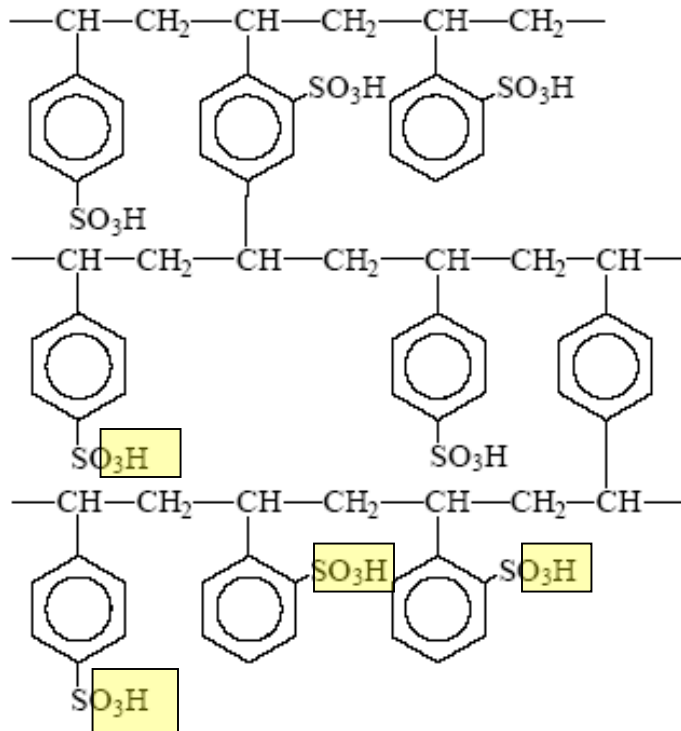


Ion Exchange Method

Ion exchange resins are insoluble cross linked long chain organic polymers having a microporous structure where acidic or basic functional groups attached to the chain are responsible for the ion exchange capacity. Cation exchange resins contain acidic functional groups like $-\text{COOH}$, $-\text{SO}_3\text{H}$ etc. while anion exchange resins contain basic functional groups like $-\text{OH}$, $-\text{NH}_2$ etc.

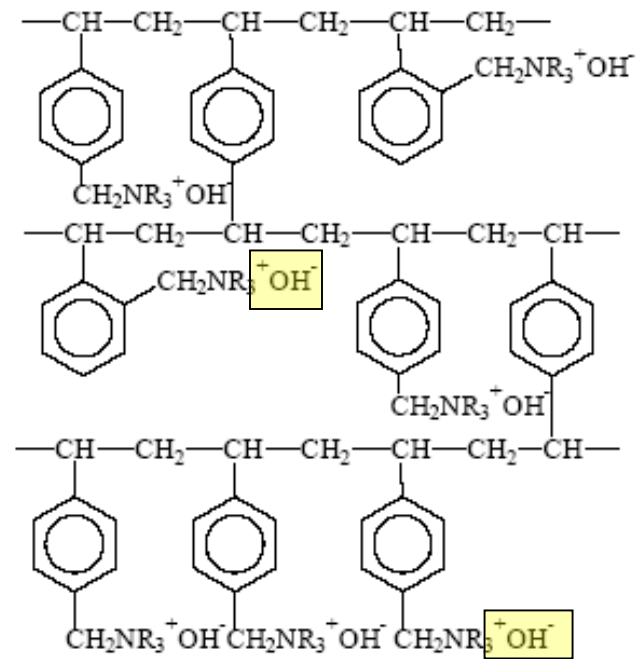
Structure of Cation and Anion exchange resins

Cation exchange resin



A strongly acidic sulphonated polystyrene cation exchange resin

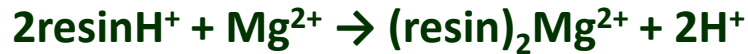
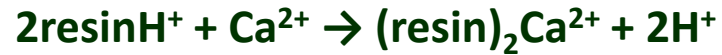
Anion exchange resin



A strongly basic quaternary ammonium anion exchange resin

R = CH₃

The hard water is allowed to pass through a cation exchange column to remove all the cations like Ca^{2+} , Mg^{2+} etc.



Afterwards the water is allowed to pass through an anion exchange resin column to remove anions like SO_4^{2-} , Cl^- etc.



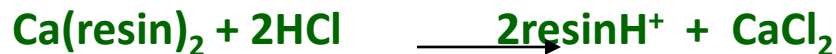
The H^+ and OH^- ions so produced from the cation and anion exchange resins combine to become water



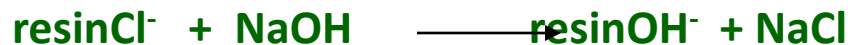
Water thus coming out of the ion exchanger will be free from both cations and anions and hence called demineralised water.

Regeneration

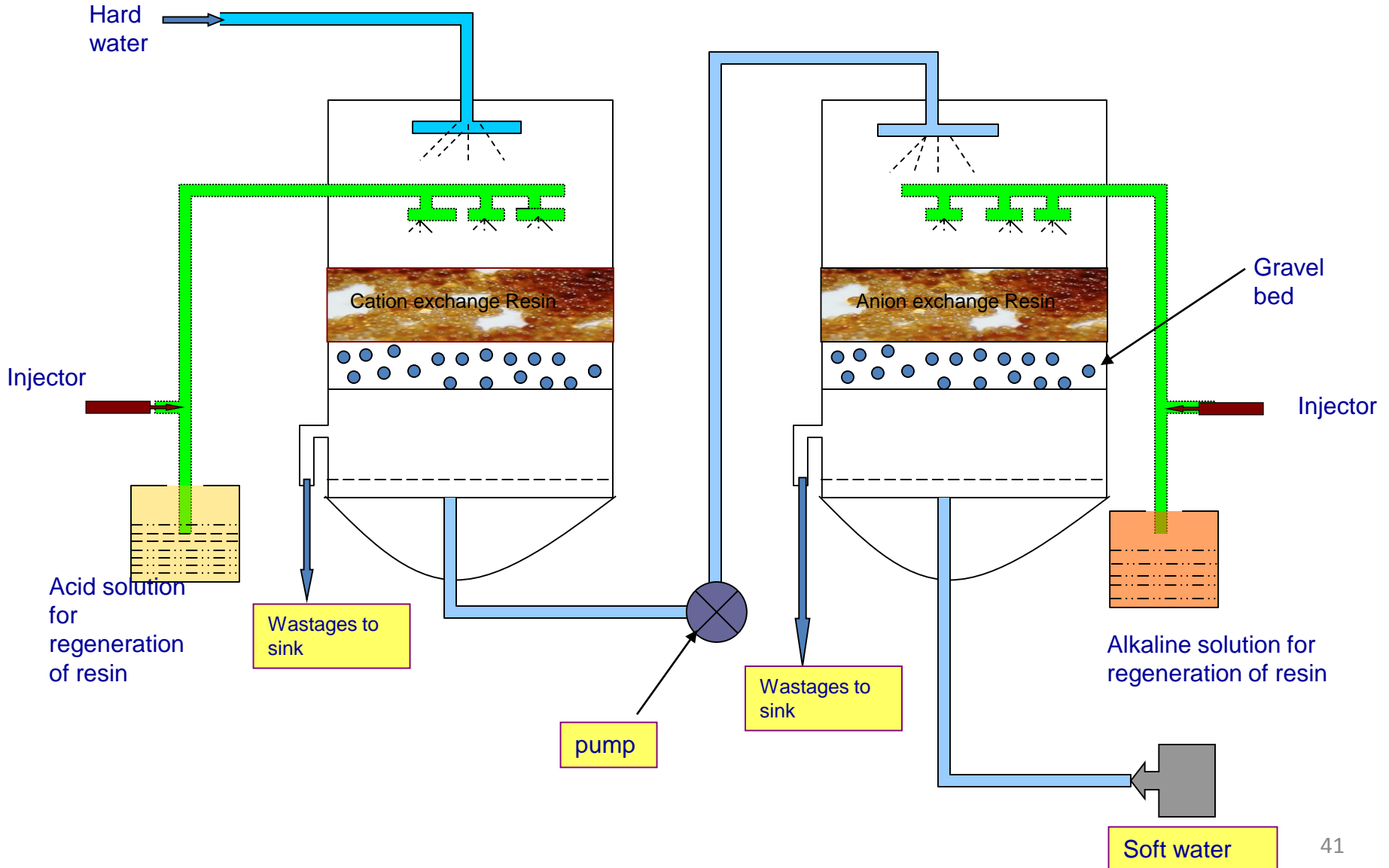
exhausted cationic resin is regenerated by treating with moderately concentrated HCl or H_2SO_4



exhausted anionic resin is regenerated by treating with moderately concentrated NaOH solution



Ion exchange purifier or softener



Advantages of the process

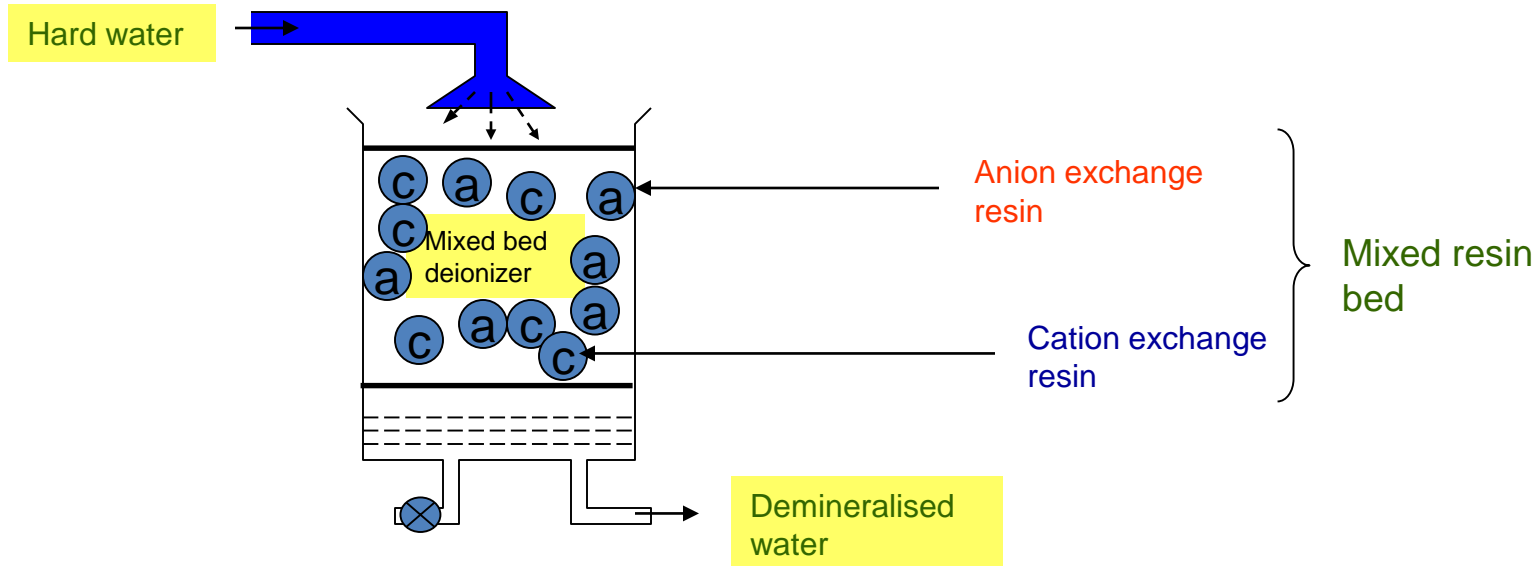
- 1. This process may be used to soften highly acidic or alkaline water**
- 2. The resultant water is of very low hardness (about 2ppm) and is suitable for high pressure boilers**

Limitations

- 1. Resin is quite expensive. Hence the process is costly**
- 2. On treating the turbid water efficiency of the process reduce**

Mixed bed demineralisation

1. It is a single cylindrical chamber containing a mixture of anion and cation exchange resins bed
2. When the hard water is passed through this bed slowly the cations and anions of the hard water comes in to contact with the two kind of resins many number of times
3. Hence, it is equivalent to passing the hard water many number of times through a series of cation and anion exchange resins.
4. The soft water from this method contains less than 1ppm of dissolved salts and hence more suitable for boilers



Regeneration

Mixed bed is back washed which separates out two resins as they possess different densities

Separately they are regenerated

Then used freshly