

# Paper and Pulp

## HOW PAPER IS MADE



# Paper production





# Introduction:

The pulp and paper industry comprises companies that use wood as raw material and produce pulp, paper, paperboard and other cellulose-based products. Almost all varieties of paper are made by using bamboo, straw, jute, lokta, recycled waste paper, rice, cotton, and even old clothes, etc. Paper pulp and paper are not only made from cellulosic fibres plant materials but also uses papers after recycling, purifying and deinking.

**Pulp** is commercially fibrous material (cellulose) obtained from bamboo, wood, and sugarcane fibers by mechanical and chemical method. The process of producing pulp is called **pulping**.

**Paper** is the aqueous deposit of any vegetables fiber in sheet form. It is made of cellulose, tree being the main source of fibers.

The raw materials are broadly classified into two categories: Fibrous type and non fibrous type of raw materials.

**i. Fibrous raw material:** Paper pulp: Ground wood, bleached and unbleached pulp, semi-chemical pulp.

Reuse pulp: Paper product, newspaper, paperbound

Cellulose pulp: Straw, linen and cotton.

Speciality pulp: Inorganic fibers such as asbestos and glass.

**ii. Non fibrous raw materials:** The chemicals which are used for filtering sizing, and coating of paper are included in such raw materials.



These chemicals are used for pulping and bleaching

**Inorganic raw materials:**

Clay, Talc,  $\text{TiO}_2$ ,  $\text{ZnS}$ ,  $\text{CaCO}_3$ , alum, sulphur, lime,  $\text{NaOH}$ , soda ash,  $\text{H}_2\text{O}_2$ ,  $\text{Cl}_2$ ,  $\text{Mg}(\text{OH})_2$ ,  $\text{NaClO}_3$  etc.

**Organic raw materials:** Rosin, starch, wax, glycerol, dyes etc.

# Stages in production of paper

## MANUFACTURING STEPS

- ▶ TIMBER
- ▶ DE -BARKING
- ▶ CHIPPING PROCESS
- ▶ CHEMICAL PULPING PROCESS
- ▶ MECHANICAL PULPING PROCESS
- ▶ HYDRAPULPING
- ▶ BLEND CHEST
- ▶ WASTE PAPER
- ▶ DE- INKING
- ▶ REFINING
- ▶ SCREENING & CLEANING
- ▶ PAPERMAKING MACHINE
- ▶ CONVERSION & PRINTING

# Timber

- ▶ Timber used for papermaking comes from well managed forests where more trees are planted than harvested to ensure sustainable growth.





## De-Barker

- ▶ Bark is stripped from the logs by knife, drum, abrasion, or hydraulic barker. The stripped bark is then used for fuel or as soil enrichment.

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# CHIPPING

- ▶ Stripped logs or timber are chipped into small pieces by knives mounted in massive chipping machine.
- ▶ chips are then stored in huge bins ready for the next process.



CHIPPING MACHINE



## CHEMICAL PULPING PROCESS

- ▶ Chips from the storage bins are fed into a digester. The woodchips are then 'cooked' to remove lignin.
- ▶ Lignin is the binding material which holds the cellulose fibres together.
- ▶ The chemical process is energy self-sufficient as nearly all by-products can be used to fire the pulp mill power plant.





## MECHANICAL PULPING PROCESS



- ❖ MECHANICAL PULP YIELDS OVER 90% OF THE WOOD AS FIBER IS PRODUCED BY FORCING DEBARKED LOGS, ABOUT TWO METERS LONG, AND HOT WATER BETWEEN ENORMOUS ROTATING STEEL DISCS WITH TEETH THAT LITERALLY TEAR THE WOOD APART

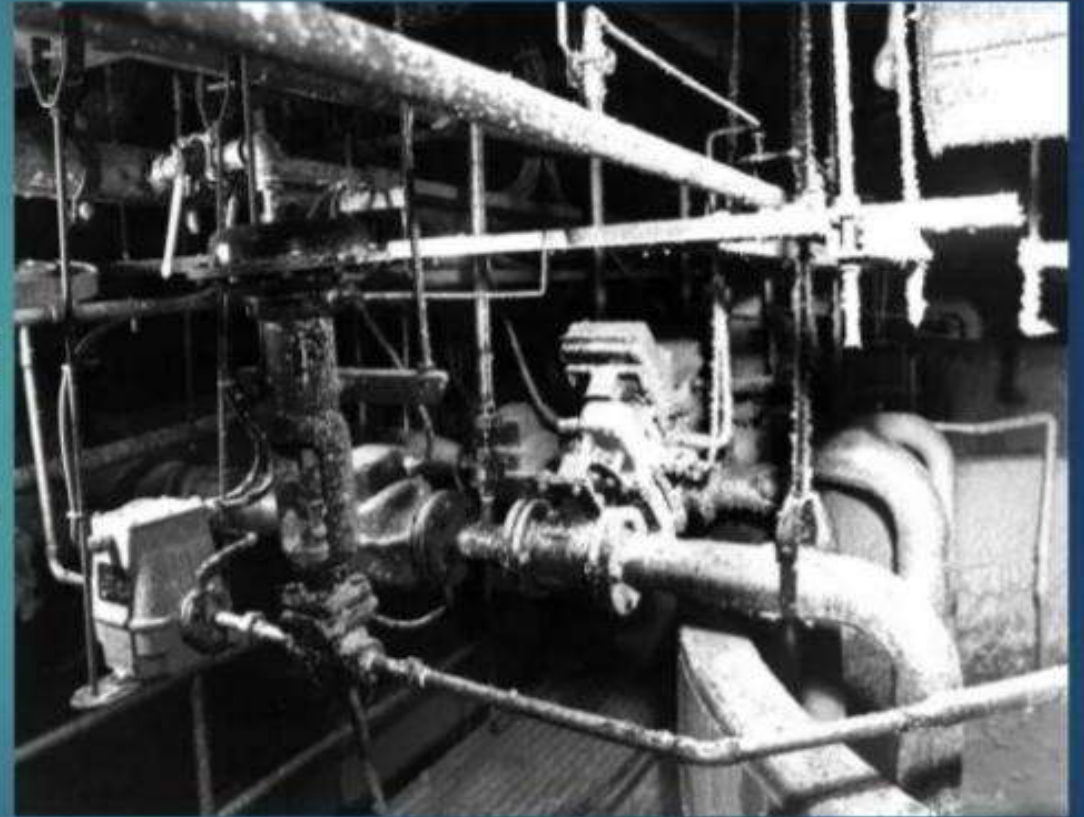
# HYDRAPULPER

- THE WOOD FIBRES ARE BROUGHT INTO A CIRCULAR TANK CONTAINING WATER.
- THIS HAS A VERY POWERFUL AGITATOR AT THE BOTTOM WHICH BREAKS UP THE BALES (WOODEN FIBRES) INTO SMALL PIECES.



## BLEND CHEST

- ▶ CHEMICALS CAN BE ADDED TO OBTAIN THE REQUIRED CHARACTERISTICS TO THE FINISHED PAPER.
- ▶ DYES ARE ALSO ADDED , aS NECESSARY , to COLOR THE PAPER





## WASTE PAPER



- ▶ Waste paper is collected from Waste Paper Banks and Commercial dumps.
- ▶ Waste paper currently represents 67% of the raw material in paper industry.
- ▶ Paper not suitable for recycling is removed.

## DE-INKING

BEFORE PRINTED PAPER CAN BE RECYCLED THE INK NEEDS TO BE REMOVED, OTHERWISE IT WILL BE DISPERSED INTO THE PULP.

THERE ARE TWO MAIN PROCESSES FOR DE-INKING WASTE PAPER –

- WASHING
- FLOTATION .





## REFINING

- ▶ This is where the cellulose fibers pass through a refining process which is vital in the art of papermaking. Before refining, the fibers are stiff, inflexible and form few bonds.



## SCREENING AND CLEANING

- ▶ Pulps contain undesirable fibrous and non-fibrous materials, which should be removed before the pulp is made into paper .
- ▶ Cleaning involves removing small particles of dirt and grit using rotating screens and centrifugal cleaners.



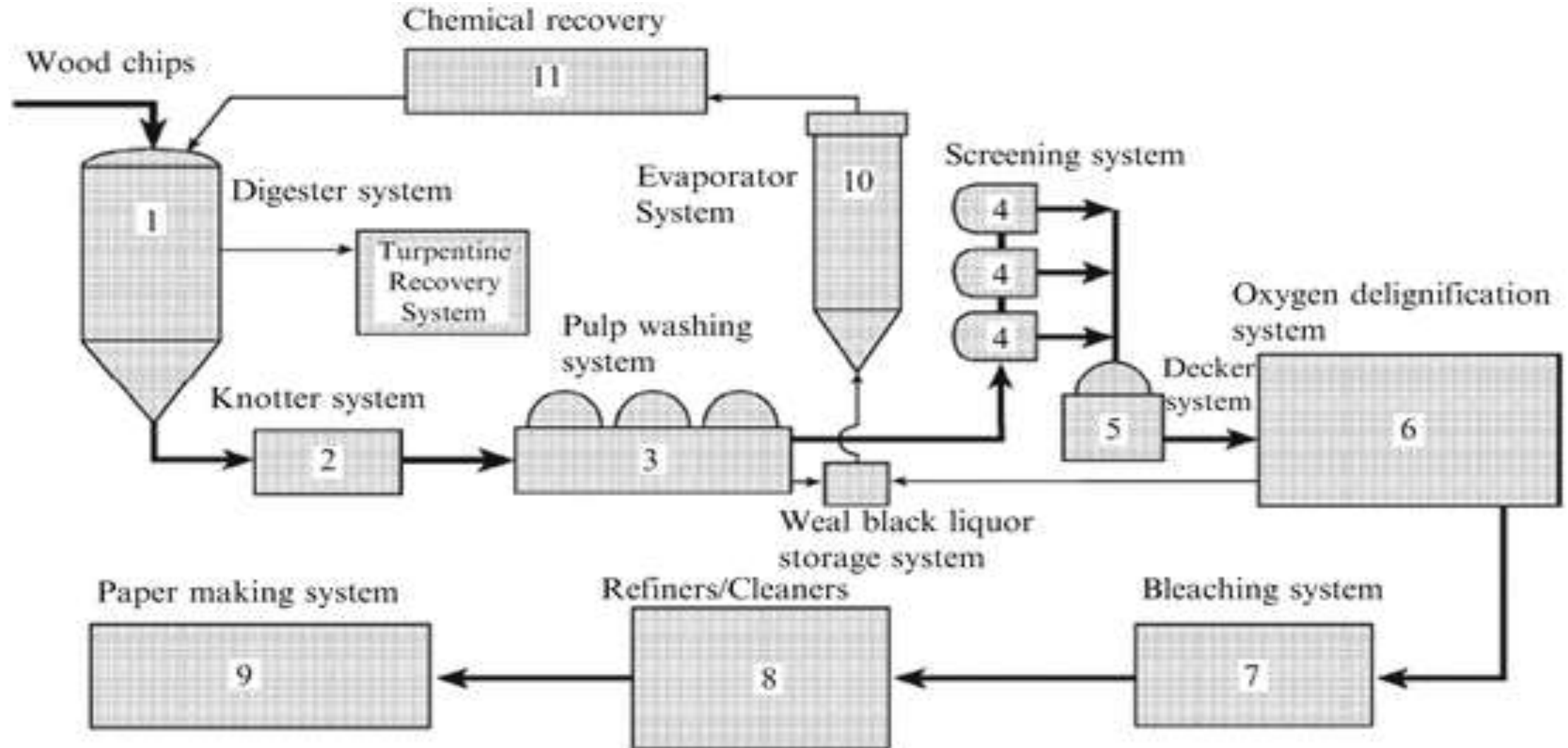


## PAPERMAKING MACHINE



A SLURRY OF FIBRE (USUALLY WOOD OR OTHER VEGETABLE FIBRES) IS DRAINED TO CREATE A CONTINUOUS PAPER WEB. AFTER THE FORMING SECTION THE WET WEB PASSES THROUGH A PRESS SECTION TO SQUEEZE OUT EXCESS WATER, THEN THE PRESSED WEB PASSES THROUGH A HEATED DRYING SECTION.

# Flow sheet diagram for paper production



# Key Properties of Paper

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- ✓ Fibers
- ✓ Basis Weight
- ✓ Caliper  
(Thickness)
- ✓ Grain Direction
- ✓ Formation
- ✓ Surface Sizing
- ✓ Opacity



- ✓ Brightness
- ✓ Whiteness
- ✓ Absorption
- ✓ Smoothness
- ✓ Paper Strength
- ✓ Stretch
- ✓ Moisture