Commercial Papermaking Essay, Research Paper

Commercial Papermaking

Paper in 20th-century civilization, is one of our most important industrial products. Books, magazines, and newspapers are printed on paper. Data from computers are usually printed on paper. Education, government and industry could not operate without printing and writing on paper. Paperboard (used in packaging), and absorbent papers (tissue and towelling) are other widely used paper products.

Paper is made from cellulose fibbers, which are found in all plant cell walls. When a mixture of water and fibbers is filtered through a fine screen, the fibbers tangle together to form a sheet of paper. As the wet sheet is dried chemical bonds form between the molecules in cellulose fibbers next to one and other. This gives the sheet of paper its strength. The grade and type of any paper depends on the fibbers and processes used in making it.

The basic process of making paper has not changed in more than 2000 years. It involves two stages: the breaking up of raw materials in water to make a suspension of individual fibbers and the formation of felted sheets by spreading this suspension on a porous surface, to drain excess water. The essential steps of papermaking by machine are identical with those of hand papermaking just much more complex. The first step in machine papermaking is the preparation of the raw material. For centuries, the main raw materials used in papermaking were cotton and linen fibbers obtained from rags. Today more than 95 percent of paper is made from wood cellulose. Wood is used mainly for the cheapest grades of paper, such as newsprint. Cotton and linen fibbers are still used for high quality writing and artist’s papers. Many kinds of wood can be used such as aspen, beach, birch fir, gum, hemlock, oak, pine, and spruce.

The preparation of making wood into a pulp for papermaking is accomplished in two different ways. In the groundwood process, blocks of wood are held against a fast revolving grindstone that shreds off short wood fibbers from the block. The fibbers produced by this process are short and are used only in the production of cheap newsprint and used to be added with other types of wood fibber in the making of high-quality paper. Another technique uses a chemical-solvent processes where wood chips are treated with solvents that remove “resinous material and lignin” from the wood, leaving pure fibbers of cellulose. The oldest of the chemical-solvent processes, the soda process, introduced in 1851, uses a solution of caustic soda (sodium hydroxide) as a solvent. The wood is cooked or “digested” in this solution under steam pressure. The fibbers produced by this process do not have great strength but are used in mixtures with other wood fibbers. Pulps produced by any of these processes are washed then passed through a series of screens to remove knots, debris, and other unwanted material. Some pulps are bleached to produce a whiter sheet of paper.

Most paper today is made on Fourdrinier machines patented after the first successful papermaking machine, which was developed in the early 19th century. It is capable of making a continuous sheet of paper up to 33 feet wide, at speeds faster than 3,000 feet per minute. Some machines are more than 350 feet long. The Fourdrinier machine has an endless belt of wire mesh that moves horizontally. A flow of watery pulp is spread on the level belt that passes over a number of rolls. A shallow wooden box beneath the belt catches most of the water that drains off, leaving a matt of fibbers on the surface of the wire. Air suction pumps beneath the belt help to drain the water through the wire, and the belt itself is moved from side to side to aid the felting of the fibbers. Once the sheet of fibbers is strong enough it is then passed between large press rolls that squeeze out most of the remaining water from the sheet. At this point a watermark may be produced by pressing a wire pattern into the to surface of the wet sheet. Any other water is removed as the sheet is passed over steam-heated cylinders. Chemical bonds that hold the finished sheet together also take place at this step. The next stage is known as calendaring, pressing between smooth chilled rolls to produce the smooth finish known as machine finish. At the end of the Fourdrinier machine, the paper is slit by revolving cutters and wound on reels. The production of the paper is completed once the sheets are cut into smaller sections, unless the paper is to be used on a continuous press that uses rolls of paper. Special papers are given additional treatment. Supercalendered paper is subjected to a further calendering process under great pressure between metal and paper-covered rolls. Coated paper, such as is used for fine halftone reproduction, is sized with clay or glue and calendered.

Paper is usually sold by the ream, in sheets of standard sizes. A ream of paper usually contains 480 sheets, but reams of drawing paper and handmade paper contain 472 sheets. Book paper and newsprint for flat-plate printing are sold in reams of 500 sheets and in perfect reams of 516 sheets. The most common book-paper size is octavo (112 by 168 cm/44 by 66 in). Newsprint for rotary-press printing comes in rolls of varying sizes; a typical roll of newsprint, as used by large metropolitan newspapers in the U.S., is about 168 cm (66 in) wide, 7925 m (26,000 ft) long, and weighs about 725 kg (1600 lb).

In the United States alone, the consumption of paper and paperboard averages about 660 pounds per person each year and about 64 million metric tones of paper and paperboard are produced annually. With such great demand, papermaking is continuously being improved and modernized, and new machines are constantly being developed.

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