CH1019 Chemical Process Technology

Lecture 2

Chapter 1 Chlor-Alkali Industries

Balasubramanian S
Assistant Professor (OG)
Department of Chemical Engineering

Overview of topics

Chapter 1 CHLOR ALKALI INDUSTRIES

1. Products of Chlor-Alkali Industries
2. Sodium Chloride
3. Sodium Ash
4. Sodium bi-carbonate
5. Chlorine and Caustic Soda

Overview of topics

Chapter 1 CHLOR ALKALI INDUSTRIES

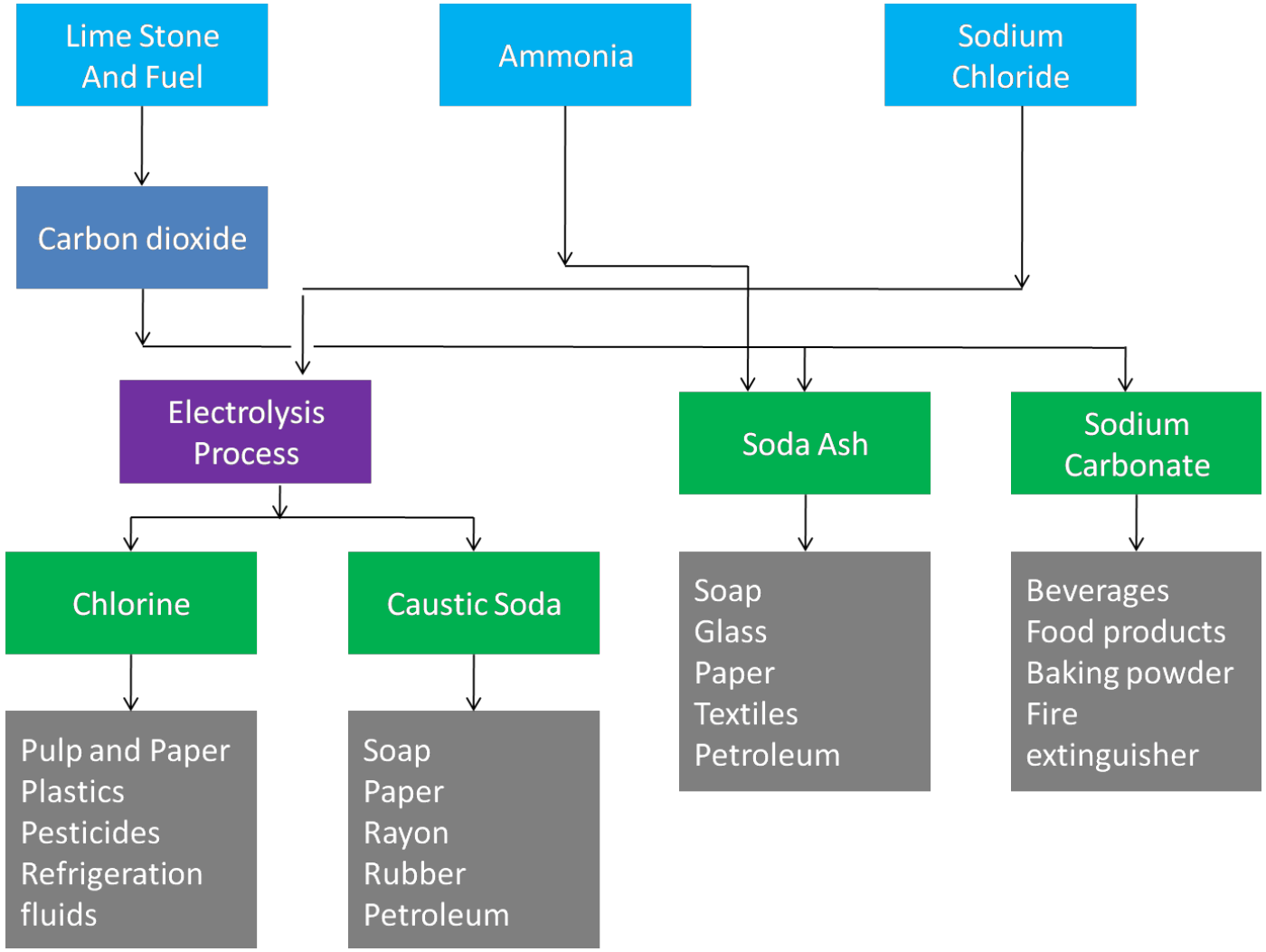
1. Products of Chlor-Alkali Industries
2. Sodium Chloride
3. Sodium Ash
4. Sodium bi-carbonate
5. Chlorine and Caustic Soda

Products of Chlor-Alkali Industries

The Chlor-alkali industries represents three major industrial chemicals

1. Soda ash
2. Caustic Soda
3. Chlorine

Products of Chlor-Alkali Industries



Products of Chlor-Alkali Industries

Apart from these compounds the common salt (NaCl), Sodium chlorides is the basic raw material for great many compounds such as

1. Sodium hydroxide
2. Sodium sulfate
3. Hydrochloric acid
4. Sodium chlorate and Sodium chlorite

The salt (NaCl) is used in the regeneration of sodium zeolite water softeners

Products of Chlor-Alkali Industries

Manufacture of NaCl

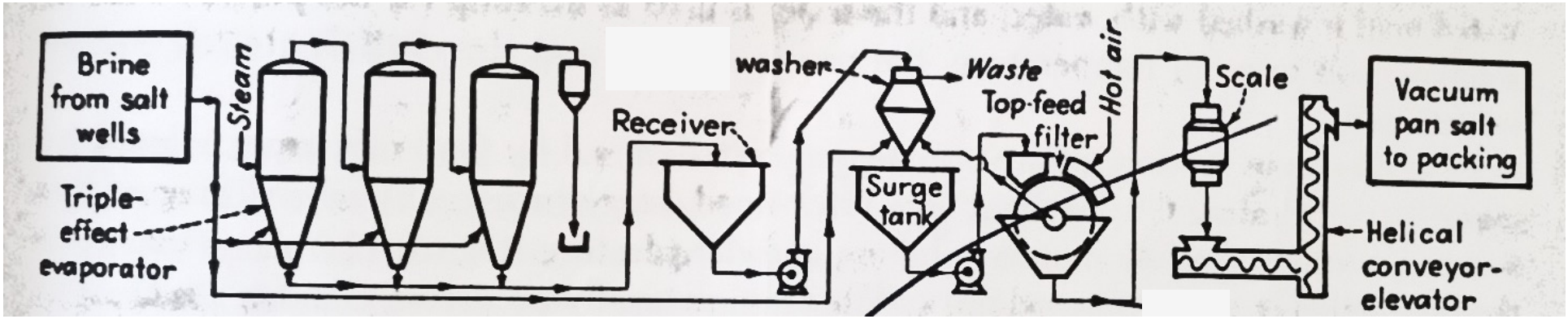
Salt is obtained in three different ways, namely,

1. Solar evaporation of sea water
2. Mining of salt rock
3. From well brines (and purification using vacuum pan systems)

- Purity of salt obtained from solar evaporation = 99.0%
- Purity of salt from rock salt = 99.5%
- The salt obtained through well = 98.0% pure

Products of Chlor-Alkali Industries

Manufacture of NaCl using Vacuum pan systems

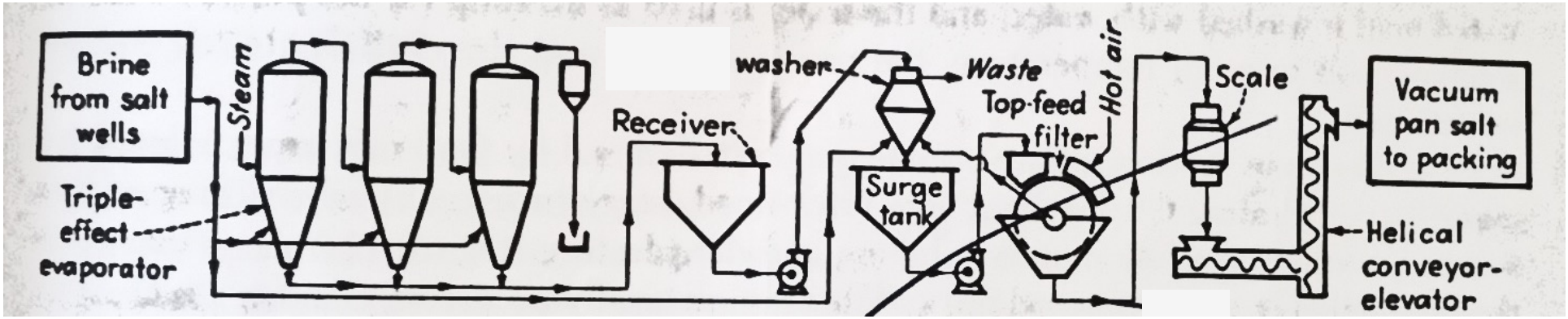


- Salt brine is obtained by pumping water into a salt deposit and bringing the brine to the surface.

- Two concentric pipes are used with water being forced down the center pipe and brine returning to the surface through the annular space between the two pipes.

Products of Chlor-Alkali Industries

Manufacture of NaCl using Vacuum pan systems



- The vacuum pan employing multiple effect evaporators is the most common method of producing brine from wells as shown in above figure.

Products of Chlor-Alkali Industries

S. No.	Process	Equipment	Unit Operation	Unit Process	Objective
01	Continuous	Concentric Pipes	Drilling	-	Drill and obtain the brine solution
02	Batch	Vacuum pan evaporator	Evaporation	-	Concentration of salt from brine solution under reduced atmospheric pressure
03	Batch	Receiver	Storage	-	To store the concentrated brine solution
04	Continuous	Washer	Washing/ Cleaning	-	To wash and purify the brine

Products of Chlor-Alkali Industries

S. No.	Process	Equipment	Unit Operation	Unit Process	Objective
05	Continuous	Rotary filter/ Drier	Filtration/Drying	-	Separation of solid salt cake and liquid brine solution. Dry the salt cake by passing the hot air
06	Continuous	Scale	Weighing	-	To weigh the salt obtained from the rotary filter
07	Continuous	Helical conveyor	Solid transportation	-	To convey the salt (NaCl) and pack the salt to market

Products of Chlor-Alkali Industries

Manufacture of Soda Ash (Sodium Carbonate – (Na_2CO_3)

Classification of processes in the manufacture of Soda Ash

1. LeBlanc Process
2. Solvay Process
3. Natural soda from deposits
4. Dual process

Products of Chlor-Alkali Industries

History - Manufacture of Soda Ash (Sodium Carbonate – (Na_2CO_3))

1. LeBlanc Process

- This process was discovered in 1773 and was used universally for many years in the world.

- Salt cake (sodium sulfate) reacts with lime stone to give soda ash and a troublesome product gypsum (calcium sulfate).

- The process is no longer used.

Products of Chlor-Alkali Industries

History - Manufacture of Soda Ash (Sodium Carbonate – (Na_2CO_3)

2. Solvay process

- In 1864, Ernest Solvay, a Belgium chemist, invented soda process (or Ammonia –Soda process)
- The Solvay method has completely replaced and the LeBlanc method by 1985.
- This method is still very popular Worldwide.

Products of Chlor-Alkali Industries

History - Manufacture of Soda Ash (Sodium Carbonate – (Na_2CO_3)

3. Natural process

- In U.S. large deposits of natural Trona ore facilitates the manufacture of soda ash from it.

- The ore Trona also called as sodium sequicarbonate. Heating this ore gives soda ash.

Products of Chlor-Alkali Industries

History - Manufacture of Soda Ash (Sodium Carbonate – (Na_2CO_3)

3. Dual process

- It is also called modified Solvay process.

- The principal modification is the recovery of NH4Cl as coproduct rather than liberation of combined ammonia for cycle.

Products of Chlor-Alkali Industries

References

1. Dryden C. E, *Outlines of Chemical technology – for the 21st Century*, 3rd edition, East-West Press (2004)

2. Austin G. T, *Shreve's Chemical Process Industries*, 5th edition, Mc Graw Hill International editions (1984)