

Lecture 13. Production of pulp

Pulp is a commercial fibrous material obtained from bamboo, wood, bagasse (waste material) etc. by mechanical and chemical means.

- Pulping means disintegration of bulky fibrous material to small fibres.
- There are mainly three modes of production of pulp:
 - (a) Mechanical
 - (b) Chemical
 - (c) Semi chemical

Sulfate (Kraft) Pulping Process

- Most popularly used process.
- This is an alkaline process.
- Na_2SO_4 is added to the cooking liquor. So its common name is sulfate process.
- The presence of sodium sulfide makes bleaching of pulp easier and the paper produced has better strength.

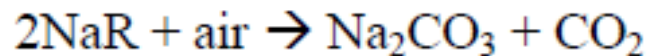
Chemical reactions involved

(i) Digestion (hydrolysis and solubilization of lignin)

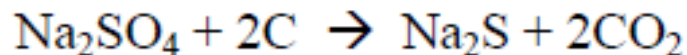


(ii) Chemical recovery from black liquor

(a) Smelting

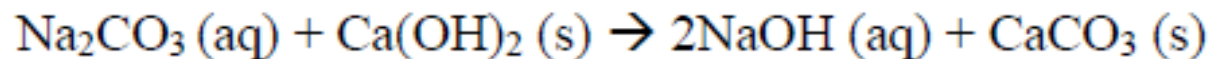


(lignin)



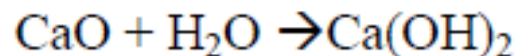
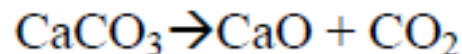
(from R) (white liquor)

(b) Causticizing

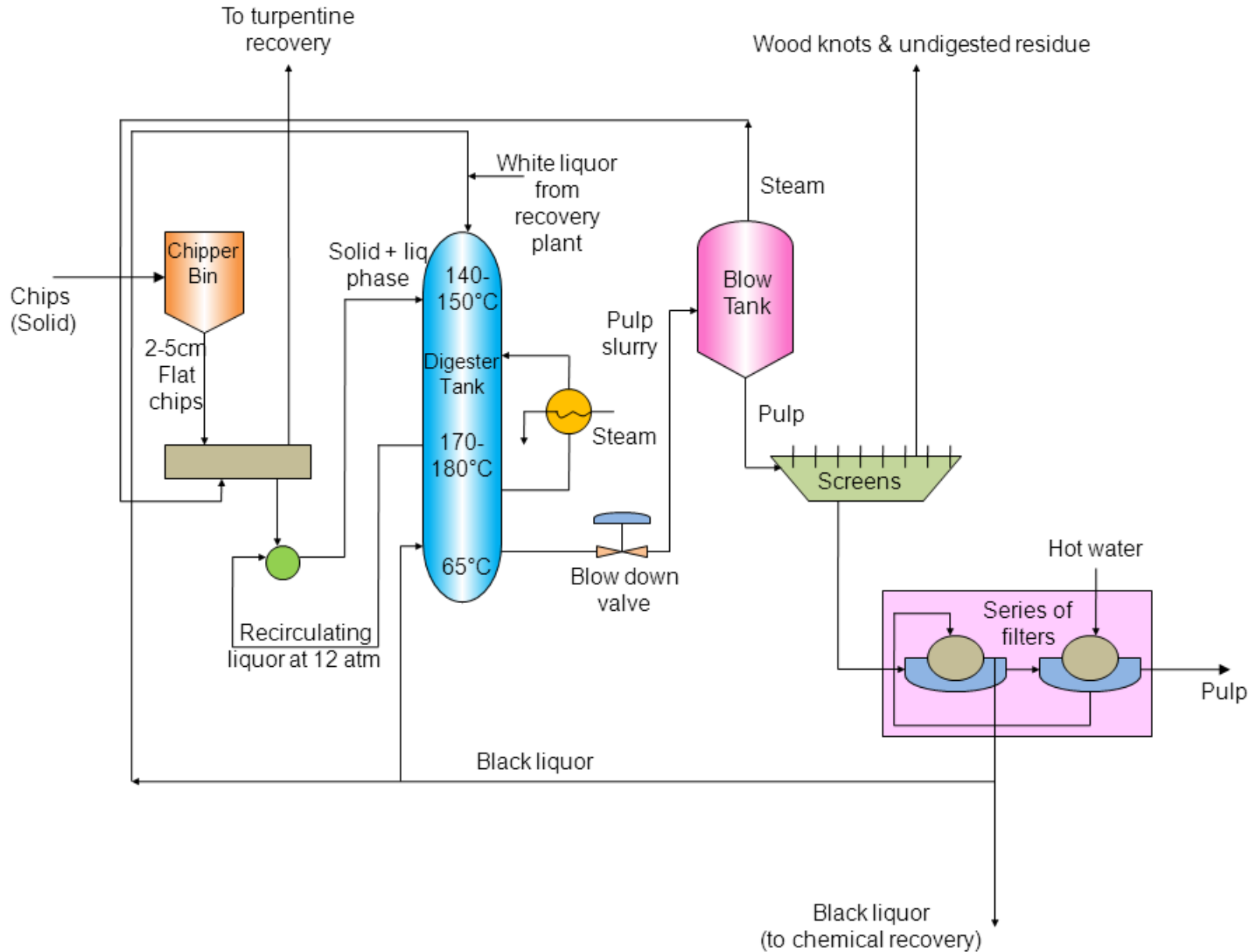


(green liquor)

(white liquor)



Flow sheet of manufacture of pulp manufacture



Functional role of various processes

(a) Chipper bin:-

- ❑ Chips are fed in this device.
- ❑ Cut logs are conveyed to the chipper where rotary disks with heavy knives reduce the wood to size 2-5cm flat chips.
- ❑ Size reduction is done to maximize penetration of process chemicals.

(b) Digester tower:-

- ❑ Continuous digester tower is 25 – 30m tall.
- ❑ Chips are preheated with volatilizing turpentine and non-condensable gases.
- ❑ For controlling digestion temperature, cooking liquor is withdrawn as side streams and circulated through heat exchanger.
- ❑ Digestion is done to free lignin and other non-cellulosic content.
- ❑ Cooking time is about one and a half hours at 170°C.
- ❑ To avoid mechanical weakening of fibres, digested chips are cooled with recycled black liquor.
- ❑ Temperature is maintained at 140-180°C and pressure at about 10 atm.
- ❑ Bottom temperature is maintained at 65°C

(c) Blow down valve:-

This valve reduces the pressure of the stream from 80atm to 1atm before entering blow tank.

(d) Blow tank:-

When hot pulp slurry is passed to the blow tank, heat is recovered in the form of steam.

The chips are preheated with this recovered steam.

The blow tank has high concentration of pulp and low concentration of water.

(e) Screens:-

Pulp is screened so as to remove wood knots and undigested residues.

(f) Series of filters

Pulp is filtered to separate black liquor for chemical recovery plant.

Black liquor is also recycled back to digester for cooling the digested chips.

Hot water is added to second filter for better filtration.

Bleaching of pulp

To produce white paper, the pulp is bleached. The chemicals used to bleach pulp must be environment friendly. Bleaching with chlorine produces dioxins and other undesirable products. So, nowadays pulp is bleached with hydrogen peroxide, ozone, chlorine dioxide, oxygen etc. The objective of bleaching is to remove small fractions of lignin that remains after digestion.