# Sawmill wastes: cleaner disposal, new uses

When a tree is converted into sawn or dressed timber, only between half and one-third of it usually gets used—that is if you exclude the leaves, bark, and root system. Each year Australian sawmilling and wood-processing operations yield wood residue equivalent to about 5½ million cubic metres of sawn timber. Bark should be added to this figure, but nobody really knows how much of that we produce.

In the past, much of the bark was left in the bush, and the wood residue at the mills—consisting mainly of sawdust, shavings, and larger waste pieces—has frequently been burnt, often creating a good deal of smoke in the process. Consequently sawmills have found themselves running foul of the various State Clean Air regulations. In addition, as sawmilling has become more centralized, rather more debarking has been done at the sawmill, bringing with it new problems, since bark is much more difficult to dispose of than wood.

*Burning wood wastes often creates a good deal of smoke, and sawmills have found themselves running foul of the various State Clean Air regulations.*

There have, of course, always been some uses for sawdust and shavings in butchers' shops, as packing, or as litter for animals or poultry. The rise of the wood-chipping industry has also improved matters, since a great many wood pieces that used to be burnt are now converted to wood chips and sold. Nevertheless, the disposal problem would be considerably reduced if further uses could be found for the wastes.

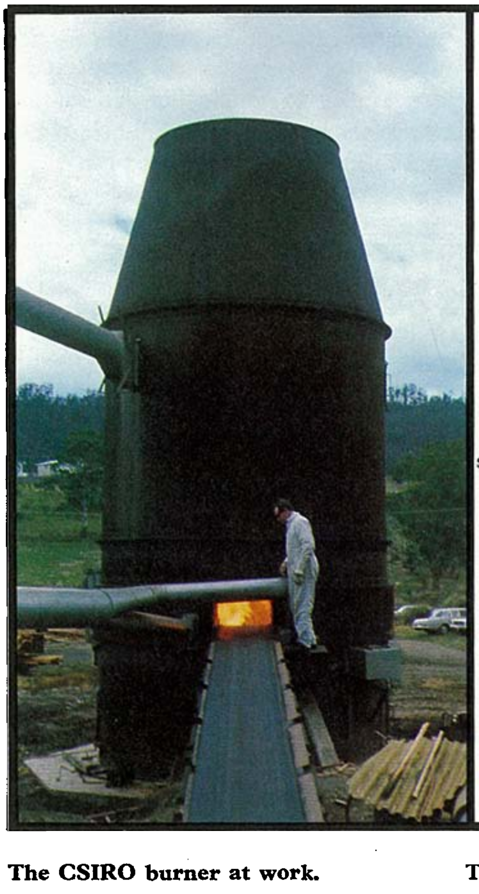
For some years now scientists from the two Divisions represented at the CSIRO Forest Products Laboratory (the Divisions of Chemical Technology and Building Research) have been looking at cleaner ways of burning wood wastes, and investigating uses for them. Working in cooperation with the timber industry, researchers at the Laboratory have come up with a number of possible developments of both kinds.

Most people have probably seen the iron 'teepee' burners possessed by many sawmills, both large and small. These can burn sawdust quite effectively, but they are often very smokey.

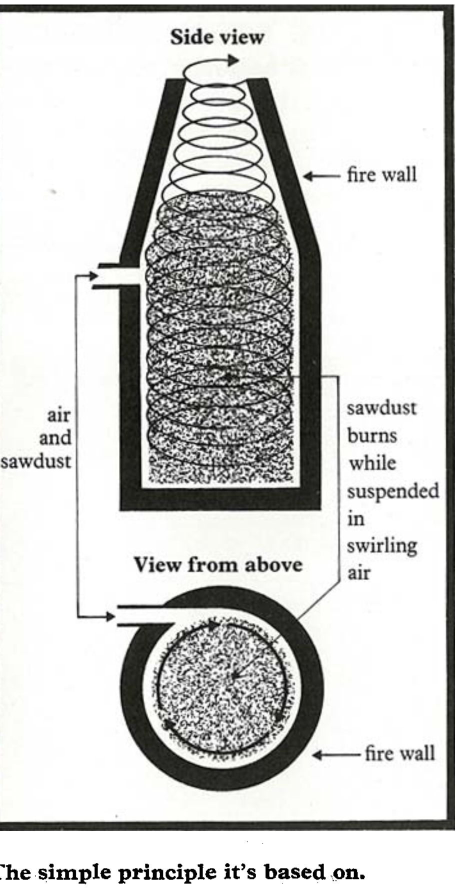
In 1945 Mr R. McCashney invented a new incinerator, which he handed over to CSIRO for further development. Nowadays, modified versions of the McCashney incinerator dispose of a good deal of the sawdust and shavings produced in this country.

The incinerator essentially consists of a bottle-shaped firebrick-lined shell. Shavings and sawdust are blown in at one point parallel to the wall through a single entry, so that they swirl around with a spiral motion. The shavings and dust burn as they whirl.

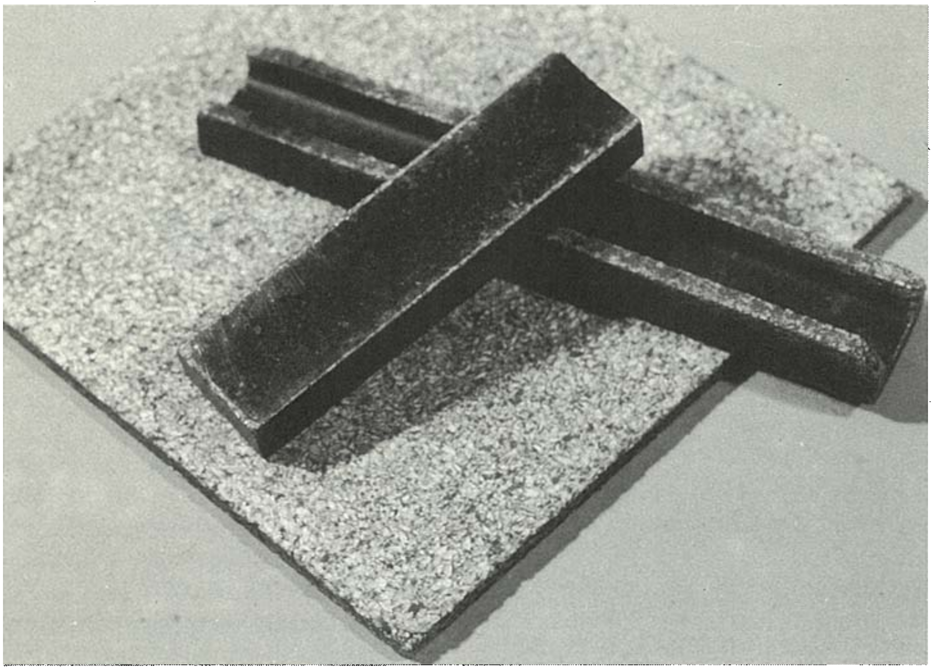
A number of other burners operating on a similar principle have been developed overseas, but they all have the disadvantage that they cannot be used to dispose of large quantities of wood pieces without these first being pulverized.



The CSIRO burner at work.




The simple principle it's based on.



**Boards and a channel section made from a mixture of sawdust and bark.**

**New incinerator**

At the Forest Products Laboratory, Mr Ron Liversidge and Dr Paul Fung are developing a burner that should burn all mill wastes without contravening the various State Clean Air regulations in the process. A full-scale experimental incinerator is now in operation at a sawmill at Hobart.

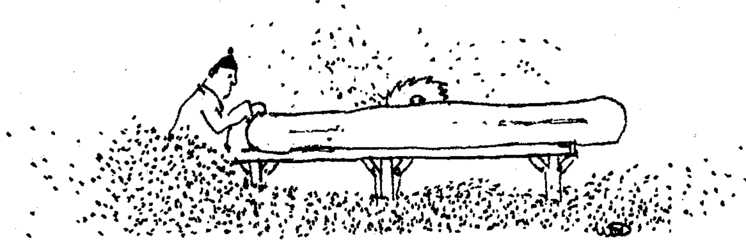
The CSIRO burner is a modified McCashney, but large pieces of wood can be fed in at the bottom and be cleanly burnt.

Testing the burner's emissions has proved difficult because of the high temperature of the flue gases, and the way they emerge from the top. *Clean Air Acts* usually demand that the gases coming out of a burner flue be tested 'isokinetically'—at the speed at which they emerge from the flue. In most chimneys, fairly cool gases pass straight up the flue and testing is relatively easy. The problem with the CSIRO burner is that the gases emerge from the top at up to 1000°C in a whirling vortex, and apparently no instruments are yet available that can test the gases without burning out in the process. Mr Liversidge and Dr Fung are looking at other ways of testing the gases. Nevertheless, they look clean—all you see when the incinerator is operating is a heat haze at the top.

The two researchers have not yet tried burning bark.

Obviously, it would be preferable to use the sawdust, shavings, and other wastes that cannot be chipped rather than burn them. Researchers at the Forest Products Laboratory have tried a number of approaches including:

- composting them
- extracting adhesives from the bark
- converting them into mouldings and boards



**Useful compost**

Composting bark and sawdust is done commercially in a number of countries, including the United States, Canada, Finland, and Sweden.

The compost produced is usually sold as a soil conditioner or, if the compost has been fortified with minerals, as a fertilizer.

Here in Australia we already use some of the pine bark we produce as fuel for drying kilns or other equipment, but much of it is still disposed of by dumping or incineration. Increasingly, however, more is being used as a weed-suppressing mulch in parks and gardens. The mulches keep the underlying soil moist and cool. They suppress weeds because bark, sawdust, and shavings all contain a high level of carbohydrate and a little nitrogen. Shavings and sawdust also contain only low levels of other plant nutrients. In a mulch, bacteria breaking down the carbohydrate compete with weeds for nitrogen in the soil, suppressing the weed growth in the process. (They also suppress the growth of any ornamental plants, so these must be given additional nitrogen.)

When mixed into poor soil, sawdust and powdered bark can improve its texture greatly. However, nitrogen must be added to prevent suppression of plant growth from nitrogen starvation. In America and Scandinavia a number of companies correct this problem by composting bark in bags for several months to reduce the carbohydrate content. The final product is a nutrient-rich humus that can be most effective in improving the soil.

For a while now, Mr Liversidge, Mr Rick Finighan, and Dr Harry Greaves have been investigating composting Australian wood residues. They know from American experience that they can com-


**Some bark-derived products marketed in the United States.**

**This mulch of radiata pine bark suppresses weeds.**

post pine residues, but doing so with eucalypt barks and sawdust has not been tried before. They have tried composting 80 samples of various wastes. It has been necessary to add both phosphorus and nitrogen, and the scientists have therefore mixed in such additives as goat or chicken manure, superphosphate, ammonium sulphate, or ammonium nitrate.

So far, the best sample has produced a good friable compost in about 8–12 months, which is too slow for the proposition to be commercially viable. However, Dr Greaves has built up a collection of bacteria and fungi from the compost samples, from which he hopes to produce starter cultures for speeding up future experiments. In the long run, the researchers hope to develop a mixture that can be bagged and left in the same bag until ready for sale after a suitable period of, say, 2–3 months.

### Making glues

Radiata pine bark contains a considerable proportion of tannins, which can be easily extracted in hot water. Back in 1953, Mr L. K. Dalton of the then CSIRO Division of Industrial Chemistry showed that these tannins form an effective waterproof adhesive, suitable for making plywood when mixed with formaldehyde. Australia imports considerable quantities of wattle tannin—which, ironically, is extracted from the Australian black wattle (*Acacia mollissima*) grown in plantations in South Africa—for conversion into adhesives for making waterproof plywood and particle-board. Pine tannin could make an effective local substitute. In fact, two recent factory trials making particleboard using adhesives based on radiata pine tannins proved very successful.

Mr Rupert Palmer, who has carried out the most recent research into producing tannins from pine barks at the Forest Products Laboratory, thinks that the locally produced pine tannins would be cheaper than the imported wattle tannin. Plywood manufacturers in Western Australia use wattle tannin glues in preference to synthetic ones because they are quite a bit cheaper, but in the eastern States the much smaller cost difference has not made their use worth while.

Dr Tony Michell and Dr Ted Hillis have been trying a different approach to using the pine bark tannins. Some years ago research workers of the New South Wales Forestry Commission showed that it was possible to make what might be a useful building board by pressing a mixture of bark of white cypress pine, or radiata pine, sawdust, and a small amount of *para*formaldehyde in a hot press—in other words, by using the tannins in the bark without extracting them first. Dr Michell and Dr Hillis have studied the feasibility of moulding pine bark, sawdust, and formaldehyde into shapes that gain strength through their design—such as channel sections.

They have also produced boards, and in many ways these have been similar to commercial hardboards such as Masonite. They were as dense, and as resistant to crushing. However, they broke more easily when bent, and tended to swell and contract more with changes in the atmospheric humidity.

There are, of course, other possible uses for sawmill wastes that have not been considered here. Perhaps one of the most novel has come from the discovery overseas that dry pine bark will very effectively clean oil from water surfaces. The suggestion is that pulverized bark should be blown onto oil slicks from the bows of barges. The oil-sodden bark would then be collected in nets suspended from the sterns of the same barges as they passed through the slick. In fact, bark is reported to be already used for cleaning up oil slicks on the western seaboard of America.

Locally, some laboratory tests carried out at the Forest Products Laboratory have confirmed that pulverized bark mops up oil very well. Sawdust and shavings did quite well too.

### More about the topic

Utilization of sawmill residue. R. M. Liversidge. *Australian Forest Industries Journal*, 1973, **38,** 42–7.

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The utilization of bark as soil conditioner and fertilizer. E. J. Howard. *Svensk Papperstidning*, 1973, **I,** 33–6.

Extractives and tannin distribution in *Pinus radiata* bark—a preliminary survey. R. Palmer. *Australian Forest Industries Journal*, 1975, **40** (in press).

Tannin-formaldehyde adhesives for wood. II. Wattle tannin adhesives. K. F. Plomley. *CSIRO Division of Forest Products Technical Paper* No. 39, 1966.

Experimental mouldings from *Pinus radiata* sawmill residue. A. J. Michell, W. E. Hillis, and J. E. Vaughan. *CSIRO Division of Chemical Technology Technical Paper* No. 3, 1975.

Oil collection—a potential use for small-particle wood residue. R. M. Liversidge. *CSIRO Forest Products Newsletter* No. 392, 1973, 2–3.

## Preventing inky creek beds

During seasoning, the fibres in eucalypt timbers tend to shrink and collapse, distorting the cross-section of the wood. Reconditioning these timbers by steaming in a chamber for 4–8 hours often restores the collapsed fibres, and hence also the shape of the wood.

During this process, the condensed steam leaches out considerable quantities of tannins, which turn black when they come into contact with any iron that may be present in the reconditioner. Country sawmills often discharge their effluents into streams, and make them black.

The black colour is in fact black ink—we have been making black ink by mixing iron and tannins since the 12th Century.

The New South Wales Forestry Commission and Dr Paul Fung at the Forest Products Laboratory have come up with a simple way of preventing the tannins from being discharged with the reconditioner effluents by precipitating the tannins with slaked lime. The discharge of a sawmill reconditioner can be cleaned merely by mixing lime into the effluent in a settling tank, and then passing it through a filter.

The Heron's Creek sawmill near Port Macquarie, N.S.W., is now treating its reconditioner effluent in this way with satisfactory results.

Treatment of reconditioner effluent. P. Y. H. Fung. *Australian Forest Industries Journal*, 1975, **40** (in press).