



Engineering Chemistry

CYC 102

Dr. Sukriti

School Of Basic Sciences

Indian Institute of Information Technology, Una
Himachal Pradesh



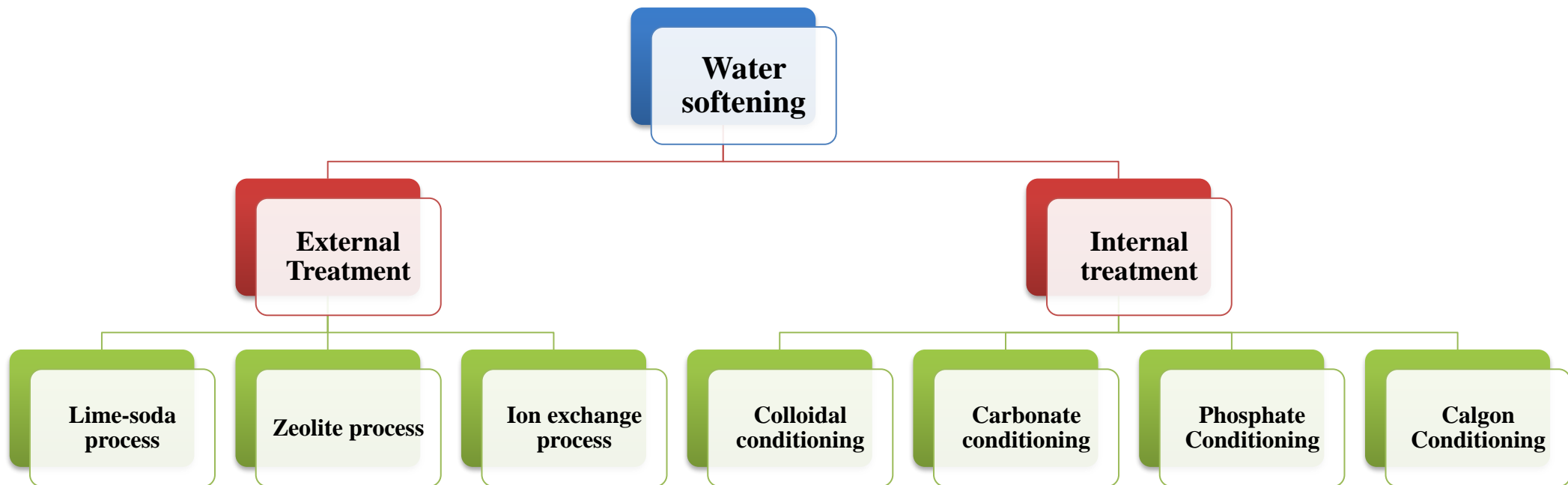
Overview

- **Water softening**
- **External treatment**
- **Cold lime-soda process**
- **Working of Cold Lime-soda process**
- **Hot-Lime soda Process**
- **Working of Hot Lime-soda process**
- **References**
- **Topics to be covered in next lecture**



Water softening

- It is the process of removing or reducing hardness producing salts from water.
- Also, suspended impurities and dissolved gases.
- For domestic and industrial purpose water softening is requisite.
- It is generally classified as follows:





External Treatment

- Removal of hardness producing salts from the water before feeding it into the boiler.
- **It can be done by following methods:**
 - ✓ Lime soda process
 - ✓ Zeolite methods
 - ✓ Ion exchange resin method
- **Lime soda process**
 - ✓ It is further divided in to two types:
 - ☐ Cold lime soda process
 - ☐ Hot lime soda process

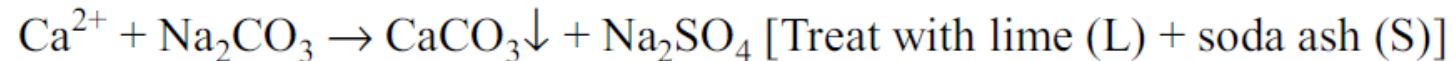
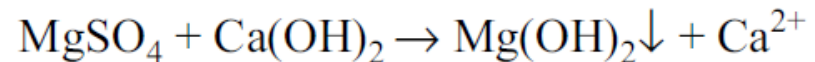
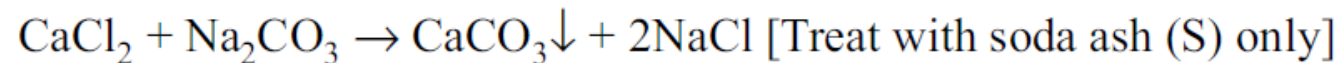


Cold Lime-Soda process

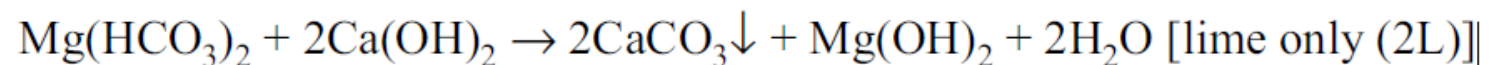
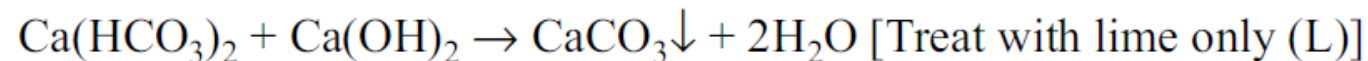
Principle

- It involves the softening of hard water by removal of salts of calcium and magnesium of temporary hardness
- Neutralize and precipitate them as their insoluble salts by the addition of adequate amounts of Na_2CO_3 (soda ash) and $\text{Ca}(\text{OH})_2$ (lime) which get deposited at the bottom.
- Required amounts of either soda ash (S) or lime (L) or both depending on the type of hardness can be calculated.

1. Permanent hardness



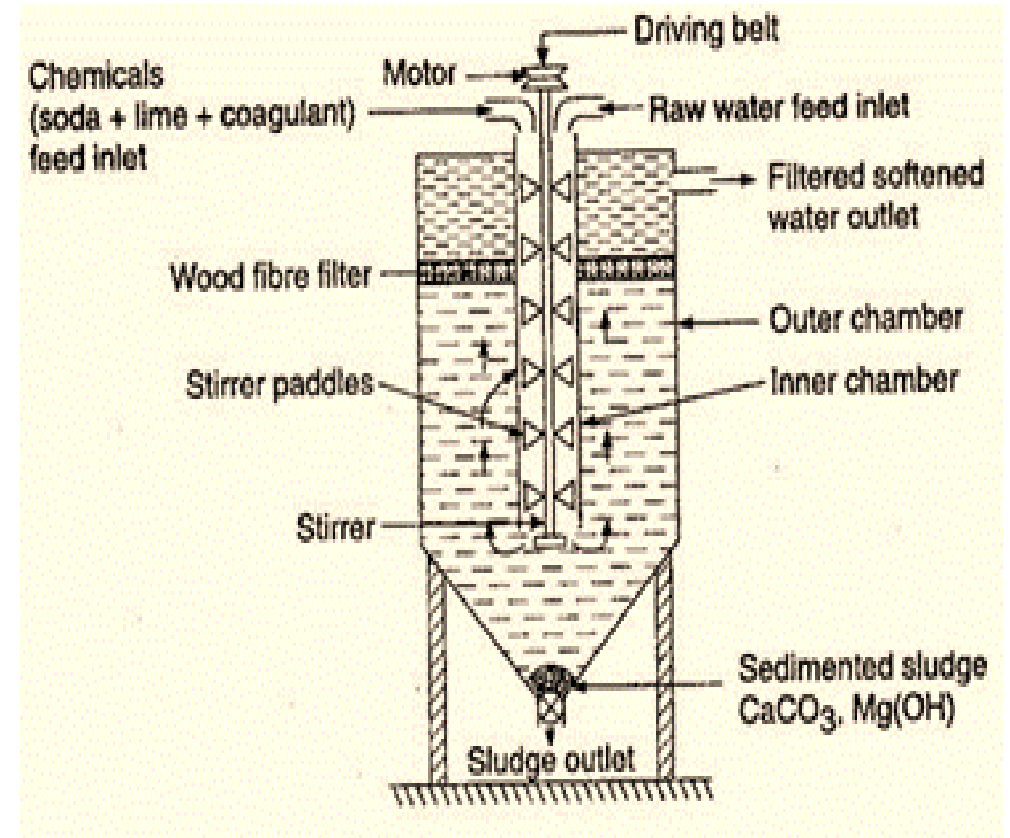
2. Temporary hardness





Working of Cold Lime-Soda process

- Raw water and calculated quantities of chemicals: from the top in to the inner vertical circular chamber.
- Vigorous stirring and continuous mixing : softening of water take place.
- Softened water comes into the outer co-axial chamber, it rises upwards.
- Heavy sludge settles down & softened water reaches up.
- Softened water : passes through a filtering media to ensure complete removal of sludge.
- Filtered soft water finally flows out continuously through the outlet at the top.
- Sludge settling at the bottom of the outer chamber is drawn off occasionally.





Hot lime-soda process

- Treating water with softening chemicals at a temp. of 80 to 110°c.
- Process : operated close to the boiling point.
- No need of coagulants

Advantages

- ✓ Reaction with Soda ash and lime interacts with calcium and magnesium ions is faster at higher temperature
- ✓ Precipitates settles quickly, hence, no need for the addition of coagulants.
- ✓ Softening rate of water is faster.
- ✓ Calcium and magnesium contents in water are reduced to 15–25 ppm.
- ✓ Sludge settles rapidly and can be removed.
- ✓ Filtration process of water is easier.



Hot lime-soda process...Contd.

It consists three parts:

- **Reaction tank**

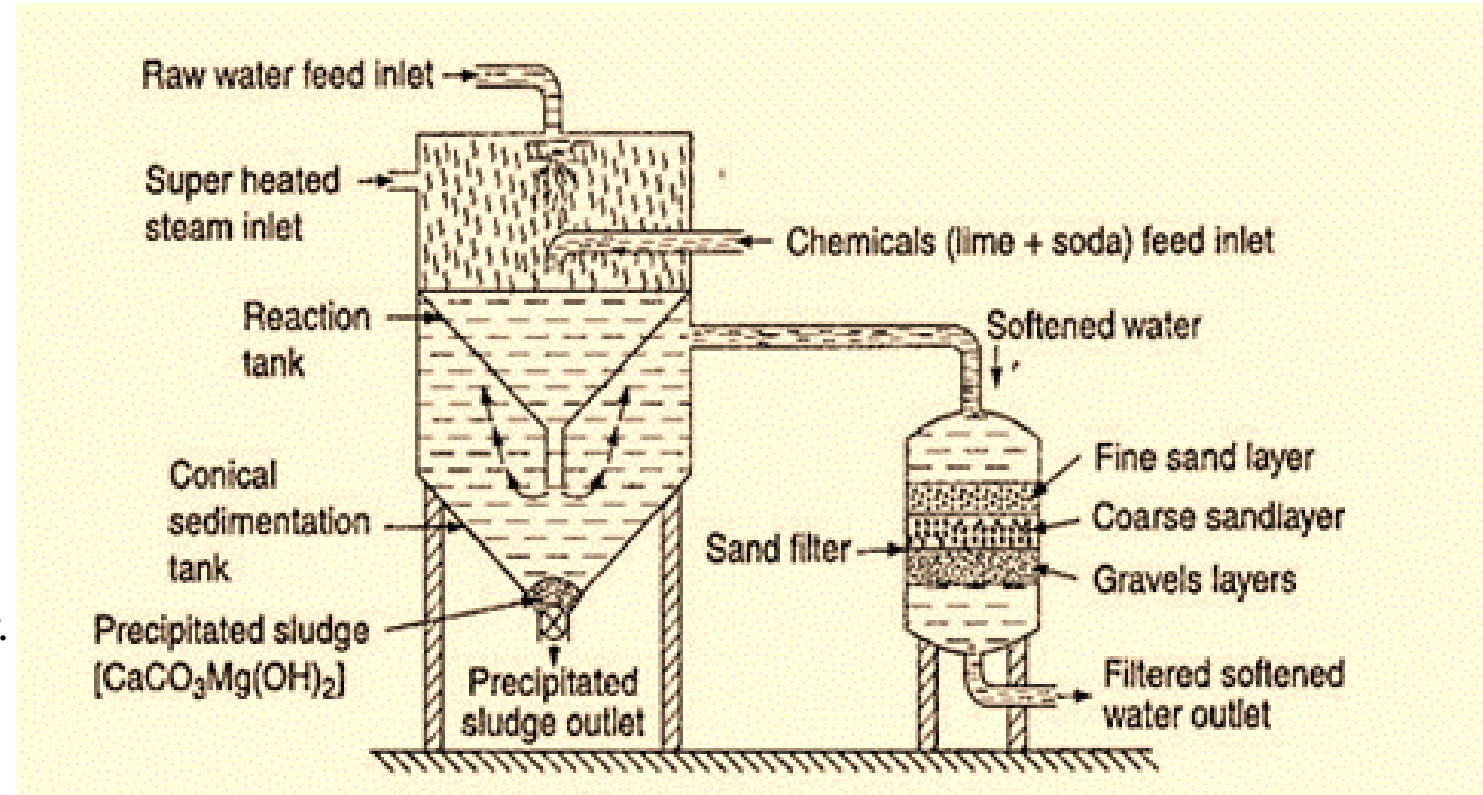
Raw water, chemicals & steam are mixed,

- **Conical sedimentation vessel**

sludge settles down.

- **Sand filter**

Complete removal of sludge from softened water.





Working of Hot Lime-soda process

- Raw water is sent to the conical chamber along with the addition of both lime and soda ash through the inlet having the hopper.
- With super-heated steam reaction occurs at a faster rate.
- carbonates of metal ions obtained settles rapidly as sludge
- Collected at the bottom and can be removed,
- Soft water obtained is passed through filtration unit.
- The filtration unit consists of layers of fine sand, coarse sand and gravel which is employed to remove other unwanted impurities of water.
- Softened water is collected and stored in tank for industrial use.



Comparison between Hot-Cold Lime soda process

Cold lime soda process	Hot lime soda process
1. It is carried out at room temperature (25-30°C)	1. It is carried out at high temperature (95-100°C)
2. It is a slow process	2. It is a rapid process
3. Use of coagulant is a necessary	3. No coagulant required
4. Filtration is not easy	4. Filtration is easy as viscosity of water is low
5. Residual hardness is 60 ppm	5. Residual hardness is 15—30 ppm
6. Dissolved gases are not removed	6. Dissolved gases are removed
7. It has low softening capacity	7. It has high softening capacity



Summary

- Water softening is required for domestic and industrial purpose
- External and internal treatment of water softening are popular
- Cold lime soda process is slow process, at room temp. and coagulant is required.
- Hot Lime soda process is rapid, at higher temperature and more efficient.



Reference

- O.G Palanna, Engineering Chemistry, Page No. 297-299; 306-311

Topic to be covered in next lecture

- Rules for lime Soda process
- Numerical based on lime soda process



Thank You!