process [Anion exchange resin]

$$R(OH)_2 + 2HCl \longrightarrow R\text{-}Cl_2 + 2H_2O$$

$$R(OH)_2 + H_2SO_4 \longrightarrow R\text{-}SO_4 + 2H_2O$$

The cation free water is then passed through a anion exchange column, which absorbs all the anions like Cl^-, SO_4^{2-} present in the water.

The water coming out of the anion exchanger is completely free from cation and anions. This water is known as demineralised water

Regeneration:

When the cation and anion exchange resin exhausted, it can be regenerated by passing a solution of dil HCl & dil NaOH.

$$R\text{-}Ca + 2HCl \longrightarrow RH_2 + CaCl_2$$

$$R\text{-}Cl_2 + 2NaOH \longrightarrow R(OH)_2 + 2NaCl.$$

Advantages:

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

* The equipment is costly
* If water contains turbidity, then the output of the process is reduced.
* Water containing Fe and Mn cannot be treated.

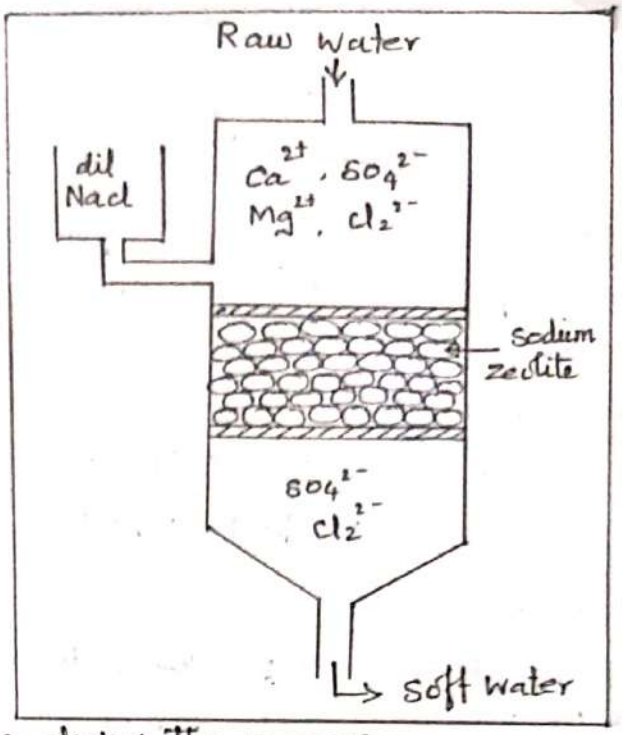
Zeolite (or) permutit process:

Zeolite are naturally occuring substance. Its formula is $Na_2O \cdot Al_2O_3 \cdot XSiO_2 \cdot YH_2O$

Natural Zeolite	Synthetic Zeolite
* Natural zeolite are green sand and non-porous. *It is widely used in agriculture and medicine. *It is derived from green sand treated with NaOH	*Synthetic zeolite are porous and gel like structure *It is used in water softening. *It is derived from clay feldspar and soda ash. *It is represented as Na_2Ze.

Process:

* When hard water is passed through a sodium zeolite b.d which is present in a cylinder.
* It exchanges its sodium ions with Ca^{2+} and Mg^{2+} ions present in the hard water and it forms Calcium and Magnesium zeolites.
* Now the water gets free from Ca^{2+} and Mg^{2+} ions.



Various chemical reactions takeplace during the process.

$$Na_2\text{-}Ze + CaCl_2 \longrightarrow Ca\text{-}Ze + 2NaCl$$

$$Na_2\text{-}Ze + MgSO_4 \longrightarrow Mg\text{-}Ze + Na_2SO_4$$

$$Na_2\text{-}Ze + Ca(HCO_3)_2 \longrightarrow Ca\text{-}Ze + 2NaHCO_3$$

Regeneration:

$$Ca\text{-}Ze + 2NaCl \longrightarrow Na_2\text{-}Ze + CaCl_2$$

$$Mg\text{-}Ze + 2NaCl \longrightarrow Na_2\text{-}Ze + MgCl_2$$

Advantages:

* No sludge is formed during this process.
* Its operation is easy
* This method is cheap
* It have only 1-2 ppm hardness.
* It can be maintained easily.

Disadvantages:

* Acidic water cannot be treated because it decomposes the structure of zeolite.
* Water containing Fe, Mn cannot be treated.
* Brackish water cannot be treated, because it contains Na^+ ions.