Numerical Ion Exchange Column Chromatography

After treating 10^4 litres of water by ion-exchanger, the cationic resin required 200 litres of 0.1 N HCl and anionic resin required 200 litres of 0.1 N NaOH solutions. Find the hardness of water.

Solution :

In an ion-exchanger all hardness causing cations are removed by cation-exchanger. Hence, the amount of acid used for regeneration of cation resin refers to the hardness of water.

Hardness in 10^4 litres of water

$\equiv$ 200 litres of 0.1 N HCl

$\equiv$ 200 l of 001 N$CaCO_3$ eq.

$=$ 200 $\times$ 0.1 l of 1 N $CaCO_3$ eq.

$=$ 20 l of 1 N $CaCO_3$ eq.

$=$ 20 $\times$ 50 g of $CaCO_3$ eq.

$=$ 1000 gms of $CaCO_3$ eq.

$\therefore$ Hardness in 1 litre of water

$$= \frac{1000}{10^4} \text{ gms of } CaCO_3 \text{ eq.}$$

$=$ 100 mgms of $CaCO_3$ eq.

$\therefore$ Hardness of water sample = 100 mg/L

$=$ 100 ppm