



Report on Process of Paper Manufacture



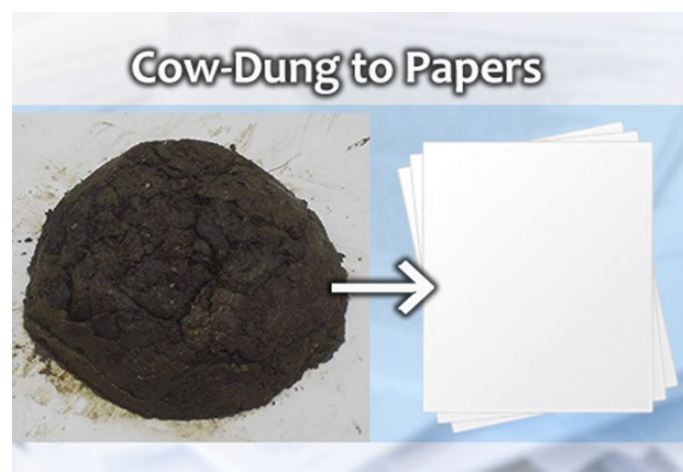
सत्यमेव जयते

Department of Science & Technology
Government of India

Technology Enabling Centre

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PREPARATION OF PAPER

1. **Raw material:** Wood chips from softwood like spruce and pine with slender, solid, elastic fibres or cow dung slurry
20kg cow dung is poured into a container with clean water and soaked in water at room temperature while allowing it to soak in. This makes the fiber material come up, dirt and sand sink to the bottom, and the fiber material is pulled out.
2. **Dehydration:** slagging of the raw material is done to remove excess moisture. These steps bring the total moisture content of the fibre to 25%.
3. **Decatasization:** This step helps stabilise the material during processing. The dehydrated raw material is put into a steam box and add 6% NaOH. The steam box is maintained at 85 °C-95 °C for 40 minutes.
4. **Slurring:** Raw material enters the SLG twin-screw's multi-functional pulper and carries out extrusion slurring after the decapitalization.
5. **Pulping:** pulping is usually carried out by chemical pulping and mechanical pulping. Chemical pulping involves the use of Sodium hydroxide and sodium sulfide. This step helps break down lignin. Cooking liquor is the byproduct of this product, which is washed off, and only cellulose fibres remain the main product of the method.

The most common method used for pulping is mechanical pulping. This process involves mechanical attrition to pulp lignocellulosic materials, except water or steam; no other chemicals are used in mechanical pulping. Lignin is not removed in this process. This step converts the raw material into fibre bundles, yielding dark, unbleached, short-length fibres. Mechanical pulping methods result in a higher product yield than chemical pulping.

Common Name	Chemical Name	Used For
DTPA	Diethylene Triamine Penta Acetate	Used for chelation (removal of transition metals from pulp).
EDTA	Ethylene Diamine Tetra Acetic Acid	

Magnesium Bisulfite	Magnesium Bisulfite	Used in Sulfite pulping
Sodium Bisulfite	Sodium Bisulfite	
Salt Cake	Sodium Sulfate	Makeup chemical in sulfate pulping chemical recovery (Na_2SO_4 . --- Na_2S)
Sulfur	Sulfur	To make HSO_3 for bi-sulfite pulping

6. **Bleaching:** Post mechanical pulping method, the short-length fibres obtained are bleached using oxygen bleaching techniques. During this process, dark lignin is removed from the short-length cellulose fibres.

Chlorine Dioxide	Chlorine Dioxide	In Pulp Bleaching and water treatment
Chlorine Gas	Chlorine	
FSA	Formamidine Sulphuric Acid or Thiourea Dioxide	Post Deinking bleaching
Hydrogen Peroxide	Hydrogen Peroxide	In Pulp Bleaching
Hypochlorous Acid	Hypochlorous Acid	
Lime	Calcium Oxide	Alkaline Pulping Process Chemical Recovery, Bleaching
Oxygen	Oxygen	In Pulp Bleaching
Ozone	Ozone	
Sodium Dithionite	Sodium Hydrosulfite	Bleaching
Sodium Hypo-chlorite	Sodium Hypo-chlorite	

Sodium Peroxide	Sodium Peroxide	
Sodium Thiosulfate	Sodium Thiosulfate	
Zinc Hydrosulfite	Zinc Hydrosulfite	Bleaching Chemical
Soda Ash	Sodium Carbonate	Makeup chemical in alkaline pulping chemical recovery ($\text{Na}_2\text{CO}_3 + \text{Ca}(\text{OH})_2 \rightarrow 2\text{NaOH} + \text{CaCO}_3$)
Sodium Bisulfite	Sodium Bisulfite	An acid type cooking liquor chemical component sometimes used to neutralized residual chlorine in the pulp during the bleaching process.

7. **Beating and refining:** The bleached cellulose fibre is fed into a refiner (Fourdrinier machine). This increases the surface area and also drains excess water. In the refiner machine, the fibres are converted into thin sheets of fibre mat, and the wet press area and the drum dryers reduce the moisture content of the sheet. Drum-type dryers are stainless steel drums that are heated to 93°C/200°F.

Guar Gum	Natural Polymer	Dry Strength Additive
Starch	Starch	Wet and dry end additive

8. **Calendaring:** in this step, the refined fibre sheets are made to pass through a series of drum rolls that enhance both the physical and mechanical properties of paper.
9. **Coating/ Finishing:** materials like kaolinite, calcium carbonate, bentonite and talc can be used to coat paper for high-quality printing used in the packaging industry and in magazines. During coating it is to be made sure that the coating fills all the cracks in paper and that it covers peak cellulose fibres on the paper surface. Three coating methods are used: by means of blade, by nozzle and the combination of coating and pressing.

Chemicals used:

Agalite or Talc	Silicate of Magnesia	It gives paper a greasy or soapy feel. and enables it to take a high finish.
Alganic Acid	Alganic acid or Na-Alginate	Coating and surface treatment
Alum	Sulfate of Alumina	For alkaline sizing along with Rosin
AKD	Alkyl Ketene Dimer	Sizing
Rosin	Abietic Acid	
Rosin Soap	Sodium Abietate	
Barium Carbonate	Barium Carbonate	Coating Pigment
Polyvinyl Alcohol (PVA)	Polyvinyl Alcohol	Pigment coating Binder
Casein	Casein	Pigment coating Binder. Casein is a heterogeneous globular, amphoteric phosphoprotein
Blanc fixe, fast white, pearl white or permanent white	Barium Sulfate	Filler, Coating Pigment
Dolomite	Calcium Magnesium Carbonate	Filler, Coating
Clay or Kaolin	Kaolinite	As filler
Lime Stone	Calcium Carbonate	To make Precipitated CaCO ₃ , is used as Filler and in Coating
Satin		Brightly white pigment

Zinc Sulfide	Zinc Sulfide	Pigment
Zinc White	Zinc Oxide	Pigment
Sodium tripolyphosphate	Sodium tripolyphosphate	Dispersant
Titania	Titanium Dioxide	Filler to increase the opacity and brightness of paper. Used in coating also.
Anatase	Titanium Dioxide	Grade of titanium oxide paper coating pigments which is water dispersible.