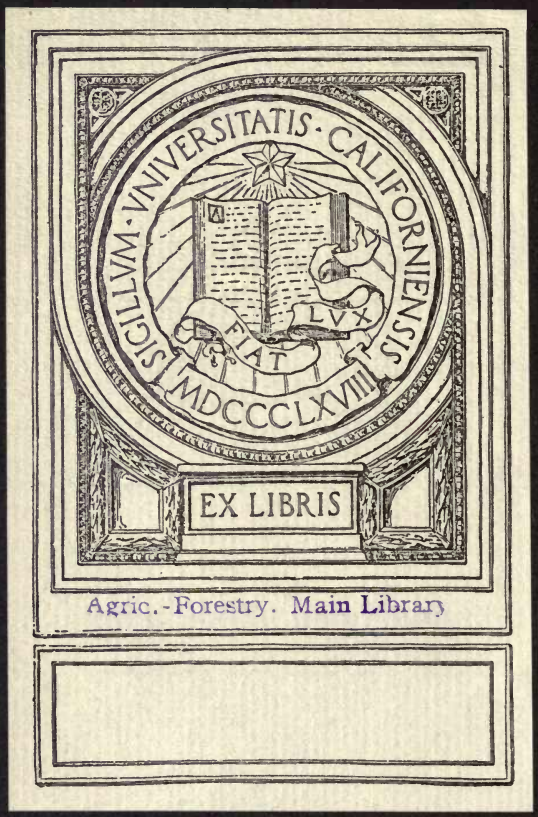
CHEMICAL METHODS FOR UTILIZING WOOD WASTES

by

W. B. Campbell



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W. B. CAMPBELL, B.Sc

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A. G. McIntyre, Superintendent

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CHEMICAL METHODS FOR UTILIZING WOOD WASTES.

The fact that tremendous quantities of wood are wasted in Canada is well known to everyone. The waste begins in the forest and continues all through the various operations which the wood must undergo before it reaches the consumer in its finished form. Every time the wood is handled a greater or lesser amount of it is lost in some form of waste. Much of this waste is necessary at the present time, but on the other hand a great deal of the waste material can be put to use even now. Moreover, as the timber supply becomes depleted and the incentive to save becomes proportionally greater, a great deal more of this waste will be utilized and will become an economic asset where now it is only a source of loss.

The first form of wood waste to be encountered in studying the question is that of the tops, branches and roots, which are discarded in the bush. As a rule in this country these are left to rot away where they fall, or else they are piled up and burnt to prevent further fire-risk, and to clear the ground for future growth. The logs themselves are usually floated to the mills and there the bark is stripped off and burnt, making another source of waste. These logs are then sawed up and another portion (ten to twenty per cent) goes to waste in sawdust, and still more wood goes into slabs and edgings, which are frequently burnt to dispose of them. Boards are cut to standard lengths and the odd ends are usually wasted. The defective pieces are frequently also burned. The shavings and odd pieces produced in planing mills generally go to waste and those made in actual construction work are practically always wasted. Most of these wastes are small in themselves and possibly many of them are too small even to be eliminated; but they are wastes nevertheless, and, as such, are responsible for some proportion of the high cost of living. It is only when they are taken in the aggregate that they assume proportions sufficiently great to make an impression on the ordinary layman. When, however, he is told that this waste amounts to $10.00 or $15.00 annually for every man, woman and child in the country, it begins to assume proportions such as may seem worthy of his notice.

How much of this waste it is possible to eliminate is, of course, unknown. A great deal of it is inevitable for the reason that the labour-cost of putting many of these products into forms commercially valuable is greater than the value of the products so produced. But some of these can be utilized profitably, and one of the objects of the opening up of the Forest Products Laboratories is to discover and spread the knowledge of methods for such utilization.

Much has been done by the lumbermen themselves through their various associations to make an asset of many forms of waste wood. This work has been mostly along the lines of using up the small pieces produced by the mills which can be used to advantage by other mills, which do not necessarily require that their saw material be in large-sized sticks. Box factories, spool manufacturers, toy makers and factories making such articles as hammer-handles, etc., are frequently able to use the odd pieces produced in the manufacture of larger articles.

But the vast quantities of shavings, sawdust and edgings mostly go to waste yet, and to these is directed the attention of chemists all over the world, since chemical utilization seems to be the most promising field in this connection.

The object of the following brief statements is to present a synopsis of some of the results already obtained, without going into the details of any of them. While all of these various industries have proved successful—that is, profitable—it should be recognized from the start that in each case much preliminary investigation is absolutely

necessary, for what is successful in one locality may prove to be complete failure in another. Most of these industries require a large and constant supply of raw material, expert technical supervision, and frequently a considerable outlay of capital for expensive equipment. The market also has to be considered, particularly in its relation to the particular locality in which the raw material is found. When these conditions are found to be favourable after proper consideration, then it is well worth while going further into the matter.

MANUFACTURE OF PULP AND PAPER.

The manufacture of pulp and paper from wood is an industry which has proved itself stable and of increasing magnitude for a number of years. Almost every kind of wood has been proved suitable for the manufacture of some form of paper, but there are considerations affecting the use of each kind which must always be observed. Most of the pulp is made from the wood cut specially for the purpose, but almost any wood can be used, provided that it is reasonably free from dirt, knots and bark, or that these can be easily removed from it. Sawdust is an exception to this rule on account of the fact that the fibres are cut so short that the pulp produced will not felt properly and the cooking is made considerably more difficult. There are several mills in the United States at present using mill-slabs, shavings and other forms of waste more or less entirely. The advantages of waste wood are, of course, its cheapness and its quantity. There are several disadvantages. It is usually green and full of water, has a large percentage of bark and comes in irregular shapes. Shavings are rather better for the purpose, and, if in sufficient quantity, make very good raw material. Another point to be taken care of in using waste material such as this is, to use the raw material of only one species, or, at least, species sufficiently alike that they may respond to the same treatment. For instance, on account of the relatively large content of resin in longleaf pine, it will not do to treat this in the same way as spruce. Neither will it be satisfactory to work hard and soft woods together in any one treatment, though any of these can be worked satisfactorily if kept separate. The process to be used will depend chiefly on the raw material at hand and on the market for any particular variety of pulp.

HARDWOOD DISTILLATION.

The distillation of hardwood, with the resultant production of charcoal, acetate of lime and wood alcohol, is an industry which is well developed and pretty stable. The latter two products are regularly quoted market articles. Charcoal is usually disposed of locally for domestic purposes, unless there is a charcoal-iron furnace within shipping distance.

Besides the wood cut especially for the purpose, hardwood slabs and other odd pieces of hardwood can be used. Where the wood is not cut especially for distillation, the plant is usually run in connection with a sawmill, so that only the part not suitable for lumber is used for the distillation. Almost any hardwood in pieces three or four inches in length and upward is suitable, but sawdust and shavings are not suitable—firstly, on account of the fact that the small size of the material makes it such a poor conductor of heat that it is impossible to char it completely in the ordinary forms of apparatus used, and, secondly, because the charcoal produced is so finely divided as to make it difficult to cool and handle, and because there is no market for it.

The woods most frequently used are beech, birch and maple, with smaller amounts of other woods as they may occur with the first-mentioned.

RESINOUS WOOD DISTILLATION.

The development of the industry of distillation of resinous, or "soft" woods for the production of charcoal, wood creosote and turpentine, is much later than that of

distilling the hardwoods, and the practice is not yet standardized to any great extent, though a great deal has been done along this line in the last few years. The value of a resinous wood for distillation is in proportion to the amount of resin, or "pitch," contained in the wood. This resin content is quite variable, even in trees of the same species and in different parts of the same tree, so that some care is necessary in the selection of the wood for distillation to avoid using wood which is too lean to yield a profit.

Pine is the wood most used and is taken mostly in the form of "lightwood." Stump-wood is also used to a considerable extent, but is usually left to the last, since it is much harder to collect and handle. Almost any kind of resinous wood is suitable to some extent, the only question being whether it contains sufficient resin to make the recovery worth while, and so is largely a matter to be considered in connection with the particular location in question. Where sawmill waste is used, the matter of selection is not so important, as the cheapness of this material makes up, to some extent, for the poorer material. This class of material, however, is not rich enough to render the more complex and expensive processes feasible, and the simpler and more rapid steam-distillation processes must be used. This recovers only the volatile oils which were originally present in the wood, and so the process is very wasteful, but is the only one at all successful with this class of material. Destructive distillation plants for resinous wood are the cheapest form to construct. They produce products of rather poor quality, however, and so the market is somewhat restricted. There are also some processes known as "bath processes" in operation. In these the wood is run into a retort and flooded with some high-boiling solvent of the turpentine and light oils. These are heated and extract the oils from the wood, and are then drained off and the oils recovered from the solvent by distillation with steam. Various solvents are used, but rosin appears to be the best at present.

Processes using a low-boiling solvent, such as naphtha, have found increasing use in the last few years, but the decreasing price of turpentine and the increasing cost of solvent has made the business increasingly difficult.

TANBARK AND TANNING EXTRACT.

Tannin is obtained from the leaves, bark and wood of a great many trees, but only a few of these (practically only hemlock and a couple of species of oak) are used commercially. Usually these are sold in the form of bark and the tanners make the extract themselves. In some cases, however, it may be of advantage to make the extract nearer the bush and save the freight on the bulky bark. The method of extraction is very simple and the extract can easily be concentrated and shipment made easy.

MANUFACTURE OF ETHYL ALCOHOL.

This is a process for the manufacture of ethyl (or "grain") alcohol from wood as distinct from the methyl (or "wood") alcohol produced by the destructive distillation. Ethyl alcohol is not poisonous in the same way as wood alcohol, and a very broad market is open for it, if production is made sufficiently cheap. Since the wood used in this process must necessarily be finely divided, almost any kind of waste wood is suitable as the large-sized pieces can be easily reduced to the proper size.

The process used consists of the conversion of the cellulose of the wood into a sugar; the sugar is then fermented to produce the alcohol and this is distilled off. The process is on a paying basis in Europe, and in at least one plant in America.

CATTLE FOOD.

Cellulose, or wood fibre, may be converted—at least partially—into a sugar, with comparative ease. There are also several other carbohydrates formed in the process,

A considerable proportion of the products so made are digestible by cattle, and, especially when mixed with other products, such as peanut meal, rice meal, alfalfa, it seems to make good cattle food and finds a market.

MANUFACTURE OF OXALIC ACID.

Finely ground wood fused with caustic soda forms sodium oxalate from which oxalic acid may easily be produced. The manufacture of this product may prove profitable, though the restricted market would be against it. A very little wood used in this way would produce all the oxalic acid used in the country. Almost any species of wood is suitable.

WASTE WOOD FOR PRODUCER GAS.

Several forms of apparatus for the production of producer gas from waste wood have been put on the market lately and are finding considerable favour. The production of power from waste wood in this way is much more economical than burning the wood under steam boilers, especially when small-sized stuff, such as sawdust and shavings, are to be disposed of. The commercial success depends on the demand for the power produced. Any kind of wood can be used, though it is an advantage to have it of fairly uniform size and preferably dry. The woods with the higher calorific values are, of course, somewhat more efficient.

Further information regarding any of these methods will be gladly supplied by the Forest Products Laboratories, McGill University, Montreal.

The work of these laboratories is directed entirely along the lines of utilization of wood waste and improved methods in the manufacture of forest products.

All information and results of the laboratories are FREE to the public and will be gladly supplied upon request.