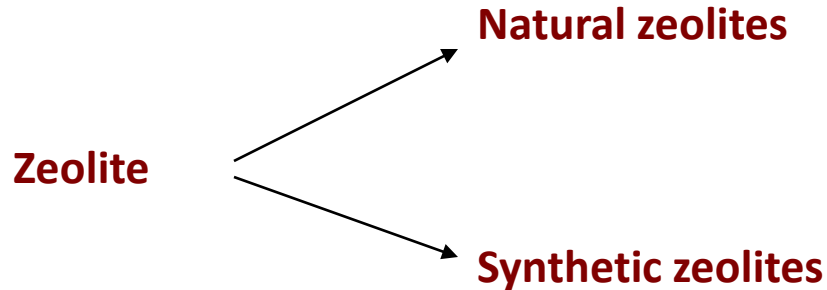


# Zeolite process (permutit/boiling stone)

Zeolite are hydrated sodium aluminosilicates  $\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot x\text{SiO}_2 \cdot y\text{H}_2\text{O}$ . ( $x=2-10$  and  $y=2-6$ ) (inorganic salts). They work as water softeners by replacing the calcium and magnesium ions in water with the sodium ions in zeolite.



## 1. Natural zeolites

Non-porous, amorphous and durable

e.g.  $\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 3\text{SiO}_2 \cdot 2\text{H}_2\text{O}$  (Natrolite)

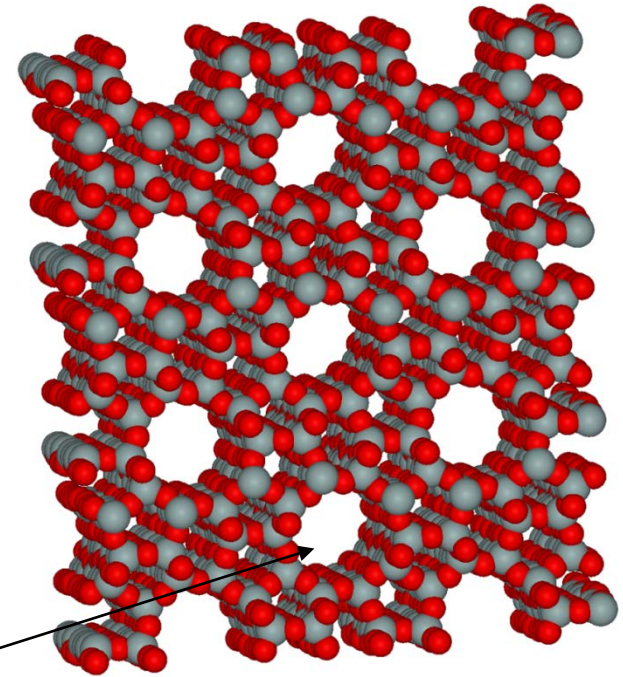
$\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2 \cdot 4\text{H}_2\text{O}$  (Laumonite)

## 2. Synthetic zeolites

Gel like structures, generally porous

$\text{Na}_2\text{CO}_3$ ,  $\text{Al}_2\text{O}_3$  and  $\text{SiO}_2$  heated together

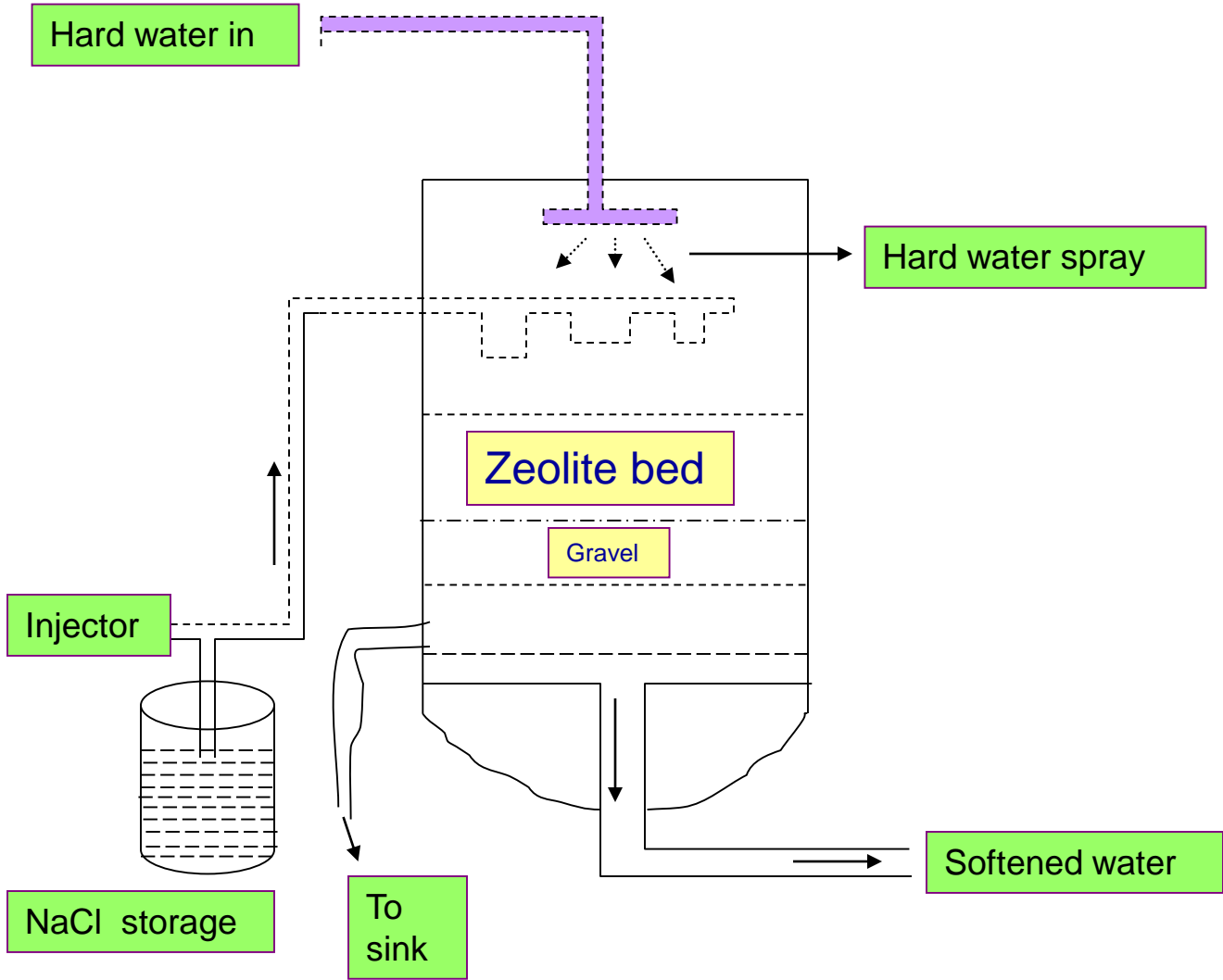
$\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot x\text{SiO}_2 \cdot y\text{H}_2\text{O}$ . ( $x=2-10$  and  $y=2-6$ )



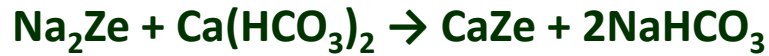
Micro pores of Zeolite

Porous Structure of zeolite

# Zeolite softener



In this process hard water is allowed to pass through a bed of zeolite at a specified rate. Then the sodium ions present in the zeolite bed continuously replace the calcium and magnesium ions present in water and hence the water becomes soft.



### *Regeneration*

When the zeolite bed becomes exhausted it requires regeneration. This is achieved by passing 10% NaCl solution through it.



### **Advantages**

1. Almost complete removal of hardness (10ppm)
2. It is compact
3. Requires only less time for softening
4. No sludge formation since no precipitate is formed
5. Can work under pressure also

# Disadvantages

1. More sodium salt concentration in softened water.
2. Turbidity containing water cannot be used
3. Process exchange only  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  ions but cannot exchange  $\text{HCO}_3^-$  and  $\text{CO}_3^{2-}$  ions. So cannot be used in boilers
4. If  $\text{Fe}^{2+}$  and  $\text{Mn}^{2+}$  are present in large quantities. They form respective zeolites so zeolites cannot be regenerated
5. Water consisting of high alkalinity or acidity cannot be used because zeolite is decomposed