



19CH101- ENGINEERING CHEMISTRY

Unit-1 WATER AND ITS TREATMENT

DEMINERALIZATION (OR) DEIONIZATION (OR) ION EXCHANGE PROCESS

In this process almost all the ions (both anions (Cl^- , SO_4^{2-}) and cations (Ca^{2+} , Mg^{2+}) present in hard water are removed. This process is also called demineralization process.

In the demineralization process, the ions present in water are removed by ion exchangers. Ion exchange resins are insoluble; cross - linked, long chain organic polymers with a micro porous structure, and the functional groups attached to the chains are responsible for the ion exchanging properties.

They are of two types.

- Cation exchangers
- Anion exchangers

CATION EXCHANGERS

Materials capable of exchanging cations are called cation exchangers. Cation exchanger resins containing acidic groups ($-\text{COOH}$, $-\text{SO}_3\text{H}$) are capable of exchanging their H^+ ions with other cations (Ca^{2+} , Mg^{2+}) of hard water.

Cation exchange resin is represented as RH_2 (or) RH .

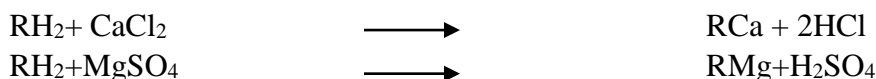
ANION EXCHANGERS

Materials capable of exchanging anions are called anion exchangers. Anion exchanger resins containing basic groups ($-\text{NH}_2$, $-\text{OH}$) are capable of exchanging their OH^- ions with the other anions of hard water.

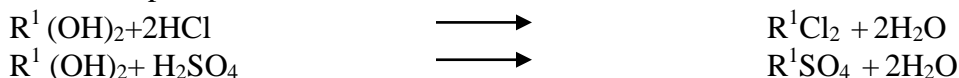
Anion exchange resin is represented as $\text{R}^1(\text{OH})_2$ (or) R^1OH .

Process

Water is passed through a tank having cation exchanger which absorbs all the cations present in water.

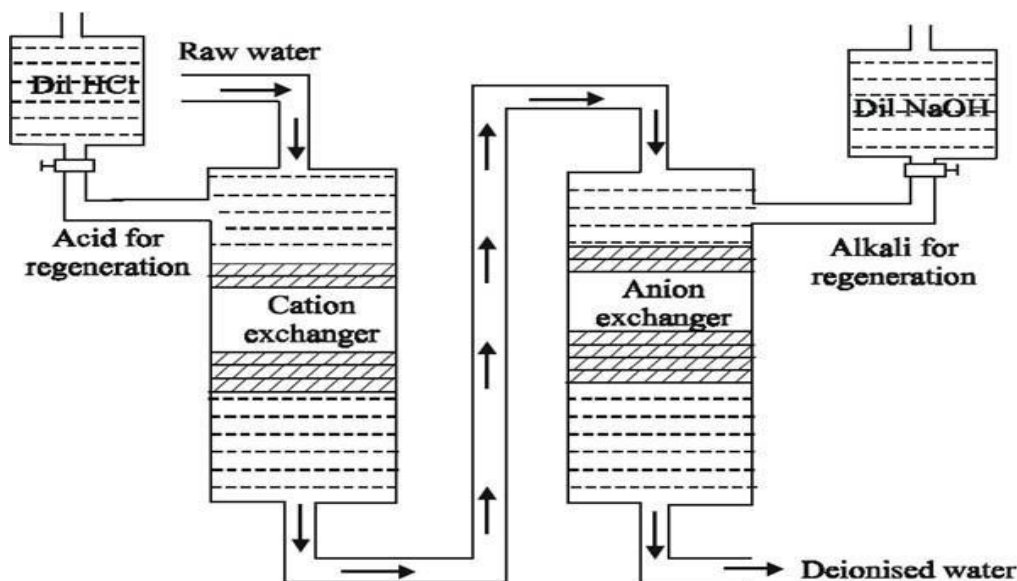


The cation free water is now passed through another tank having anion exchanger which absorbs all the anions present in water.



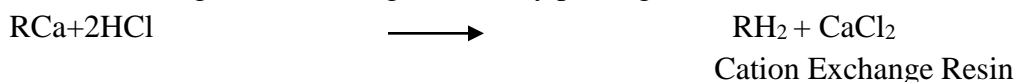


The water coming out of the anion exchanger is completely free from cations and anions responsible for hardness. It is known as deionized water (or) demineralized water. It is as pure as distilled water.

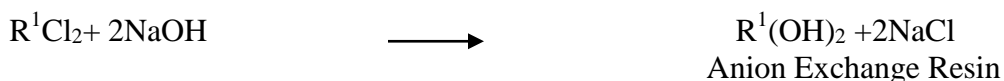


Regeneration

Cation exchange resins are regenerated by passing a dilute solution of HCl through them.



Similarly, the anion exchange resins are regenerated by passing a dilute solution of NaOH through them.



Advantages of ion exchange process

- (i) Highly acidic (or) alkaline water can be treated by this process.
- (ii) This produces water of very low hardness nearly 2 ppm.

Disadvantages of ion exchange process

- (i) The equipment is costly and more expensive chemicals are needed.
- (ii) If water contains turbidity, then the output of the process is reduced. The turbidity must be below 10 ppm.