MILWAUKEE AREA TECHNICAL COLLEGE

SUSTAINABLITITY WEBSITE

LOW CHEMICAL PAPER

Milwaukee area Technical College in combination with Xerox Corporation is in the process of converting to a grade of copy paper which is different and sustainable in that it used no chemicals in the manufacture process. By using this paper MATC is protecting the water quality around the community where the paper is made. The paper is not as white and bright of traditional copy paper because of the elimination of the chemicals in the manufacture process. Traditional paper uses bleach to obtain the white finish. The use of bleach in the process pollutes the water. To clean the water the paper manufacturer requires additional energy. Consequently the paper reduces the dependence on fossil fuels.

The green paper is also lower in weight and therefore requires less energy to be consumed moving the paper from the manufacturer to MATC. Papermaking Facts

by Ellen McCrady

Pulp Mills and Paper Mills

Pulp mills make pulp from wood chips, separating the fibers by a grinding process, enzymatic or chemical action, heat or pressure, used either alone or in combination. Afterwards, the pulps intended for use in white papers are transferred to the mill's bleach plant.

Paper mills receive that pulp and make paper out of it. They do not bleach paper on the scale used in bleach plants, although they may add a bleach to the slurried pulp to prevent yellowing (usually in groundwood pulps) before sending it to the paper machine. If they want to make white paper, they generally use white pulp.

Sometimes paper mills buy their pulp on the market, and sometimes they get it from a pulp mill located on the same site.

Pulping

There are two main kinds of pulp, mechanical and chemical.

Mechanical. If pulping is done mainly by mechanical or physical means, the product is called groundwood or "mechanical" pulp. Lignin is deliberately left in this kind of pulp, for economic reasons. Groundwood is made by grinding whole wood logs against a rotating stone. Mechanical pulps are made from wood chips by passing the chips through refiners. The refiners produce refiner mechanical pulp; if heat is used, thermomechanical pulp; if chemicals are used, chemimechanical; and if both heat and chemicals are used, thermochemimechanical (or chemithermomechanical) pulp.

Mechanical pulps are used to make newsprint and magazine paper, as well as boxes and a variety of other products. (Although grocery bags are brown, they are made not from mechanical pulp, but from unbleached kraft.) If mechanical pulp will be used for printed matter, it is bleached, usually with hydrogen peroxide, which is able to whiten the pulp without removing the lignin.

Chemical. There are two main chemical pulping processes: kraft or sulphate (alkaline), and sulphite (which may be acid, neutral or alkaline). Most pulp mills in the U.S. and worldwide use the kraft process, while most European mills use one of the sulphite processes.

Many people assume that the chemicals used in pulping give the fibers a permanent and fixed pH; that is, if an alkaline pulping process is used, they believe paper made from that pulp will be alkaline. Not true. The pulp is washed at the pulp mill, and when it gets to the paper mill, the pH of the stock is under the complete control of the papermaker. The paper produced can have a pH anywhere from 4.0 to 10.0 (or even outside that range, for specialty papers), regardless of the pulping or bleaching process it underwent earlier.

In order to make chemical pulp for "freesheet" or "woodfree" (printing and writing) paper, wood chips are cooked under pressure, with the aid of chemicals, in order to dissolve the lignin and separate the fibers. Chemicals are selected to act on the lignin and to have a minimal effect on the cellulose; temperature and pressure are not simply maximized to save time, but are chosen to give the best effect. Those who understand and carry out the chemical pulping process know the importance of retaining fiber strength. If the fiber is degraded, the pulp or paper made from it may be impossible to sell, so fiber strength is monitored, using standard tests.

Bleaching

Ten or twelve years ago, the standard bleaching sequence for kraft mills included elemental chlorine and chlorine dioxide, combined with alkaline extraction. Then it was learned that certain toxic chlorine compounds, collectively called "dioxin" in the press, were showing up in the mills' effluent. Spurred by EPA regulations, most mills are now bleaching without the elemental (gaseous) chlorine, in a process called "elemental chlorine free," which reduces the dioxin to undetectable levels, and has no measurable effect on the fish that live in the river that receives the mill's effluent.

The effect of the bleaching process on fiber is carefully monitored, and a growing variety of bleaching agents and sequences are available to optimize both brightness and retention of fiber strength.

Papermaking

Stock preparation. Before pulp goes to the paper machine, it has to be refined (beaten) to increase fiber to fiber bonding potential and make a stronger paper. If it is beaten too much, tear strength suffers while tensile strength and burst continue to increase; the pulp sheet becomes denser, less porous, more translucent and more likely to swell and cockle in contact with water.

Beating is not done to "hydrate" the fiber, although it does temporarily absorb water. "Hydration" is an obsolete term.

Most papermaking chemicals are added at this stage. Each grade of paper requires a specific combination of furnish ingredients which are selected according to the specifications of the paper being produced. This includes acids or bases to control pH, sizing agents, dry strength adhesives (starch, gums), wet strength resins, fillers (e.g., clay, $CaCO_{3)}$, dyes and pigments, drainage aids, and optical brighteners.

The fourdrinier or "wet end": The stock mixture is pumped to the headbox of the fourdrinier and spread onto the moving "wire" or screen below, which vibrates to induce microturbulence in the stock as the water drains through. Vacuum boxes below the wire speed the drainage. An increasingly popular way to speed up the papermaking process is to use a twin-wire former (or other mechanism), to draw the water off simultaneously from above and below. At the end of the wire the paper web is transferred to the couch ("cooch") felt with vacuum from the couch roll to lift the paper off the wire and lead it into the dry end.

The dry end: The mat of fibers on its endless belt of felt is carried around or past the presses (rolls which squeeze out excess water), first dryer (a set of steam-heated drums), size press (to apply surface additives), calender (a set of high-pressure rolls), and paper machine reel. Coating may be done either on the machine or in another location.

How Paper Gets to the Customer

After the paper is made, it is sent to a *converter* if it has to be cut to size, packaged, made into bags and boxes, or otherwise prepared for use. (Some mills, however, do their own converting.) If the paper was made to order for a certain *customer*, it is shipped directly to that customer. If it will be sold on the open market, it usually goes to a *distributor*, whose customers include printers and office supply stores. Some distributors have their own *retail outlets* for customers who buy small amounts for personal use.

Since paper passes through so many hands, few salespeople know which products meet permanence standards, or even whether a given product is acid-free (alkaline). This information is not usually found on the package, and few papers made in this country carry watermarks to

show whether they are alkaline or permanent. Thus the complexity of the marketing process deprives many customers of important information relating to their own paper requirements.

Caveat: This is not All There is to Papermaking

I have tried to describe a complex, variable, rapidly changing process, which is really a number of processes, because each mill has a unique set of methods. It is probably impossible to make any generalization about papermaking that does not have important exceptions.

To fill out the picture, normally I would recommend a few books, but the textbooks that cover industrial papermaking are quite technical, and books on hand papermaking do not cover industrial processes. Perhaps the best way to learn more is to take one or more courses or workshops at a papermaking school. The Institute for Paper Science and Technology (IPST) in Atlanta can provide a list of paper schools. Call 404/894-7819.

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I am indebted to Terry Norris, Bill Scott and Michael Kocurek for reviewing the accuracy and completeness of this chapter from *North American Permanent Papers*, which will appear in its revised form as a separate article in the final issue of the *Alkaline Paper Advocate*. It will also be mounted on Abbey Publications' web site at <http://palimpsest.stanford.edu/byorg/abbey/>.

Directories

1. *Lockwood-Post's Directory of the Pulp, Paper and Allied Trades*. Annual. Miller Freeman, in California, 408/848-5296. Regular ed. $257; traveler's ed., $217; add shipping & handling. About 1000 pages, with over 16 sections, including statistics of the industry, executive offices, pulp & paper mills (which itemizes personnel, equipment, and products), paper merchants & distributors, watermarks & brands, wood pulp agents, and more. Mills, converters, and merchants are listed geographically.

2. *The Paper Buyers' Encyclopedia*. Annual. Grade Finders, Inc., 662 Exton Commons, Exton, PA 19341 (610/524-7070). E-mail: info@gradefinders.com. $95. Lists manufacturers, converters, and suppliers; then the "Grade Finder Section," which lists papers by classification and gives detailed information for each. Classification is based on the use (e.g., offset, reply card), physical and special characteristics (e.g., coated, watermarked, recycled) of the papers, and quality or grade (super premium, super premium no. 1, premium no. 1, and numbers 1, 2, 3, 4 and 5). This is the only reference book in the paper industry that indicates whether a particular paper is alkaline or not.