NEW PERSPECTIVES IN LARGE SCALE PROCUREMENT OF PULPS AND FIBRES
FROM EUROPEAN AGRICULTURAL PRODUCTS

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INTRODUCTION

As is well known, at the present time EEC members are largely dependent on North America and Scandinavian countries for the cellulose pulps used in the paper industry.

The wood pulps produced in the European Community represent a small percentage of consumption. In 1983 European production was only of the order of 5 000 000 tons of unbleached and bleached chemical pulps compared to imports of 20 000 000 tons. Straw pulp was only 300 000 tons although straw, as a residue of the cereals crops, is extremely abundant (5 to 8 million tons of straw remain without valuable use in France every year).

Hardwoods (several species coming from the so-called coppices) are also largely unutilised (according to the French forestry services there are 20 million cubic metres of hardwood in Europe).

This dependence of the EEC on foreign suppliers has two consequences: the high cost of pulp and the possibility of shortage of this resource in a period of international crisis. The continuous decline of European production of pulps over the last 20 years is due to several factors, the most significant being the non-competitive nature of the small units of production, most of which are old factories. The high degree of pollution caused in the atmosphere and streams by the conventional processes, kraft or sulfite processes, is also an unfavourable factor.

At the present time, the size of the non-European modern units of chemical pulps production is of the order of 1 000 to 2 000 tons per day instead of the value of 200-300 tons per day characteristic of the old European plants. A few large size units are functional in Europe. They produce pulps at competitive prices.

This situation of crisis is not unavoidable. New techniques of forestry, new species of wood and new methods of processing wood are now realities which could be greatly developed in Europe. A large number of medium size factories could transform the pulp industry in the EEC in the coming ten years.

Let us consider the new opportunity offered by sylviculture and pulp makers for the immediate future.

AGRICULTURAL WOOD FIBRES

Since 1970 remarkable researches have led to a completely new technique to grow wood. When growing poplars, eucalyptus, sycamores or Sequoia by the technique of 'short rotation coppices', a very high wood productivity can be achieved. In France the private company AFOCEL has shown recently by several reports, that this technique of growing wood can lead to an average production of wood biomass of up to 18 to 20 tons per hectare per year. Mechanisation and automation of the crop and the homogeneity of the product are positive factors for the pulp industry of the future. Such high productivity is obtainable on rich and moist soils. It must be considered
that this wood production is an alternative to cereals and mainly maize crops. Unused lands can also be put to good use to produce this kind of wood. Technical and economic studies are now in progress in our Institute.

THE INDUSTRIAL PROCESSES TO MAKE PULPS

The chemical treatments of the materials generally implies a delignification step (kraft or bisulfite process) in which part of the hemicelluloses are dissolved and the fibres separated and swollen. The pulps for the paper industry are named chemical, semi-chemical or chemico thermomechanical pulp (CTMP). A large family of high yield pulps can be obtained now by using either conventional hardwoods (mixed species) or Gramineae stems like reeds (Arundo donax) or straw.

About ten years ago research was undertaken in the French 'Centre Technique du Papier', in Grenoble, on the most appropriate method of processing straw to produce pulps at a reasonable cost. This process is characterised by the use of sodium carbonate as the delignifying agent.

The processes can be adapted for small units of 50-10 t/day without severe problems of pollution. Hemicelluloses (xylans) are maintained in a high proportion.

The use of corn stalks instead of straw stems to make pulp is the source of severe technical difficulties due to silicium. These difficulties have not been solved. Also the proportion of cell parenchyma is still higher than that observed in straw. Accordingly, there is no possibility to use such an important residue to make cellulose pulps.

In the present world situation of cellulose production there is a need to make more investigations on new processes of delignification of ligno-cellulosic residues coming from hardwoods or straw to produce either a weakly delignified fibre product or a rather pure cellulose which can be used in other industrial areas.

PRODUCTION OF NEW TYPES OF FIBRES OR OTHER ORGANIC MATERIALS

Natural ligno-cellulosic materials are normally exploited as a raw material for the chemical industry: monomeric units are recovered after total hydrolysis as monosaccharides or as phenols and these chemicals have many industrial uses.

A second method of exploitation, which is less common and in need of development, would be to use the undergraded polymers directly.

Polymeric materials from biomass can be used as fibres in the pulp and paper industry, or transformed as filaments as in the viscose process. For this purpose the cellulose is dissolved to a collodion extruded and coagulated to produce a continuous filament of regenerated cellulose. It must be noted that the viscose process is long, expensive and polluting by comparison to the processes used in synthetic polymers.

Another possibility suggested by recent research concerns the use of new direct solvents for cellulosic materials, such as amine oxides. New adequate solvents to produce fibres without pollution have to be found in the coming years.

Up to now cellulosic pulp of high grade (\(\alpha\)-cellulose) is needed in the viscose process to obtain a total dissolution. Taking into account the composition of the different ligno-cellulosic materials it is clear that the yield in \(\alpha\)-cellulose and the ease of obtaining it depend on the morphology of the fibrous material.

With new solvents it is hoped that the yield can be increased, for example, if a given fraction of lignin is left. In our laboratory ligno-cellulosic filaments can be obtained easily according to a new method which will be patented.