

Softener Design

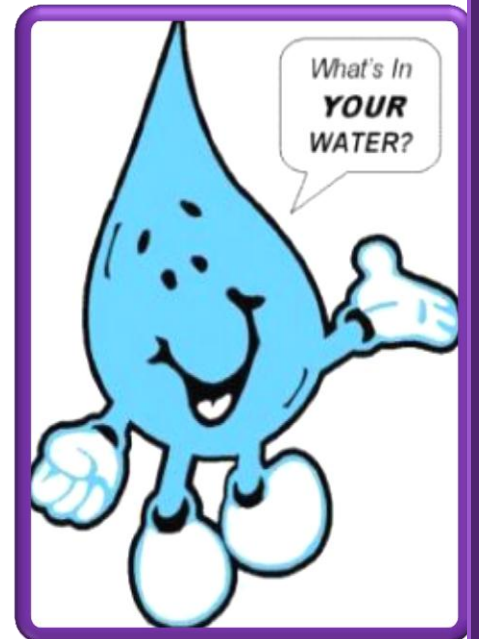
Softener Design



INTRODUCTION:

- Water is considered “hard” when it contains a lot of minerals.
- This hard water can leave a lot of mineral deposits on your pipes, glassware, etc.
- You might also notice that soap or shampoo does not lather "رغوه" very well.

- Water as a chemical solvent is good for many of the salt and the items in the ground and that reached into the water as a result of contact with the ground, which is a repository of elements of various kinds of chemical salts of calcium, magnesium, iron, manganese, silica..



Water Hardness:

Definition

- Sum of concentration of alkali ions (Calcium, magnesium)



- This phenomenon can be explained chemically through the expulsion of calcium, magnesium of sodium soap in the material, which leads to the formation of a precipitate and thus loses soap its effectiveness in cleaning.

Its effects:

- The most important effects that water hardness is when we use this water in the washing process which the presence of these ions causes the water not to be lather, which reduces cleaning efficiency and leads to wastage of large quantities of water without interest.
- In boilers and heat exchangers when using with long time that form an insulating layer in the inner wall of the piping and thus reducing heat exchange and waste large amounts of fuel to reach the desired temperature also leads to reduce the age of these devices due to the destruction of pipelines constituents.



Types of Hardness:

1. Temporary hardness

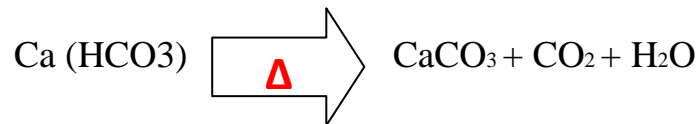
Definition

Hardness caused by the presence of calcium bicarbonate “Ca (HCO₃)₂” and magnesium bicarbonate “Mg (HCO₃)” in water.

Also called "carbonated hardness"

Temporary Hardness removal

- Usually done to get rid of this salt by heating where this leads to the disintegration of bicarbonate to Carbonate according to the following reaction:



- Since the calcium carbonate insoluble in water - but less Maipeth in water with increasing temperature, it is deposited on the inner walls of the vessel on which in it the water heating.

2. Permanent hardness

Definition

- They are Hardness caused by the presence of sulfate or chloride or silicate (calcium or magnesium)

Ion exchange:

- This method is the most common and widely used methods, both at the industrial level and in large water treatment plants or houses and being the most effective and widely used easier
- Ion exchange is used in water treatment and also provides a method of separation for many processes.

Cation Exchange:"type of our device"

- Also called acid exchange it occurs when a dissolved positive ion replaces in aqueous solution with a positive atom in the solid material ...If we have committed to talk about the most important water-soluble cationic ions which are: - calcium and magnesium, iron, manganese, sodium and hydrogen.

— Water Softening using softener:

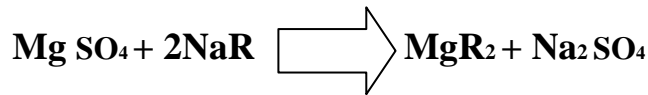
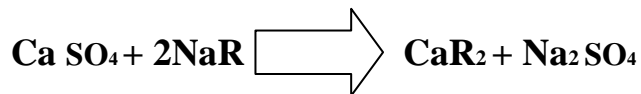
The softener device from more devices commonly used in the removal of permanent and temporary water hardness, it has become used even in the range of homes after becoming water used for drinking contains in particular high levels of calcium salts and magnesium, also may contain other ions such as iron, manganese and others.

a- Reactions that take place between hard water and resin within softener:

Usually used in the process of removing water hardness resin called Sodium resin to fit on the sodium atoms replaceable with ions dissolved in water and the process is called

"Sodium - Cation - Exchange process"

The most important ions that are replaced are calcium and magnesium ions, according to the following reactions: -



Where "NaR" is material of sodium resin.

Thus, the calcium ions dissolved in the sodium expel mounted sodium resin occupation and its sodium ions are released into the water and this is a fishing ions causing hardness ions and replace them with non-causing hardness such as sodium

• حيث " NaR " . الصوديومي الرزن مادة هي الصوديومي الرزن تركيبه في الموجود الصوديوم بطرد الذائبة الكالسيوم أيونات تقوم وهكذا واستبدالها للعسرة المسببه اليونات صيد يتم وبهذا الماء إلى الصوديوم أيونات وتنطلق موقعها واحتل كالصوديوم للعسرة مسببة غير بأيونات

Softener Design

Steps:

- 1) Resin volume
- 2) Pressure Vessel
- 3) Head Control
- 4) Brine Tank
- 5) Bed Volume "Check!!"

1) Resin Volume

$$= \dots \text{liter Resin} \quad \text{Resin Volume} = \frac{\text{flow}(\text{m}^3 \backslash \text{hr}) * \text{hrs} * T.H}{60}$$

2) Pressure Vessel

10"*54" → 50 L

13"*54" → 70 L

14"*65" → 100 L

16"*65" → 150 L

18"*65" → 175 L

21"*62" → 200 L

24"*72" → 325 L

30"*72" → 500 L

36"*72" → 700 L

48"*72" → 1225 L

3) Brine Tank

10"*54" → 100 L

13"*54" → 100 L

14"*65" → 100 L

16"*65" → 200 L

18"*65" → 200 L

21"*62" → 300 L

24"*72" → 300 L

30"*72" → 500 L

36"*72" → 500 L

48"*72" → 700 L

4) Bed Volume (B.V)

$$B.V = \frac{\textit{flow l\hr}}{\textit{resin volume}}$$

Range between 5-----40