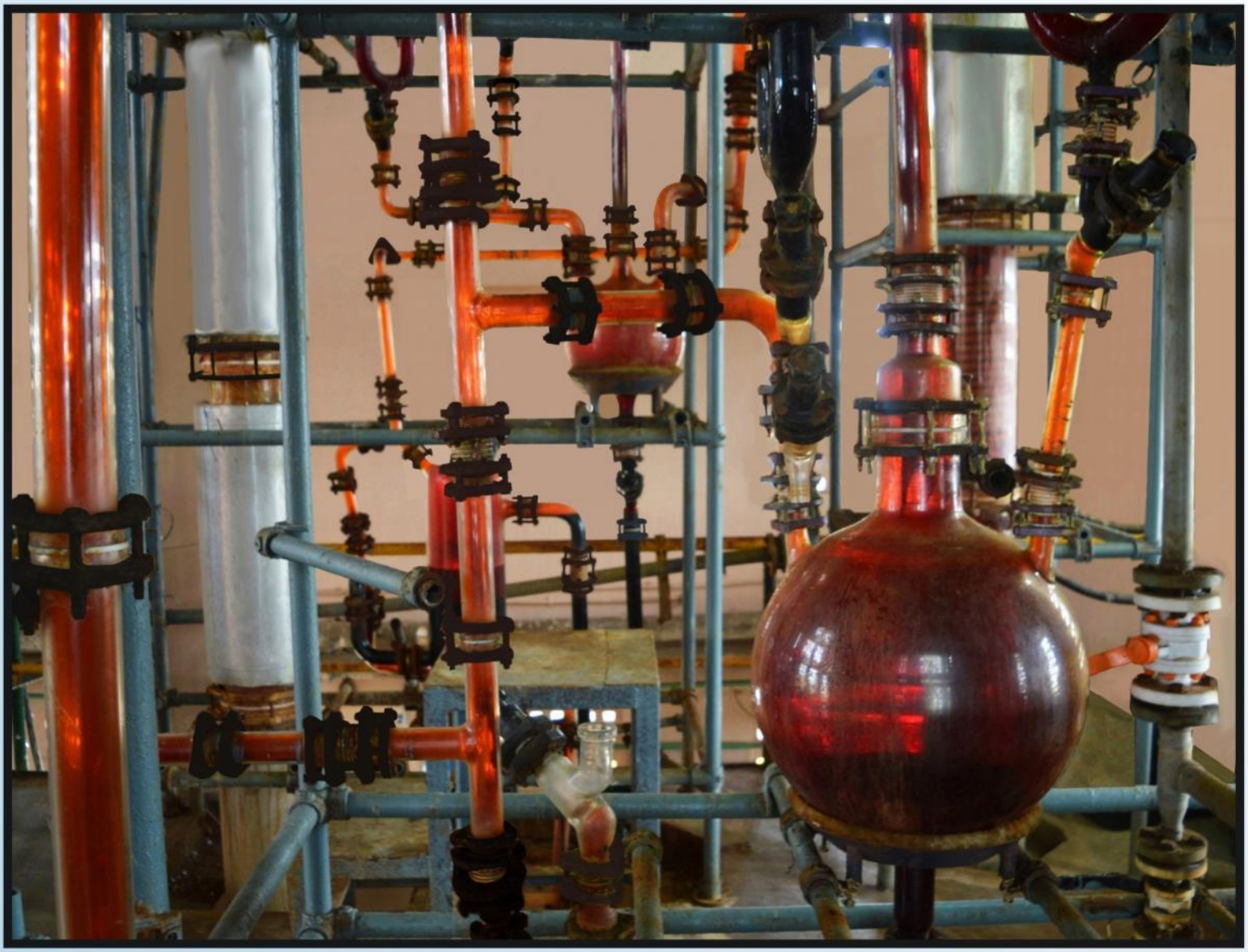
Ablaze Glass Works Pvt. Ltd.

BROMINE
RECOVERY SYSTEM



Introduction

Bromine is a very important chemical, finding its application directly and indirectly in manufacture of pesticides, agrochemicals, pharmaceuticals, fire-retardants, photography chemicals and many others.

The grassroot production of Bromine is done either from sea-bitterns, in-land brine or brine pools where it occurs as bromide salts. It is also recovered from industrial effluents/ byproducts where it occurs as different Bromide salts depending on the source.

Bromine is highly corrosive and reacts readily with metals. Thus, very few Material of Construction are compatible to handle, process and store Bromine. It is also toxic and hazardous in nature, in form of fuming liquid at room temperatures. Thus, special design and special knowledge is required to set up and operate Bromine recovery systems.

Bromine recovery by Ablaze

Ablaze has a long and successful record of design and supply of several Bromine recovery systems both grass-root and from industrial effluents. Being manufacturer of Borosilicate Glass equipment, PTFE components and PTFE lined components, Ablaze is well qualified to handle such recovery systems as these are the major Material of Construction used in such systems. Ablaze also has in-house capababilities for instrumentation and automation,which is necessary for reliableand safe operation.

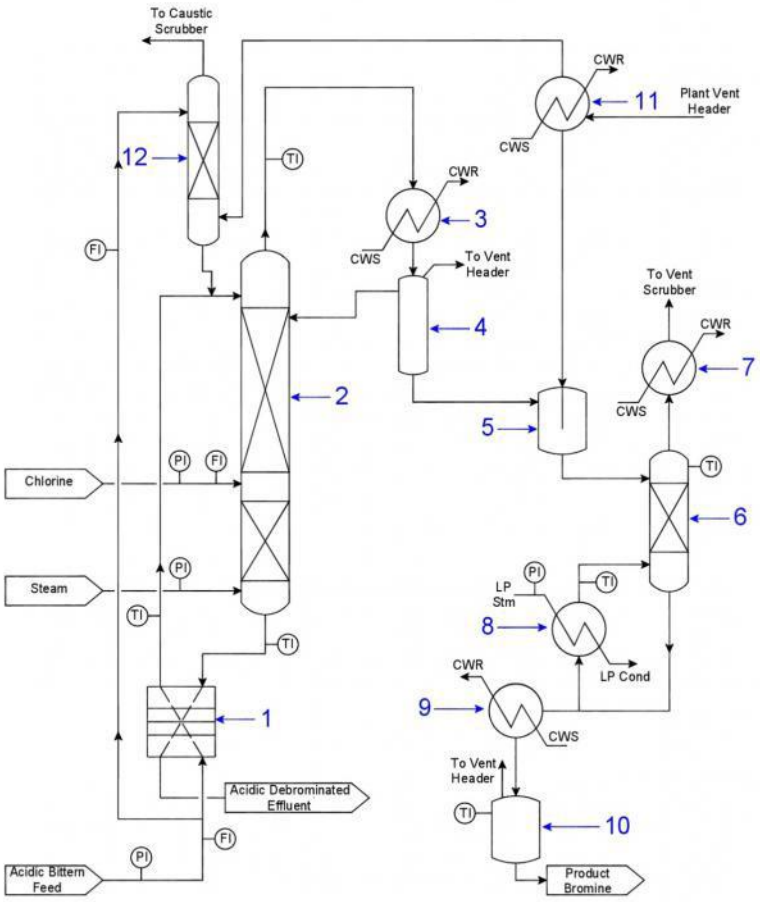
Custom made designs are offered for various Bromine recovery systems, depending on the source of Bromide and the end use of final product Bromine.

Grass root Bromine recovery

Grass root Bromine recovery is carried out typically either from Sea-bittern or In-land brine. Sea-bittern is the mother liquor left after the solar evaporation of Common Salt, which may need to be concentrated further.

Depending on the Bromine content in the Bittern, either Hot Blowing Process or Cold Blowing Process is selected for recovery. Generally, Hot Process is preferred when the Bromine content is 3 gpl or above whereas Cold Process is preferred when the Bromine content is below that. Also, Cold Process is preferred for very large production capacities.

Hot Process Bromine Recovery



Components

1. Feed/Effluent Heat Exchanger
2. Reaction-Stripping Column
3. Overhead Condensers
4. Phase Seperator
5. Crude Bromine Intermediate Receiver
6. Bromine Purification Column
7. Bromine Purification Condensers
8. Bromine Purifiction Re-boiler
9. Bromine Coolers
10. Pure Bromine Intermediate Receiver
11. Vent Condenser
12. Vent Scrubber Column

Fig.: Hot Process Bromine Recovery

The acidified feed containing Bromide salts is preheated and fed to Reaction-cum-stripping tower. Here, dry Chlorine gas and Low Pressure saturated steam are injected. The Chlorine gas liberates free Bromine which is stripped out by live steam in form of vapors.

These vapors are condensed in series of condensers, using Cooling and Chilling water and condensate is collected in phase-separator. The water phase is separated from Bromine and is refluxed to the tower. The Bromine so separated is Crude Bromine and contains some dissolved Chlorine.

Crude Bromine is subjected to distillation whereby Chlorine is removed and pure Bromine collected as Bottom product. This Bromine is cooled by Cooling and Chilling water through Product coolers and collected in Product receiver/s. From here, it may be bottled or filled into MSGL vessels depending on the end purpose.

The plant vents containing Chlorine and Bromine vapors are taken to Vent condenser where Chilling water condenses most of the Bromine and recycles into the system. The non-condensibles are taken to the Vent scrubber where part of Cold feed is fed to absorb most of the vapors. The tail gas may be taken to secondary Alkali scrubber if required.

The debrominated effluent from the stripping tower exchanges heat with the feed and is relatively cooled down. It may be taken for neutralization and effluent treatment.

Cold Process Bromine Recovery

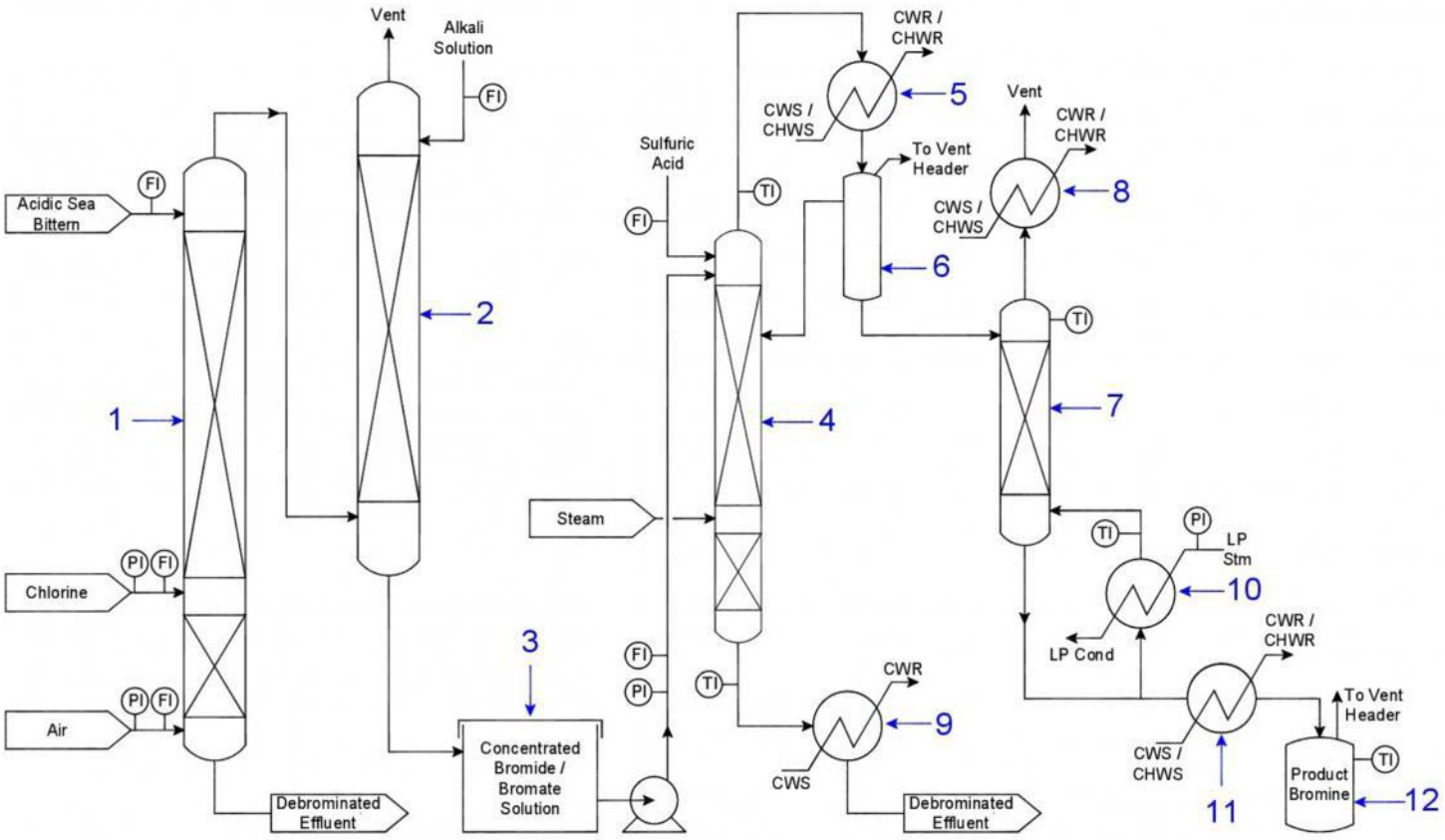


Fig.: Cold Process Bromine Recovery

Components

1.Air Blowing Tower

2.Alkali Absorption Tower

3.Concentrated Bromide Tank

4.Acidification Tower

5.Bromine Condenser

6.Phase Separator

7.Purification Column

8.Purification Condenser

9.DB Effluent Cooler

10.Purification Reboiler

11.Product Bromine Cooler

12.Product Bromine Receiver

The acidified feed containing Bromide salts is fed to Reaction-cum-Air blowing tower. Here, dry Chlorine gas and Low Pressure Air are injected. The Chlorine gas liberates free Bromine which is stripped out by Air in form of vapors.

These vapors enter Absorption tower where Alkali solution is circulated. The Bromine vapors react with Alkali and a Bromide-Bromate solution is formed as a result. The Bromine content in the resultant solution is highly enriched compared to original content. The unabsorbed air is vented out.

The enriched Bromide-Bromate solution is subjected to acidification in the liberation tower. Here, as a result of the reaction, Bromine vapors are liberated. Live steam is injected at the bottom to strip out this Bromine. The vapors leave the top of the tower.

These vapors are condensed in series of condensers, using Cooling and Chilling water and condensate is collected in phase-separator. The water phase is separated from Bromine and is refluxed to the tower. The Bromine so separated is Crude Bromine and contains dissolved some Chlorine.

Crude Bromine is subjected to distillation whereby Chlorine is removed and pure Bromine collected as Bottom product. This Bromine is cooled by Cooling and Chilling water through Product coolers and collected in Product receiver/s. From here, it may be bottled or filled into MSGL vessels depending on the end purpose.

The plant vents containing Chlorine and Bromine vapors are taken to Vent condenser where Chilling water condenses most of the Bromine and recycles into the system. The non-condensibles are taken to the Vent scrubber where part of Cold feed is fed to absorb most of the vapors. The tail gas may be taken to secondary Alkali scrubber if required.

The debrominated effluent from the Air blowing tower may be taken for neutralization and effluent treatment.

Bromine recovery from industrial effluents

As the industrial effluents are more concentrated in Bromine/ Bromide content (typically ranging from 10% to 30%), Hot Process is employed for Bromine recovery from industrial effluents such as NaBr, KBr, etc.

However, since the industrial effluents invariably contain some impurities carried over from the source process, such recovery system is preceded by a suitable pre-treatment system.

After the pre-treatment and acidification of the feed, Bromine recovery process for industrial effluent is similar to the Hot process above for the grass root recovery. Depending on the size of the plant, the pre-heat system may be different. Sometimes, depending on the source of feed, the final Bromine purification section may be differently designed.

Additional information on Bromine recovery system:

Typical Product quality for Bromine recovered from such recovery plants is as follows

- Bromine 99.5% w/w min
- Chlorine 0.3% w/w max
- Moisture 0.1% w/w max

However, system can be designed to give desired Product quality as per the Customer requirement. For eg. System can be designed to give dry Bromine if so required.

Requirements for Bromine recovery system:

Raw material required:

- Bromide Feed
- Chlorine gas
- Small quantity of HCL or Sulfuric acid (for pH adjustment)
- Small quantity of Caustic / Lime stone (for DB effluent neutralization)

Utilities required :

- Low Pressure Steam
- Cooling water
- Chilling water

Salient features of Ablaze Bromine recovery system:

- Energy efficiency
- Lower specific consumption figures
- Integrated with Instrumentation
- Safety
- Alternative/ options of MoC

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