EXTRACTION OF BROMINE FROM SEA WATER

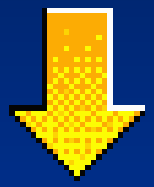
1. Oxidation of Bromide ions to Bromine.
2. Removal of Bromine Vapour.
3. Reduction of Bromine to Hydrobromic acid.
4. Oxidation of Hydrobromic acid to Bromine

1:Oxidation Of Bromide to Bromine

- Seawater is acidified using H_2SO_4.
- (pH8-3.5).
- Why? At High pH Chlorine and Bromine react with Water.
- $Br_{2(aq)} + H_2O_{(aq)} \rightarrow HBr_{(aq)} + HBrO_{(aq)}$
- $Cl_{2(aq)} + H_2O_{(aq)} \rightarrow HCl_{(aq)} + HClO_{(aq)}$

What is Redox?

Iron is OXIDISED – It is Losing Electrons



$Fe \rightarrow Fe^{2+} + 2e^-$

$O + 2e^- \rightarrow O^{2-}$

Oxygen is being Reduced- It is Gaining Electrons

A Small Excess of Chlorine is added to the acidified Water, to displace Bromine by a redox reaction.

$Cl_{2(aq)} + 2Br^-_{(aq)} \rightarrow 2Cl^-_{(aq)} + Br_{2(aq)}$

$2Br^-_{(aq)} \rightarrow Br_{2(aq)} + 2e^-$: $Cl_{2(aq)} + 2e^- \rightarrow 2Cl^-$

Chlorine is the Oxidising agent and
Bromine the Reducing agent

2: Removal of Bromine Vapour

Treated Sea water then passes into a Blowing out tower: Bromine being very volatile is removed from the air along with some chlorine.

The Bromine Vapour Concentration is TOO LOW
to produce liquid Bromine

Blowing out tower

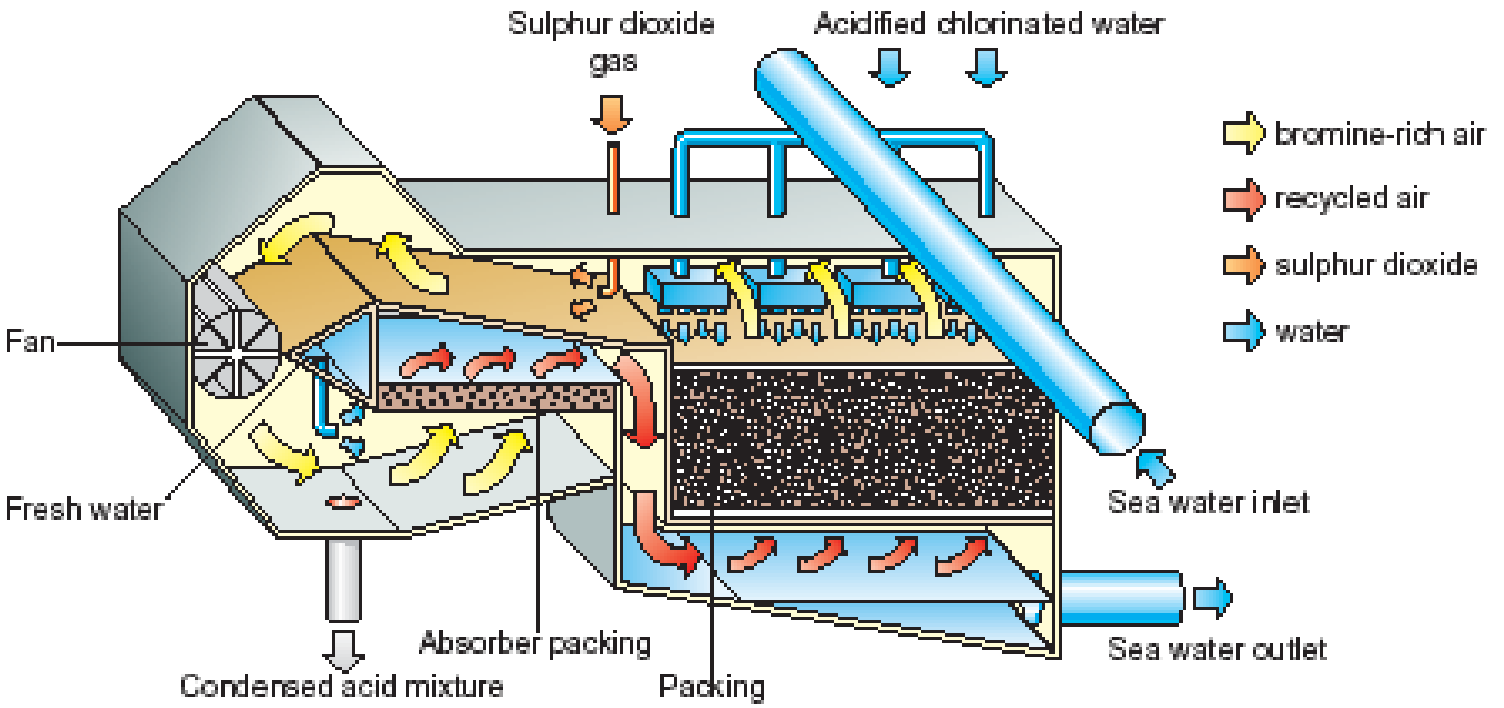


Figure 7 Inside a blowing-out tower.

3: Reduction of Bromine to Hydrobromic acid

Sulphur dioxide is injected into the blowing out tower.

The Bromine is reduced to hydrobromic acid by the sulphur dioxide

$$Br_{2(aq)} + SO_{2(g)} + 2H2O0_{(l)} \rightarrow 2HBr_{(aq)} + H2SO_{4(aq)}$$

A fine mist of acids is produced when fresh water is injected into the tower.

This is then condensed in the absorber stage of the tower.

The mixture now contains 13% by mass of bromine.

4: Oxidation of Hydrobromic acid to Bromine

The Acid passes into a steaming out tower.

Chlorine regenerates the bromine using a redox reaction

$2HBr_{(aq)} + Cl_{2(g)} \rightarrow Br_{2(g)} + 2HCl_{(aq)}$

Chlorine oxidises the Bromide in HBr to bromine.

Hot vapour is condensed to form an aqueous layer and a lower layer of bromine

4: Oxidation of Hydrobromic acid to Bromine

- Spent seawater is discharged.
- Remaining Br_2 and Cl_2 are destroyed using sulphur dioxide before any water leaves the blowing out tower.

- On discharge the pH s 3.5 but rapidly rises to ph8.

Dense Dark and Beautiful

- Extraction is a continuous process.

Bromine is transported in lead –lined steel Tanks.