

## Temperate forest

### From wood to paper

#### Sustainable paper

Until the past century paper was generally made from rags, rope or hemp, a method which went into crisis especially due to continuous epidemics of plague which drove people to burn contaminated clothes and rags causing a drastic reduction in raw material. To make paper, a valid substitute for rags is certainly wood which has much lower costs.

The best paper is made from some conifers such as firs and pines or broad-leaved trees such as eucalyptus, birch and poplar. Also other types of trees, though, are currently used: in Indonesia, for example, trees are drawn directly from the tropical forest to create **MTH** cellulose (Mixed Tropical Hardwood). The quality of this paper is poorer but with no doubt it's less expensive to cut a forest of full-grown trees rather than planting more suitable trees as acacias and waiting for them to grow. This has led to the destruction of thousand of hectares of forest not only in Brazil, as public opinion might think, but also in countries as Canada, Indonesia, Finland, Russia and Africa. If we consider that two thirds of animal and plant species have their habitat in various forest ecosystems and that woods and forests produce oxygen which is absolutely indispensable for our existence along with water, which is another primary resource in great danger, it's easy to understand that we absolutely need to implement a change in our behaviour as introducing the use of recycled paper or FSC certified paper (Forest Stewardship Council).

#### Alternative Materials to Wood

Many studies have been recently undertaken to find alternative materials to avoid the production of paper using traditional wood.

In particular, some materials have been selected:

- herbal essences such as straw
- oatgrass residues as corn, wheat and rice
- residues of the processing of sugar cane and sugar beet
- residues of juicing citrus fruits, especially oranges and lemons
- marine surplus as algae
- particular plants as sorghum, cotton, flax and kenaf that has fibers very similar to those of conifers and for this reason is suitable for the production of both mechanical or chemical pastes for paper making.

In particular, cassava, miscanthus, cotton, flax and sorghum are plants with a high per hectare return and rapid growth. Poplar, in any case, is cultivated across the Po valley as it has a quick development ranging around 8-10 years, higher yields and versatility in use.

#### Paper recycling

The Italian paper industry uses more and more waste paper. The terms waste paper or recycled fibers refer to paper which has already served its fabrication purpose and is recycled within a productive cycle. A feature of cellulose, in fact, is that it can be used multiple times. Fiber recycling can be made only a limited number of times from 5 to 7 times, as during every recovering cycle, fibers deteriorate. Poor quality material coming from pulping is generally used to make cardboard and the best pulping material, instead, is used to make printing paper or other special papers.

Even the collection of waste material is distinguished in two categories:

- pulping from industrial and commercial collection which is made of trimmings of paper products, daily newspaper returns and other newspapers, corrugated cardboard, etc. It's collected at the premises of paper product and editorial firms, department stores, offices and is selected and packed before delivery to the paper mills.
- domestic waste paper which comes from separate garbage collection and is constituted by paper products employed in houses, small shops and offices and is made of newspaper and mixed paper. It must be separated from the beginning from solid urban waste before it's contaminated by other materials which could make it useless.

The fiber from waste paper has a yield of about 95%, whilst wood yield ranges from 30 to 80% depending on the milling procedure which is employed (semi-chemical, chemithermo-mechanical or chemi-mechanical or mechanical). The traditional semi-chemical procedure which is called kraft employs from 2 to 3,5 tons of wood to produce a ton of pure cellulose paper. Even if deinking is necessary, in paper recycling processes fiber must not be separated from lignin or other encrusting substances. In this way it's possible to reduce water consumption up to 80% and energy requirement up to 50%. The use of recovery material reduces the request of virgin raw materials and even the quantity of materials destined for landfills with a significant reduction of disposal costs.

## Production of waste paper

The production of waste paper is very similar to the production of virgin fibers, although a different mixture preparation is required. Infact, during this phase all alien materials which could contaminate production, as iron, plastic glues, glass, paraffins, etc., need to be removed from the pulping process. The presence of these materials, infact, influences the quality of paper and creates problems during the production process. Paper is later reduced in pulp and filtered through a series of strainers which initially remove the coarser parts and progressively eliminate the smallest ones. Producing recycled printing paper requires in-depth straining. Starting from cheap raw materials to obtain paper with a sufficient degree of white, deinking is employed to remove ink present in the pulping process.

The whitening process or reinking clearly requires products which aren't harmful for the environment. Oxygen is employed rather than chlorine and attention is required to avoid the dispersion of harmful products outside the paper mill. Recycled paper production avoids the use of optical brighteners which modify the wavelength of ultraviolet radiations making it visible and thus artificially increasing reflected light favouring deinking.

Both impurities removed and inks must be stocked and employed for other uses. Paper produced from pulping can be similar to paper produced from virgin fibers depending on how sophisticated are the straining and deinking processes. At the end of the straining process the paste produced is passed through a flat board machine and manufactured like any other paper.

Paper mills must be equipped with special machinery for the treatment of waste paper, processing scraps and wastewater. Residual sludge is used as agricultural amendment, within road foundations and brick production. Paper made from organic waste which is difficult to dispose, as algae which develop excessively, gives a great contribution to the environment.