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COMMERCIAL PROCESSES OF PULPING WOODS

Five general processes are used commercially in making pulp for paper, paperboard, and wallboard from wood. One is the mechanical or groundwood process, in which wood bolts are reduced to pulp on a grindstone. Three processes, the sulfite, sulfate, and soda, depend upon the dissolving action of chemical reagents to remove essentially all of the constituents of the wood except the cellulose fibers, which remain in a fairly pure state. This is accomplished by digesting the wood chips with the proper chemical under steam pressure. Another process, the semi-chemical, causes the removal of only a part of the wood constituents by chemical means and so affects the fiber bonds that the pulping can be completed by mechanical fiberizing.

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 pulps before it is converted 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 pulp. 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 the manufacture of groundwood pulp is small, because the shortness of the fiber limits its use to specialty products. A modification of the mechanical process introduces a mild chemical treatment of the bolts of wood before they are ground. The pulp is called chemigroundwood. This process is especially applicable to the hardwoods because of the improvement obtained in the quality of the pulp.

The sulfite process employs an acid chemical (calcium, magnesium, sodium, or ammonium bisulfites plus sulfurous acid). The yield is less than half the weight of the wood, but the pulp is much stronger than groundwood pulp. The unbleached pulp is comparatively light colored and is readily bleached. Long-fibered, low-resin-content softwoods,

such as spruce, balsam, and hemlock, are mostly used in producing sulfite pulp. A small amount of southern yellow pine and some aspen, birch, and other hardwoods 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. In combination with groundwood pulp, it is used 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. A modification of the sulfite process, having the objective of obtaining yields of 60 percent of the wood, is called high-yield sulfite pulping and results from less complete pulping action than usual. A certain amount of mechanical action is then necessary to fiberize the incompletely cooked chips. The pulps are used unbleached, for example, in newsprint.

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. As in the sulfite process, the yield of pulp is less than half the weight of the wood. Sulfate pulps are generally the strongest of the commercial pulps. When suitably cooked, the pulps can be used to produce strong bleached pulps for high-grade papers, including book, magazine, writing, bond, and specialty papers. The principal uses for unbleached sulfate pulp are kraft wrapping paper, bag paper, and boxboard. Bleached hardwood sulfate pulps are used extensively in printing papers. A modification of the sulfate process involves a treatment of either hardwoods or softwoods with steam before the woods are cooked by the conventional pulping process. The pulp is then purified by a standard procedure and used for making rayon. Another modification of the sulfate process produces a high yield of kraft pulp by the incomplete cooking of pine. This kind of pulp is used primarily for making container board.

The soda process, also alkaline, employs caustic soda as the pulping agent and is used principally for the reduction of hardwoods. Aspen, cottonwood, basswood, beech, birch, maple, tupelo (gum), and oak 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 semichemical processes are more recent developments. They obtain their name from the fact that the chips are first merely softened

and only partly dissolved by chemicals and then are 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 65 to 80 percent of the weight of the wood. The semi-chemical pulping process is applied predominately to hardwoods and the pulps are used in corrugating board (major product), newsprint, and specialty boards. Semichemical pulps can be brightened to light shades for use in printing papers or bleached to a high white by conventional bleaching methods. The latter are made in yields of 50 to 60 percent and are used in printing, glassine, and bond papers and specialty boards like food cartons.

A process used principally for the production of a coarse fiber product involves the treatment of wood chips with steam or water at high temperatures and pressures to weaken the fiber bonds, followed by a mechanical fiberization. The yields are 85 to 95 percent. These pulps are composed of a mixture of single fibers and fiber bundles. The two important commercial coarse-fiber pulps are called "exploded" pulp (Mason process), and "defibrated" pulp (Asplund process). They are used in the manufacture of hardboard, insulating board, absorbent felts for roofing, and similar papers.