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## COMMERCIAL PROCESSES OF PULPING WOODS FOR PAPER

Six processes are commercially used in making paper pulp from wood. One is the mechanical or groundwood process, in which the wood is reduced to pulp on a grindstone. Four processes, the sulfite, sulfate, soda, and neutral sulfite, depend upon the dissolving action of chemical reagents which remove essentially all of the lignin and leave the cellulose fibers in a fairly pure state. This is accomplished by digesting the wood chips with the proper chemical under steam pressure. A sixth process, the semichemical, causes the removal of only a part of the lignin by chemical means and the pulping action is completed by mechanical refining.

The mechanical process is the cheapest and returns the highest yield of pulp (90 percent or more by weight) but the strength of this pulp is low. Consequently, it is usually mixed with some of the stronger chemical fibers before conversion into paper. Newsprint and the cheaper magazine and catalog papers are composed largely of groundwood pulp. Certain fiber and building boards are also made mostly of groundwood. Only a few species of wood are employed; those found most desirable are the long-fibered, light-colored spruces and balsam. Some of the pines and hemlocks are also used but to a smaller extent. The quantity of hardwood consumed in groundwood manufacture is small because the shortness of the fiber limits its use to specialty products.

The sulfite process employs an acid chemical (calcium bisulfite plus sulfurous acid). The yield is less than half the weight of the wood but the pulp is much stronger than groundwood. The unbleached pulp is comparatively light-colored and is readily bleachable. Long-fibered, low resin content softwoods, such as spruce, balsam, and hemlock, are mostly used in producing sulfite pulp, although some aspen, birch, and southern yellow pine are also used. Sulfite pulp is adaptable to the widest variety of uses of any of the commercial pulps. It is used in certain grades of book, wrapping, bond, and tissue papers and, in combination with groundwood, in numerous products, of which the most noteworthy is newsprint. Purified sulfite pulp is used for the manufacture of viscose rayon and other cellulose derivatives.

The sulfate process is applicable to almost any wood. Since the chemical liquor used is alkaline (a solution of sodium hydroxide and sodium sulfide), resins, waxes, or fats in the wood do not hinder its pulping action. Hence it is used principally for the conversion of the pines. Like the sulfite process the yield of pulp is less than half the weight of the wood. In some grades the pulp has high strength. Sulfate pulp was formerly used only unbleached, but in recent years

methods have been developed for producing strong bleached pulps from as well. This development extends the use of the sulfate process to adds such woods as southern pine to the manufacture of high-grade papers, including book, magazine, writing, bond, and specialty papers. The principal uses for unbleached sulfate pulp are kraft wrapping, paper, and boxboard.

The soda process, also alkaline, employs caustic soda as the pulping agent and is used principally for the reduction of hardwood Aspen, cottonwood, basswood, beech, birch, maple, and tupelo (gum) are commonly used. The yield is from about 40 to 48 percent, depending on the species of wood employed and the severity of the cooking conditions. Soda pulp is sometimes used alone in the manufacture of bulky papers such as blotting, where the strength requirements are not high. Book lithograph, and envelope papers are often made from a mixture of sulfite pulp and soda pulp.

The neutral sulfite or monosulfite process uses a slightly alkaline or neutral sodium sulfite cooking liquor. Yields obtained are often lower than in the other chemical processes, but the pulps are comparatively strong. Pulps from coniferous woods are used unbleached, semibleached, and bleached in a wide variety of relatively high-grade papers. Pulps from the broad-leaved woods, though of moderate strength, are characterized in the bleached form by exceptional brightness, making them especially adapted to high-grade printing papers.

The semichemical processes are more recent developments. They obtain their name from the fact that the chips are merely softened by steam or chemicals and then reduced to pulp by mechanical action. The chemical solutions used may vary. A neutral sodium sulfite solution is used principally although either alkaline sulfate or acid sulfite liquors are applicable. The yield of pulp is relatively high, from 70 to 80 percent of the weight of wood. The main use of the semichemical processes at present is in the production of corrugating board stock from hardwoods, lower-grade wrappings, roofing felt, and insulating board. Experiments have shown semichemical pulps from some species to be suitable for strong liner board and other higher-strength products. Experiments have also shown the possibilities of bleaching semichemical pulps as well as their adaptability in making newsprint, glassine, tissues, and bond and book papers.