

# Pulp and Paper Ideas for Sale

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To a majority of us, paper is something which we write on. Our first mental image of paper is the printed page. This is true as far as the etymology of the word paper is concerned, it being derived from the word "papyrus," a Latin word applied to writing material which was used by the Egyptians as early as 2400 B.C. As literacy advanced, standards of living rose and sanitation improved, paper has found diversified uses not only in the home, but also in the business world. At least 250 kinds of paper have been made in the United States.

This commodity, however, seems to be taken for granted. We only think of it as a convenience. A sheet of paper is used, then thrown away. Are we ever apprised of the way cellulose fibers come together and form the sheet we are familiar with? The fiber is no longer recognizable. It has been transformed, but not destroyed. The unit molecule of cellulose is there, but it is not the same unit as found in its natural state in living plants and trees. That is why the structure of this chain of "noble" molecules has eluded many a scientist. Its behavior, however, towards water and chemical reagents or its response to mechanical treatment is no longer a subject for conjecture. This is where we can capitalize on cellulose fiber, its versatility plus its abundance.

The precursor to paper is pulp. Pulp is the dissolved portion of the raw material (usually wood chips) after undergoing mechanical treatment or cooking with the aid of chemicals under certain conditions of temperature and pressure. What process of iso-

lation is to be used and the quality and quantity of the isolated fibers are the problems of the pulp and paper chemist and determined by the end uses of the products and their commercial feasibilities.

To produce the pulp for paper making, the following are the known processes used:

- I. Mechanical or groundwood—The fibers are separated by mechanical means such as grinders.
- II. Chemical—The process depends upon the active ingredients used.

#### A. Acid

1. Sulphite—cooking liquor is a solution of calcium or magnesium bisulfite

#### B. Alkaline

1. Soda—cooking liquor is sodium hydroxide solution
2. Sulfate—cooking liquor contains sodium sulfide and sodium hydroxide.

III. Semichemical and semimechanical—combination of the mechanical and chemical methods.

In the pulp state, the fibrous material is ready to be made into paper. "Paper is made in the beater," so the saying goes, but actually not. The beater is a device whereby the fibers are cut into the desired lengths, compressed, bruised, bent and softened before running the pulp over the paper machine. Although cellulose fibers are separate from one another, when "beaten" under water, "hydration" occurs. This is evidenced by the slimy feeling when you pass your

fingers through the "furnish."\* Hence, the fibrous character becomes lost, although not entirely, depending upon the degree of beating.

This phenomenon of "hydration" is not completely understood but there are numerous theories and hypotheses advanced to explain the bonding of fiber to fiber when the sheet is formed upon the removal of water. The fact is water is admitted into the fiber by beating, then subsequently removed as the paper sheet dries. Some investigators attribute the final effect of beating to the fibrillation of fibers as a means of increasing the points of contact, thus giving more surface for attachment and accelerating the binding property.

The combined effects of beating can also be adjusted to give the desired combination of the qualities in the final product. We notice that soft-textured paper such as Kleenex tissue, toilet paper and blotting paper have very low strength properties. They are weak in character, so to say. In the sheet formation, they easily part with water and are said to be "free." Tests for freeness, are therefore, conducted to determine the ease with which the sheets part with water. As beating time is increased, a correspondingly stronger and more coherent structure is obtained, the sheets become less "free" and may produce a sheet similar to parchment. Hence, between the limits of the characteristics of tissue paper and the qualities of parchment paper, we can make as many kinds of paper we can conceive of.

To improve the characteristics and get the desired qualities of paper, manufacturers usually add substances during the process of beating. These materials are called fillers. Sizing is also done to make paper less absorbent and more resistant to moisture. To get the desired whiteness, bleaching is resorted to.

From the papermaking point of view, the following are some of the good qualities that

must be sought for in a wood for producing high quality paper:

- I. Morphological properties
  - A. High ratio of fiber length to fiber diameter. Standard ratio of spruce is 100:1.
- II. Chemical properties
  - A. Low alkali solubility
  - B. High cellulose content
  - C. Low content of resin and other extraneous materials such as tannin, etc.

To determine the suitability of a raw material for pulping, the following steps are recommended, although variations may be made depending upon the discretion of the investigators:

- I. Preliminary investigation
  - A. Microscopical examination and measurement of fiber length
  - B. Determination of ash
  - C. Determination of resin (including waxes, tannins, and fats)
  - D. Alkali solubility
  - E. Cellulose content
  - F. Soda cook under average cooking conditions
- II. Comprehensive examination—carried out on samples which show promise
  - A. Determination of the optimum conditions for either soda or sulphite process or both
  - B. Assessment of the strength of the pulps and their beating
  - C. Bleaching trials
  - D. Determination of alpha, beta, and gamma celluloses in pulps with high cellulose content
- III. Consideration of the factors concerned in the establishment of an industry
  - A. Market studies to determine quantities and qualities that can be marketed
  - B. Mill trials on a sample consignment of wood

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\* "Furnish" is the mixture of fibrous and non-fibrous materials that are blended in water suspension to produce paper of the desired characteristics.