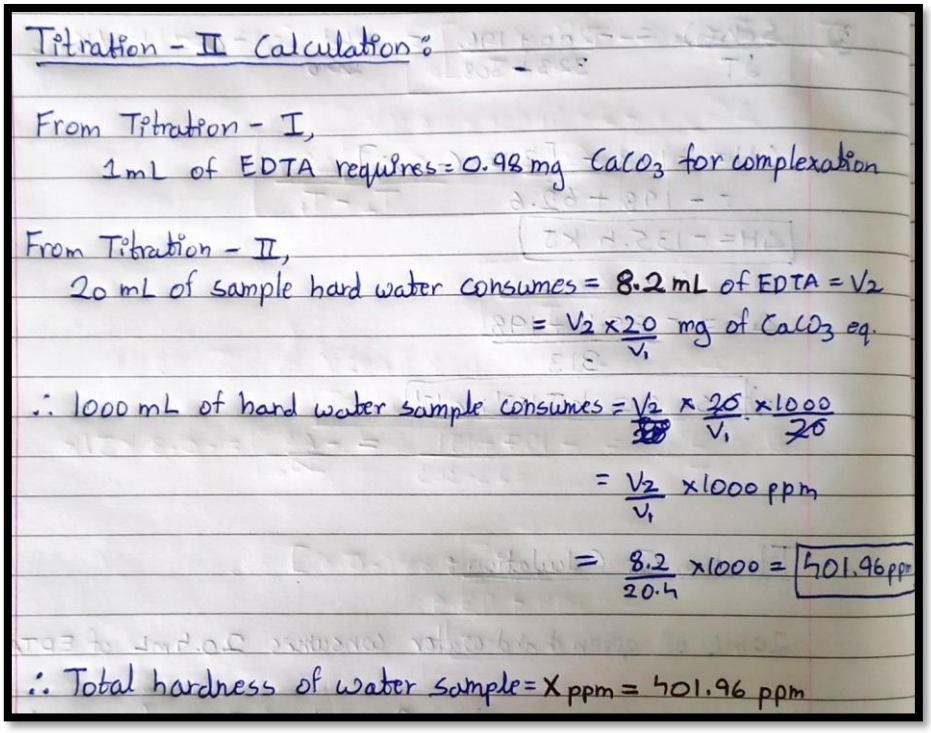
20 mL of sample hard water consumes = V_2 mL of EDTA.

= V_2 x 20/V_1 mg of $CaCO_3$ eq.

∴1000 mL of hard water sample consumes = V_2 x ~~20~~/V_1×1000/~~20~~

= V_2/V_1×1000 ppm

∴Total hardness of the water sample = **X ppm = 401.96 ppm**



Titration-3: Removal of hardness using ion exchange method

Table:

S. No.	Volume of sample hard water (mL)	Burette reading (mL)		Volume of EDTA (V_3, mL)
		Initial	Final	
1	**20**	**0**	**2.6**	**2.6**
2	**20**	**0**	**2.6**	**2.6**
3	–	–	–	–
Concordant titer value				**2.6**

Calculation:

From Titration 1, we have the following relation:

$\therefore$ 1 mL of EDTA requires = $20/V_1$ mg $CaCO_3$ for complexation

From this relation, it can be seen that

20 mL of water sample after softening through the column consumes = V_3 mL of EDTA.

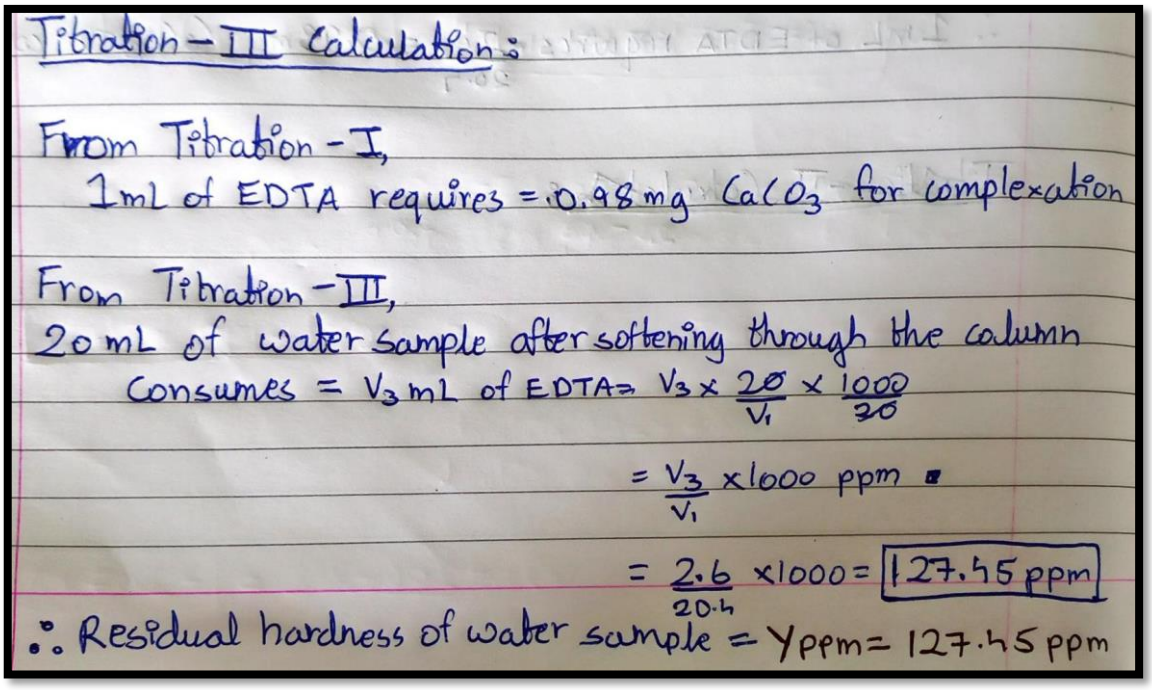
= V_3 x $20/V_1$ mg of $CaCO_3$ eq.

$\therefore$ 1000 mL of water sample after softening through the column consumes

= V_3 x $\cancel{20}/V_1 \times 1000/\cancel{20}$

= $V_3/V_1 \times 1000$ ppm

$\therefore$ Residual hardness of the water sample = **Y ppm = 127.45 ppm**



Result:

1) Total hardness of the water sample = **X ppm = 401.96 ppm**
2) Residual hardness in the water sample = **Y ppm = 127.45 ppm**
3) Hardness removed through the column = **(X-Y) ppm = 274.51 ppm**