

***DEMINERALIZATION (OR)
ION EXCHANGE PROCESS***

*** This process removes almost all the ions. (both anion and cations) present in hard water.**

*** The soft water produced by lime - soda and zeolite process. does not contain hardness producing Ca^{2+} and Mg^{2+} ions, but it will contain other ions like Na^+ , K^+ , SO_4 , Cl^- etc...,**

*** On the other hand D.M (Demineralised water) does not contain both anions and cations.**

*** Thus a soft water is not Demineralised water where as Demineralised water is soft water.**

Demineralisation process is carried out by using ion-exchange resins.

Which are long chain, cross linked insoluble organic polymers with a micro porous structure.

The functional groups attached to the chains are responsible for the ion exchanging properties.

The following two types of ion exchange resins are used

- 1. Cation exchange resins (or) Cation exchanger**
- 2. Anion exchange resins (or) Anion exchanger**

1. Cation exchanger

Resins containing acidic functional group ($-\text{COOH}$, $-\text{SO}_3\text{H}$) are capable of exchanging their H^+ ions with other cations of hard water. Cation exchange resin is represented by RH_2 .

Example :-

1. Sulfonated coals ($\text{R} - \text{SO}_3\text{H}$)
2. Sulfonated polystyrene

2. Anion exchanger

Resins containing basic functional groups (-NH₂, OH) are capable of exchanging their anions with other anions of hard water

Anion exchange resins is represented as.
 $R(OH)_2$

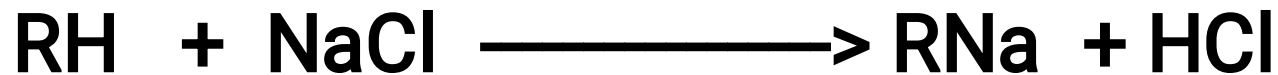
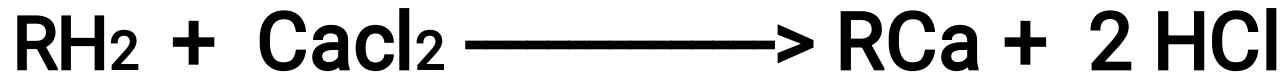
Example :-

1. Cross - linked quaternary ammonium salts
2. Urea - formaldehyde resin

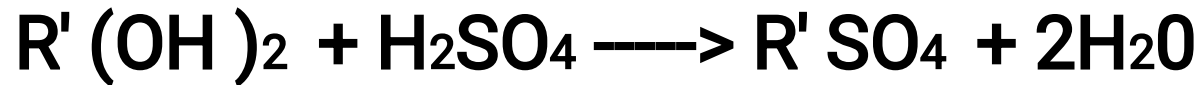


Process

The hard water first passed through a cation exchange column, which absorbs all the. Cation like Ca^{2+} , Mg^{2+} , Na^{+} , K^{+} etc., present in the hard water.

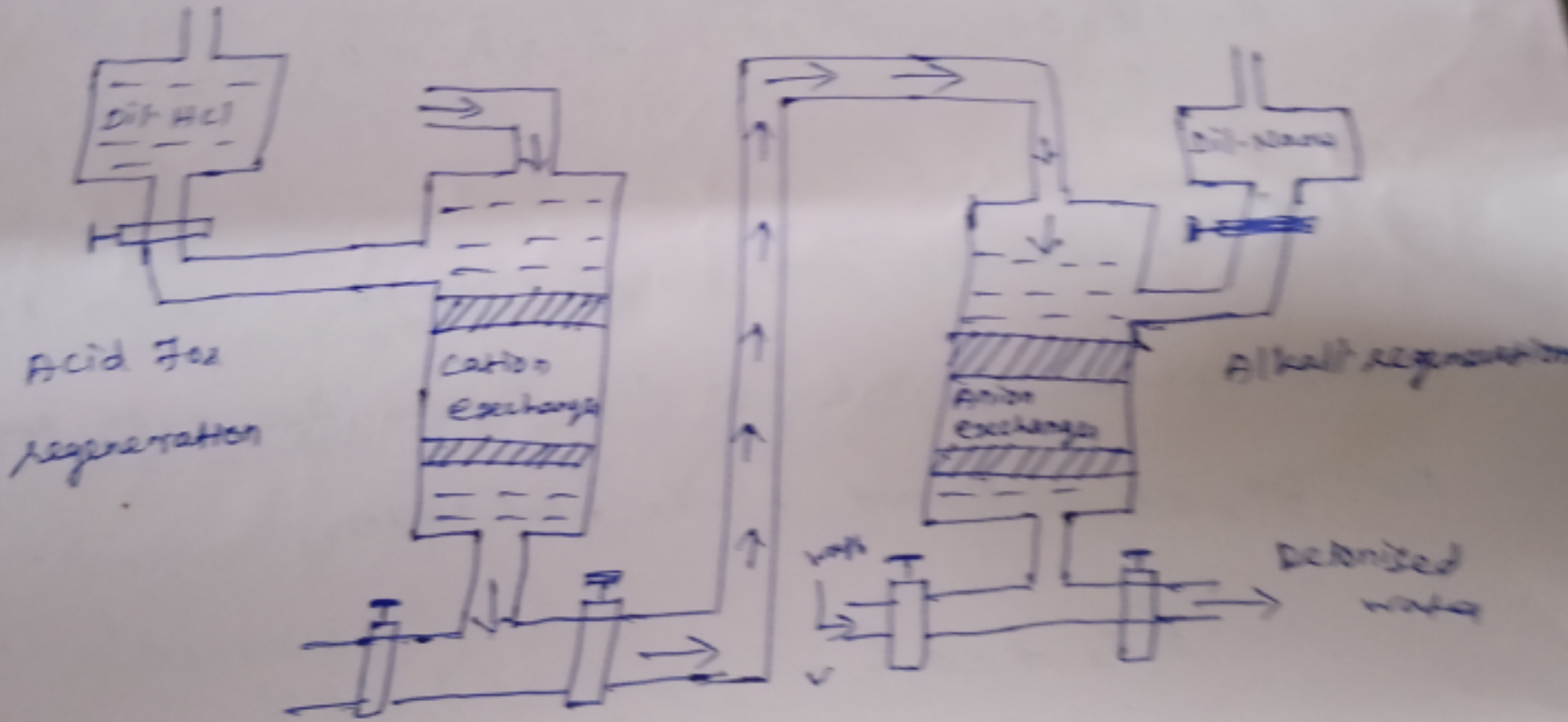


The cation free water is then passed through an anion exchange column, which absorbs all the anions like Cl^{-} , SO_4 , HCO_3 etc., present in the water.



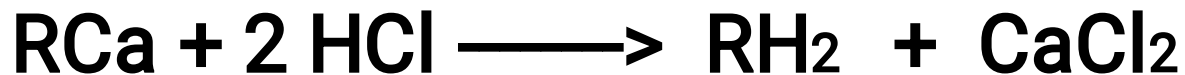
The water coming out of the anion exchanger is completely free from cations and anions.

This water is known as demineralized water (or) deionized water

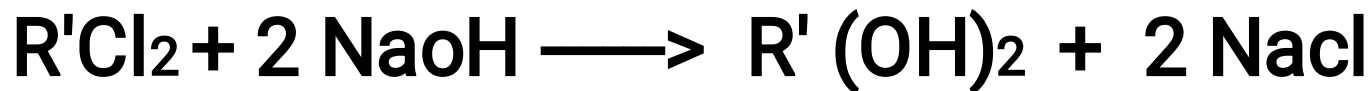


Regeneration :-

When the cation exchange resin is exhausted, it can be regenerated by passing a solution of dil. HCl(or) H₂SO₄



Similarly, When the anion exchange resins is exhausted, it can be regenerated by passing a solution of dil. NaOH



Advantage of ion - exchange process

- 1. Highly acidic (or) alkaline water can be treated by this process.**
- 2. The water obtained by this process will have very low hardness (nearly 2 ppm)**

Disadvantages of ion - exchange process

- 1. Water containing turbidity reduces the output and Fe, Mn form stable compounds the resin**
- 2. The equipment is costly and more expensive chemicals are needed.**

