Pulp and Paper Industry

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Structure of presentation

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- History
- Properties
- Uses
- Process
- SHE consideration
- Steps against environmental problem

Introduction

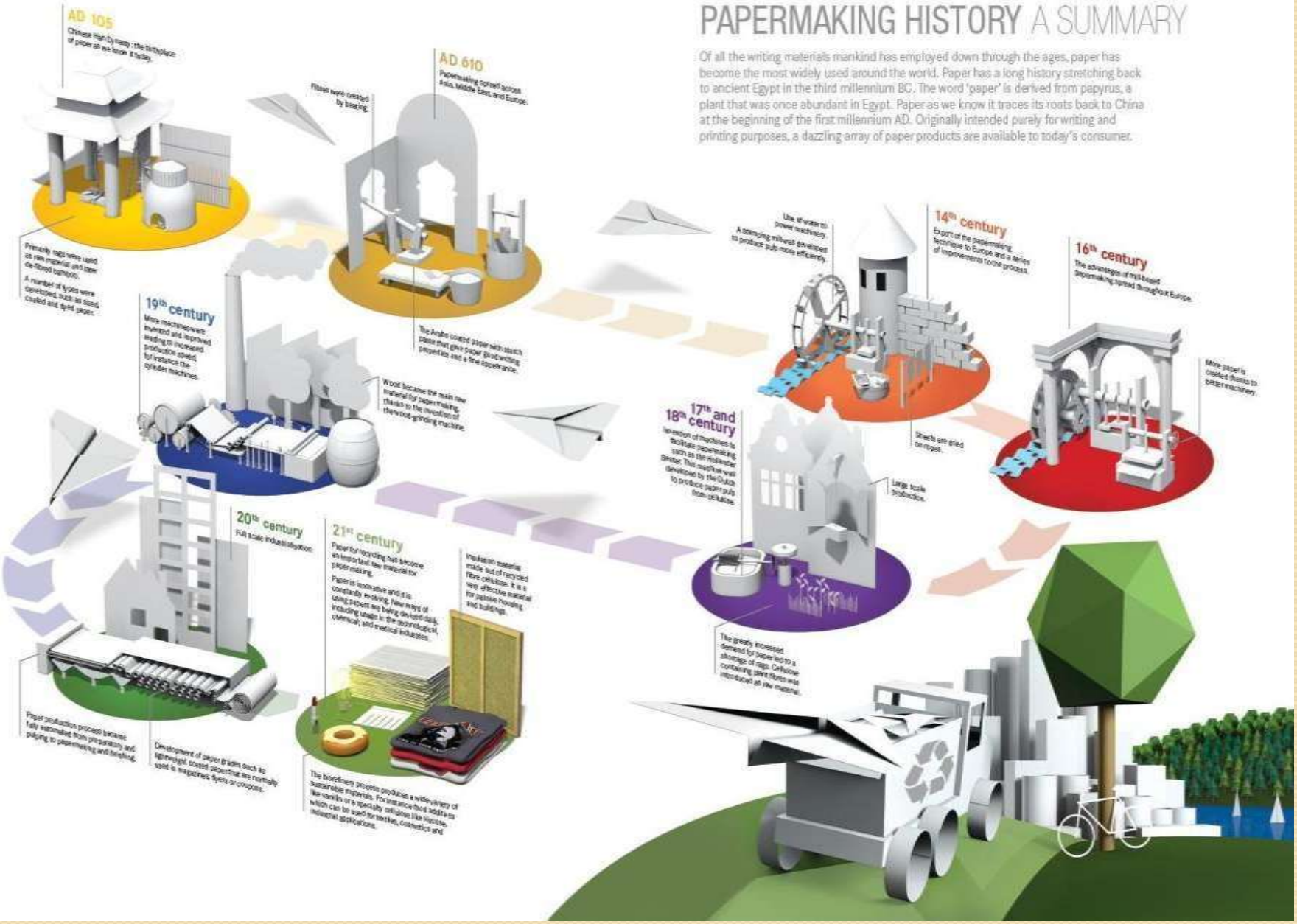
- The pulp and paper industry converts wood or recycled fibre into pulp and primary forms of paper.
- First mechanical and then chemical methods have been developed to produce pulp from wood.
- Pulp mills separate the fibres of wood or from other materials, such as rags, wastepaper or straw in order to create pulp.
- Paper mills primarily are engaged in manufacturing paper from wood pulp and other fibre pulp, and may also manufacture converted paper products.

Histor
y

- The earliest paper was made from papyrus grass in Egypt.
- Papermaking has traditionally been traced to China about 105 AD by Cai Lun
- Chinese paper making techniques became more specialized over the next few centuries with sized, coated and dyed paper, and paper with insect protection

PAPERMAKING HISTORY A SUMMARY

Of all the writing materials mankind has employed down through the ages, paper has become the most widely used around the world. Paper has a long history stretching back to ancient Egypt in the third millennium BC. The word 'paper' is derived from papyrus, a plant that was once abundant in Egypt. Paper as we know it traces its roots back to China at the beginning of the first millennium AD. Originally intended purely for writing and printing purposes, a dazzling array of paper products are available to today's consumer.



Properties of pulp can be determined by:

- Ash content in pulp but it is not important parameter of pulp.
- Dirt content of pulp particularly of recycled pulp is important for its suitability to make fine paper.
- Moisture Content of Market Pulp is important from storage, transportation and handling point of view.

- Fiber Length of Pulp is one of the most important parameters of pulp
- Fines Content an additional measure of pulp particle size is the percentage of fines.
- Kappa Number of Pulp is the determination of relative hardness, bleach ability or degree of delignification of pulp.

- Permanganate Number (K Number) is a chemical test performed on pulp to determine the degree of delignification.
- Viscosity of Pulp is the solution viscosity of a pulp gives an estimation of the average degree of polymerization of the cellulose fiber.

Uses of the product

- Around the world we use more than 1 million tons of paper every day.
- Our paper consumption is escalating, particularly in emerging markets such as China.
- Paper is a versatile product with many end uses varying from household papers, graphic and office papers to medical papers.

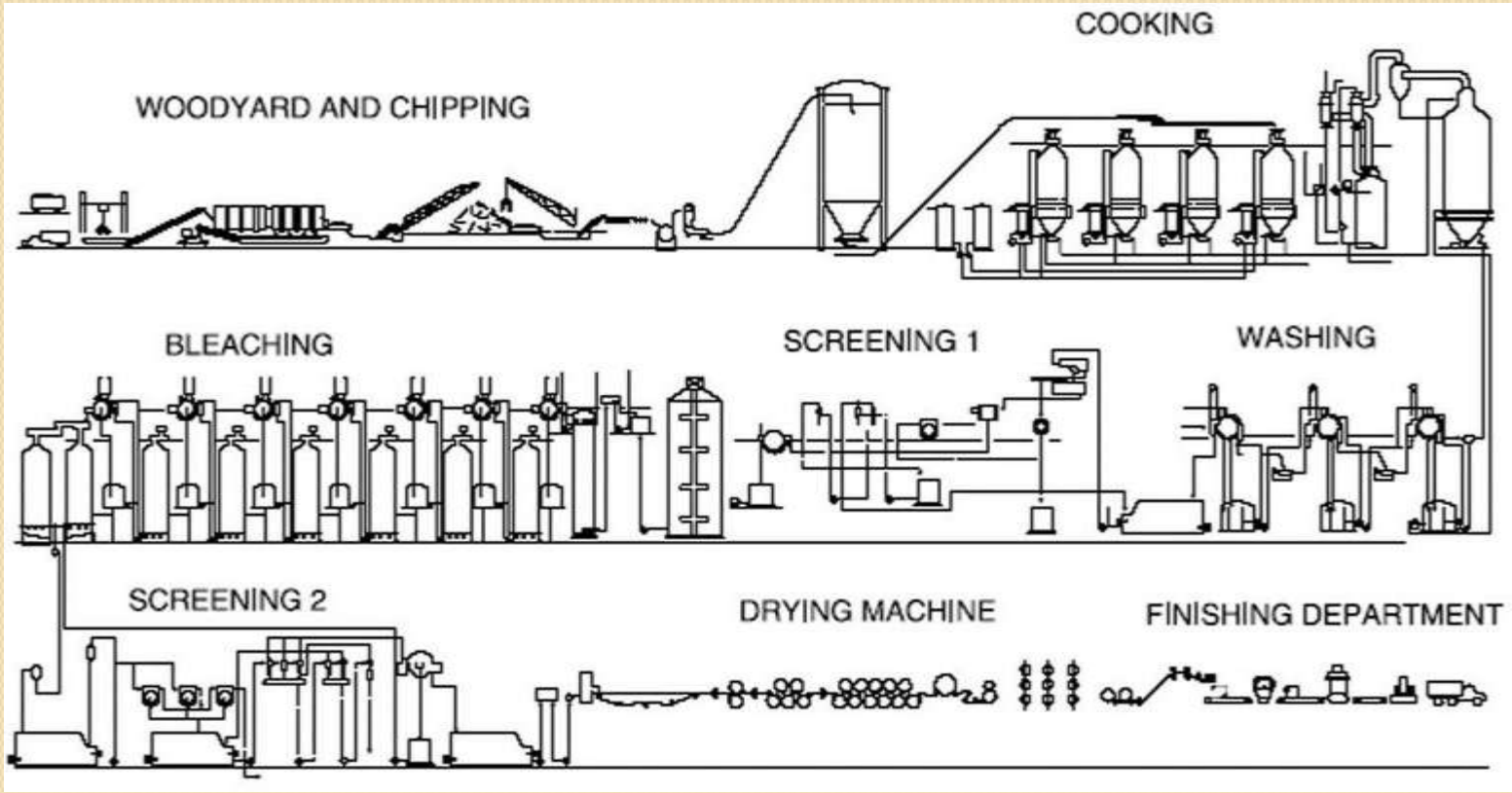
- 50% of the paper and board produced globally is used for packaging.
- The second largest market for paper is printing and writing.
- 400 million tons/year: Global paper consumption as of 2010. Half of this is consumed by Europeans and North Americans and is thrown away after a short time.
- 500 million tons: Forecasted increase in paper consumption by 2020.

Pulp and Paper Process

The production process can be divided into 7 sub-processes:

- raw materials processes;
- wood-yard;
- fibre line;
- chemical recovery;
- bleaching;
- paper production;
- products and recycling.

Simplified flow diagram of integrated mill



Raw material Process

- Wood is the main fibrous raw material used to produce pulp, and accounts for more than 90% of the production.
- Non-wood fibres are an important source of raw materials, especially in developing countries.
- Manpower requirements and the safety of workers and populations must be an issue of concern for investors.

Raw material storage and preparation

- Preparation of the raw material is necessary before it enters the papermaking process.
- Wood, for instance, first needs to be debarked usually by mechanical or hydraulic processes, and is then disintegrated, generally by chipping into particles of the adequate size.

Pulping

- The goal of pulping is to separate the fibres from the material
- There are 3 different groups of pulping methods,

1. Mechanical pulping, This method consists in grinding raw material against an abrasive surface to defibre the raw material (more generally softwood) without any lignin dissolution.

2.Chemical pulping, this method separates the fibres from the raw material by making soluble all the non-cellulosic components in a cooking liquor at high temperature and pressure. This pulping gives better quality but greater pollution.

3.Chemi-mechanical pulping, involve a chemical pre-treatment of the raw material, before a mechanical treatment to liberate the fibres.

Bleaching

- Pulp for packaging material can generally be used without bleaching. For other purposes, it has to be bleached.
- In mechanical pulping most common agents are sodium or hydrogen peroxide and sodium hydrosulphite used alone or in combination.
- In chemical pulping chlorine, sodium or calcium hypochlorite and chlorine dioxide are used.
- Oxygen pre-bleaching becomes more important in order to reduce chlorine use.

Papermaking

- The five main paper grades listed in decreasing order of production volume are: (French statistics)

- Cultural paper: newspaper, books, writing paper… 46%
- Packaging paper: kraft for packaging, corrugated paper… 37%

- Paperboard: 9%

-Industrial paper: cigarette, sensitized paper, dielectric, checks, filters.. 3%

- Tissues: toilet paper, handkerchiefs, napkins… 5%

SHE consideration

- Safety :
- Machine intervention
- Slips trips and falls
- Work at height

- Health :
- Noise
- Dust

Environmental problems

- Air emissions - Nitrogen dioxide and sulfur dioxide are major contributors of acid rain.
- Deforestation
- Water pollution - **solid waste** such as sludge derived from their pulping and bleaching operations.
- Solid wastes - Dirty wood chips or fibers as well as bark

Energy use

- The pulp and paper industry uses 84% of the **fuel energy** consumed by the forest products industry as a whole.
- It is one of the largest producers of greenhouse gas (GHG) emissions.
- Over the past few years, the pulp and paper industry has considerably reduced its GHG emissions by introducing energy conservation projects and by increasing its use of biomass as an energy source.

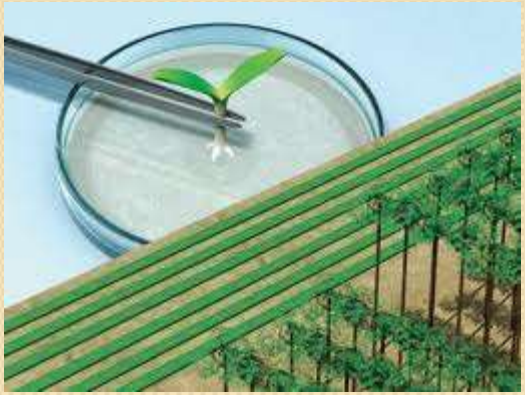
What we can do to save our environment???

Recycling

- In Europe an average of 56% of used paper is recovered. The recycling process includes following stages:
  - Sorting
  - Dissolving
  - De – inking
  - Mixing
  - Papermaking process

Genetically modified trees

- Lignin is the main wood component that must be effectively removed from the pulp.
- It has been possible to use genetic engineering to modify lignin content and/or composition in poplars.



Price aspects of this process

- The production cost was calculated to be 670 euros/t of hemicelluloses.
- This is approx 9 times lower than the price of ethylene vinyl alcohol, which is produced by petrochemicals and is currently used as an oxygen barrier in fiber-based packaging materials.