(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
20 June 2002 (20.06.2002)

PCT

(10) International Publication Number
WO 02/47876 A1

(51) International Patent Classification[7]: B27K 3/50

(21) International Application Number: PCT/AU01/01625

(22) International Filing Date:
17 December 2001 (17.12.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PR 2114 15 December 2000 (15.12.2000) AU

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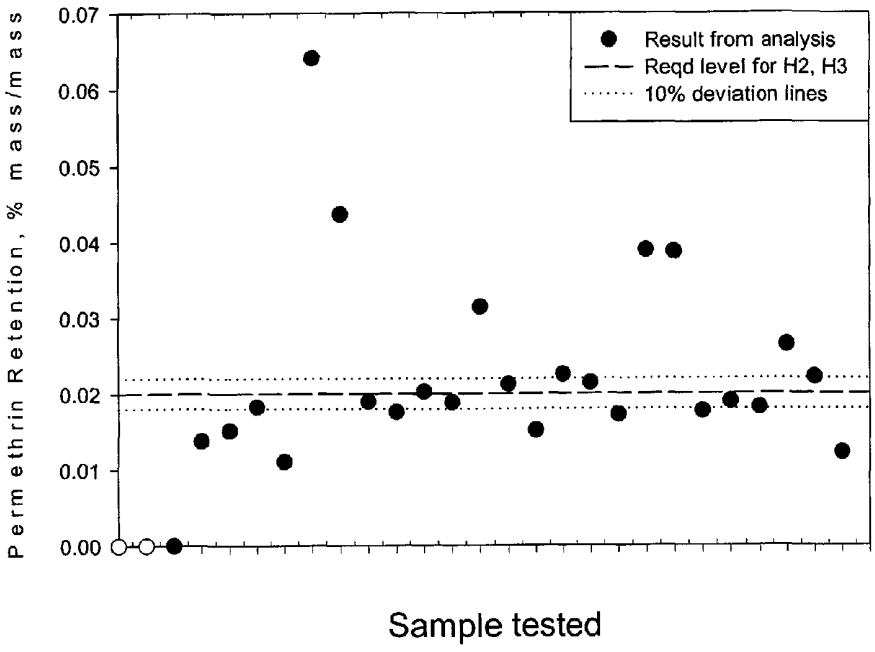
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

[Continued on next page]

(54) Title: MATERIAL AND METHOD FOR TREATMENT OF TIMBER



(57) Abstract: A material and method for treating timber. The material comprises a preservative and a carrier. The carrier is selected such that it remains mobile within the wood and provides for migration of the preservative within the treated wood. By providing a carrier which is mobile within the wood, the timber has a 'self healing' effect wherein the carrier/preservative migrates to any freshly cut or exposed surface of the wood to thereby redistribute and treat such a surface within the preservative and hence maintain integrity of a treatment envelope surrounding the wood.

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TITLE: MATERIAL AND METHOD FOR TREAMENT OF TIMBER

Technical Field

The present invention relates to preservatives and particularly preservatives for timber building materials.

Background of the Invention

Wood continues to be the most commonly used framing material for the construction of residential properties. Its weakness to termite attack in some countries has been lessened by treatment of wood with insecticides. Application methods and approved chemicals vary dramatically through out the world.

Softwood timbers, *pinus radiata*, *pinus elliotti*, and *pinus carribea* used as framing timber is Australia are susceptible to termite attack. Changes to government regulations have limited the use of soil poisoning agents (banning of organo-cholride insecticides), which has led to a higher incidence of termite attack of timber framed houses.

Many countries including Australia and the USA are struggling to find suitable cost-effective methods to combat this ever-increasing risk of termite attack.

One of the strategies to combat termite attack of softwood frames is the treatment of the timber with insecticides or more broad-spectrum wood preservatives.

In Australia, for example, treatment of timber is covered by the Australian standard AS 1604-2000/. Hazard class H2 is defined for the biological hazard - borer and termites. Retention is measured in mass/mass (%m/m).

The approved chemicals are shown in the following table.

Table 1 Minimum preservative retention in the penetration zone - Hazard Class 2 (H2)

Waterborne		Light organic solvent preservatives		
Copper chrome arsenic (CU + Cr + As)	Ammoniacal copper quaternary (Cu + DDAC)	Permethrin	Cypermethrin	Deltamethrin
0.320 %m/m	0.35 %m/m	0.020 %m/m	0.030 %m/m	.0020 %m/m

Penetration is defined under the standard as -

"All preservative-treated wood shall show evidence of distribution of the preservative in the penetration zone in accordance with the following requirements:

(a) If the species of timber used is of natural durability class 1 or 2, the preservative shall penetrate all the sapwood. Preservative penetration of the heartwood is not required.

(b) If the species of timber used is of natural durability class 3 or 4, the preservative shall penetrate all of the sapwood and, in addition one of the following requirements shall apply.

(i) Where the lesser cross-sectional dimension is greater than 35 mm, the penetration shall be not less than 8 mm from any surface. Where the lesser cross-sectional dimension is equal or less then 35 mm, the penetration shall be not less than 5 mm from any surface.

(ii) Unpenetrated heartwood shall be permitted, provided that it comprises less than 20% of the cross-section of the piece and does not extend more than halfway through the piece from one surface to the opposite surface and does not exceed half the dimension of the side in the cross-section on which it occurs."

In order to provide for penetration of the preservative, a carrier must be used. As shown in the Australian standard, the carriers currently available are waterborne or solvent borne systems.

Waterborne carriers swell wood and hence timber thus treated needs to be re-dried prior to use in service. Australian Standards specify the maximum moisture content of pine framing. This level is around 12-14% moisture content.

The process sequence is:

Dry wood → treat → re-dry wood

Solvent borne preservatives because they are non-polar do not raise the moisture content and hence do not swell the wood.

The process sequence is:

Dry wood → solvent treat

The disadvantage of this treatment is the high cost of solvents and potential environmental concerns with volatile organic compounds (VOC's) being released into the atmosphere.

Application of the insecticides to wood is normally carried out by a batch process involving a pressure vessel. For water-borne preservatives a vacuum pressure process

(Bethell or full cell) is used. This ensures, providing the wood is dry, complete sapwood penetration and adequate heartwood penetration if required.

For LOSP (light organic solvent preservatives) a double vacuum process ensures penetration to AS 1604-2000.

Pressure plants are expensive to construct, and being batch processes, conventional treatments do not match well with continuous sawmill production and require a high level of operator control to maintain costs.

The present invention seeks to overcome at least some of the disadvantages of the prior art or at least provide a commercial alternative thereto.

Disclosure of the Invention

In a broad aspect, the present invention comprises a material for treating wood comprising a preservative and a carrier, the carrier remaining mobile within the wood such that it provides for migration of the preservative within the treated wood.

In a further preferred embodiment, the carrier is a drying oil such as linseed oil or fish oil or any other drying oil, and may include extenders such as heating oil. These carriers remain mobile in the wood for a considerable period of time thereby allowing for migration of the preservative. The quantity of extender can between 90 to 10% of the total carrier, preferably 30 to 70% and most preferably 40 to 60%.

A wide variety of preservatives may also be used in combination with the carrier oil. Various insecticides and termidicides known in the art may be mixed with the oil including synthetic pyrethroid, permethrin, cypermethrin, imidachloprid etc.

Fungicides and mouldicides may also be used such as iodopropynylbutylcarbamate (IPBC), organic tin compounds such as tributyltin napthenate (TBTN), organic copper compounds such as copper 8 quinolinolate and copper napthenate, organic zinc compounds, quaternary ammonium compounds, tertiary ammonium compounds, isothiazolones, triazoles such as tebuconazole, boron compounds. This would allow the treatment material to be used as a permanent preservative as defined by Hazard classes 3,4 and 5 in Australian Standard AS 1604-2000 America Wood Preservers Association (AWPA) standards (USA) and MP 3640 (New Zealand).

Drying agents such as cobalt, manganese, zirconium and copper napthenate may be added to accelerate the drying of the drying oil.

The amount of the preservative/active constituent in the treatment material depends upon the preservative effect required but is expected to be below 5%, preferably below 2% and in many cases most preferably below 1%.

The applicant has found that the above mentioned material comprising a mixture of preservative and 'mobile' carrier provides an effective wood preservative which has a 'self healing' effect. Since the carrier remains mobile within the wood, it is capable of redistributing the active components of the preservative. This redistribution or migration of the carrier/preservative mixture will generally occur preferentially along the grain of the wood, however, some distribution across the grain will also occur. By providing such a migratable material, it is not necessary for the ends of the timber to be retreated after cutting since the active components of the material will be provided to the freshly cut ends with the migrating carrier oil.

Via this 'self healing' effect, the carrier/preservative migrates to any freshly cut or exposed surface of the wood to thereby redistribute and treat such a surface with the preservative and hence maintain integrity of the treatment envelope.

This is a significant advance over conventional preservative techniques. All previous techniques essentially treat the wood, are re-dried and then remain 'dormant' or fixed within the wood. The present inventive material and method provide a 'self healing' wood capable of retreating itself and in particular providing a preservative treatment to cut or damaged surface areas, which of course are the most common entry for termites.

Migration/penetration of the preservative system occurs in both radial and tangential directions forming an envelope around the treated wood. Such penetration in the tangential direction does not occur with water borne preservatives. Further, such migration ensures a consistency of the envelope around the surface of the treated wood. The envelope may be formed in both the heartwood and the sapwood and the aforementioned 'self healing' phenomenon also preferably occurs in the heartwood and the sapwood.

It will be recognised by persons skilled in the art that this self healing effect can be influenced by a number of parameters, for instance different carriers have different mobilities within the wood. Certain carriers may dry more quickly than others. Accordingly, the self healing effect will not be indefinite but tests have shown that this

self healing effect will last from around a minimum of two to three weeks up to several months.

In a second embodiment, the present invention provides a method of treating wood comprising contact the wood with a mixture of preservative and carrier, the carrier remaining mobile within the wood such that it provides for migration of the preservative within the wood.

The treatment step can be conducted using conventional pressure application techniques such as existing vacuum pressure systems known in light organic solvent plants. Alternatively, the applicant has also found the mixture of the preservative and carrier can be applied without the need for pressure application. Treatment can be accomplished by spraying, dipping etc which, unlike previous conventional batch systems, is ideal for use on continuous production line facilities such as saw mills.

The applicant has also found that the proposed treatment material and method provides more than adequate protection without the need for complete sapwood penetration as required under the Australian Standard.

To explain, in one embodiment a protective envelope of preservative/carrier oil mixture with a depth of around 5 mm can be provided by simple dipping or spraying. This 5 mm envelope provides more than adequate protection from termite attack and, as mentioned above, allows migration of the preservative longitudinally through a timber board or beam to cover any end cuts. This of course is a major benefit over conventional techniques.

As discussed earlier, the Australian standard requires that, irrespective of the species of timber, ie natural durability class 1 to 4, the preservative shall penetrate all sapwood. The present invention does not require penetration of all sapwood. It uses an envelope type protection rather than penetration throughout the sapwood. This 5 mm envelope is a move away from conventional techniques but still provides adequate protection for treated timber and with the use of a preservative/mobile carrier oil results in the aforementioned self healing effect which of course is unknown with conventional techniques.

The most preferred carrier is linseed oil which is a drying oil, ie saturates in air. The linseed oil dries to form a water barrier and penetrates without the need for pressure. Advantageously, it is also low odour. Other drying oils such as fish oil may be used and

other light weight hydrocarbons, eg heating oil may be used in limited quantities as an extender to the linseed or fish oil in order to reduce costs. Another advantage of the carrier oil is its high boiling point/flash point which reduces vapour emissions in production and use.

Another surprising benefit of using such a high boiling point carrier is its advantageous effect on migration of the preservative. To explain, it is believed that higher boiling point of the carrier/preservative mixture tends to allow the preservative to move inwards, as compared with more volatile solvents which migrate outwardly.

Indeed, the extender can also have a beneficial effect on the migration of the preservative. The extenders currently tested by the applicant have boiling points between about 175°C and 300°C. These extenders remain quite mobile within the wood.

Preferably, the boiling point of the entire solvent/carrier system should remain above 62°C. While this is not essential it is preferred and suitable quantities of drying oils such as linseed or fish oil can be mixed with heating oil to obtain this boiling point.

Of course, using such a non-swelling drying carrier oil also has the advantage that the treated wood/timber does not need to be re-dried, ie treatment can be accomplished by simple dipping of the wood for periods of say up to one minute. Current trials with radiata and slash pine have both achieved 5 mm envelope penetration within about five to 60 seconds dipping time.

It is envisaged that other carrier oils may also be used provided, that when mixed with the preservative they remain mobile within the wood to allow migration of the preservative.

Best Mode for Carrying Out the Invention

Tests were conducted to verify the efficacy of the above mentioned process, including the mobility and self healing characteristics of the preservative/carrier system previously described.

Example 1

Radiata heartwood, radiata sapwood, slash heartwood and slash sapwood was sourced from various suppliers. Boards measuring 35 mm x 90 mm x 4.8 metres were cut into four separate 1 metre lengths. Boards measuring 35 mm x 90 mm x 2.4 metres were cut into two separate 1 metre lengths. A drying oil (linseed oil) used in combination with an extender (heating oil) was used (ratio of linseed oil to extender 50:50). The

preservative formulation also had an addition of 0.01% (m/m) copper (present as copper naphthenate) as an indicator of the penetration. The test was conducted by firstly weighing the boards, and then dipping the board, in a mixture of the preservative formulation with 0.01% (m/m) copper (present as copper naphthenate) for 1 minute. They were allowed to drip until dry to the touch. Boards were then weighed again and stacked for 24 hours before being cut in half. The exposed surface on one half of the board was sprayed with indicator solution and photographed.

As shown in Table 2 resultant weights taken both before and after treatment show average uptakes for radiata heartwood at 18 l/m^3, 20 l/m3 for radiata sapwood, 16 l/m^3 for slash heartwood and 18 l/m^3 for slash sapwood. Standard deviations were low and the coefficient of variation was less than 20 in all but the slash heartwood. This indicates that there is little variability in uptake of preservative into radiata heartwood and sapwood, and slash sapwood.

Table 2 – Example 1: Uptake Results (60 Second Dip)

Wood Type	Uptake	StDev	Coeff of Var
Radiata heartwood	17.89	3.5	19.67
Radiata sapwood	19.97	3.5	17.65
Slash heartwood	16.36	5.35	32.73
Slash sapwood	18.35	2.9	15.9

The attached figures show the effect of the treatment on radiata heartwood, radiata sapwood, slash heartwood and slash sapwood at various times after treatment as follows:

Figures 1 to 4 show radiata heartwood, slash heartwood, radiata sapwood and slash sapwood respectively 24 hours after treatment,

Figures 5 to 8 are close ups of the cut surface of the material shown in figures 1 to 4 respectively, and

Figures 9 to 12 show two stacks of the material, the lower stack being that shown in figures 1 to 4 and the other stacks being the same material 24 hours later.

As shown in figures 1 to 4 and more clearly in figures 5 to 8, the inventive process provided a consistent 5 mm envelope of penetration through the radiata heartwood, radiata sapwood and slash sapwood. A few of the slash heartwood samples did not show such a 5 mm envelope.

All samples, however, showed the migration of the treatment material ('self healing' effect) 24 hours later. Figures 9 to 12 provide an excellent comparison of

mobility/penetration within 24 hours. Each figure has two stacks as mentioned above. The bottom stack is the material shown in figures 1 to 4. The top stack is the radiata/slash heartwood/sapwood 24 hours after end cuts. The increased penetration of the carrier/preservative is clearly evident. The migration of the treatment material and self healing effect is most obvious in the radiata sapwood shown in figure 11 and radiata heartwood shown in figure 9.

Example 2

In Example 1, the treatment process involved a 60 second dip. Trials with pinus elliotti (slash pine) have shown that treatment times can be reduced to as low as five seconds without effecting penetration or retention. Treatment uptake depends on the profile used with rougher headed material giving uptakes 10 to 15% higher than smooth dress material.

In addition, these trials have shown that packs can be treated in their final shape and form, ie tightly block strapped, without effecting uptake and penetration.

The table below shows the correlation between dipping time and average uptake. As is clear from this example, dip times as low as five seconds can provide sufficient uptake of carrier/preservative mixture for efficient generation of the protective envelope. This is even true, as mentioned above, with packs of tightly strapped material. In this case packs of 95 x 45 mm timber were used stacked six high and five wide.

Table 3 – Example 2: Uptake Results (Dip time Variation)

Species	Profile	Dip Time (sec)	Average uptake (l/m3)	%coeff of variation
Slash Pine	Rougher headed	60	25	28
Slash Pine	Rougher headed	45	30	34
Slash Pine	Rougher headed	30	26	32
Slash Pine	Rougher headed	5	18	22
Slash Pine	Rougher headed	5	17	21

Example 3

This example related to the treatment of Douglas fir. Douglas fir (psuedotsuga menziesii) is an inherently difficult species to treat. Trials with this species using the above mentioned formulation have shown penetration in both the hardwood and sapwood similar to pine species. The treatment process involved a 60 second immersion in a preservative carrier mix, where the carrier was at 50:50 mix of linseed oil and heating oil.

Average uptakes for 100 x 50 and 150 x 50 were around 20 L/m^3. A well defined envelope was formed in both the heartwood and sapwood.

Accordingly, it can be seen from this example that the inventive treatment may be applied to a wide variety of timber products.

Example 4

In addition to sawn timber, the treatment material and process is suitable for composite products. Treatment trials have been carried out with various wood composite to assist uptake and penetration, ie formation of the preservative envelope. Composites treated include particle board, plywood, medium density fibre board (MDF) and oriented strand board (OSB).

The treatment process was similar to the above, ie a 60 second immersion.

Details over these tests are given under Table 3

Table 4 – Example 4: Uptake Results (Composite Products)

Wood Type	Uptake	Std dev	%CV
Particle Board	29.4	6.2	21.1
Plywood	37.2	7.7	20.6
MDF	14.3	0.6	4.1
OSB	85.9	8.9	10.3

Example 5

The examples above were conducted using oil mixtures as the carrier. Tests have also being conducted using water-in-oil emulsions including up to 30% water. If desired, emulsifiers in the form of non-ionic surfactants can also be added to the emulsifier.

It has been found that such formulations gave similar envelopes of penetration with similar uptakes. Advantageously, wood swelling was minimal at these concentrations of water.

Table 5 – Example 5: Uptake Results (Water in Oil Emulsion)

Species	Profile	Dip Time (sec)	Average uptake (l/m3)	%coeff of variation
Radiata pine	Rougher headed	60	21	26
Radiata pine	Rougher headed	30	19	22
Radiata pine	Rougher headed	15	19	30
Radiata pine	Rougher headed	5	15	28

As can be seen from Table 5 above, using water in oil emulsions also give sufficient uptake of the carrier/preservative mixture to provide suitable treatment. It is

also noted that with water in oil emulsions, the uptake between five second dip times and 60 second tip times is even less than previous examples.

Example 6

Further tests were conducted on the susceptibility of the treated blocks to termite attack.

Commercial-size-section (35 x 90 mm) material of both slash and radiata pine were treated with the described material and supplied as 1m lengths. One hundred and forty test blocks (35 x 90 x 190 mm long) were used; one block cut from each 1m length supplied. Twenty-eight treatments (including 16 with block ends treated) with 5 replicates were exposed in plastic food containers to termites foraging in trenches at Beerburrum, south-east Queensland, Australia. Radiata pine control blocks were also exposed in plastic food containers to monitor termite foraging vigour on each trench. Following exposure for 29 weeks, mass losses of the blocks were estimated, analysed and reported.

On 3 of the 4 trenches, *C. acinaciformis* or *Schedorhinotermes seclusus*, or both provided a severe termite foraging pressure. Termites did not forage on the remaining trench, which had been used recently for other work and the absence of termites may have been a "carry-over" effect. We have not observed this phenomenon before. On the other trenches, the termites entered the vast majority of boxes, but essentially damaged only untreated and solvent test blocks and feeder blocks (see Table). All treatments appeared to protect the test blocks. Exposing cut untreated ends to the termites did not promote termite foraging on these blocks and there appeared no need to treat the ends of the test blocks with treatment material, with regard to *C. acinaciformis*. Industry, however, should be cognisant of differences in foraging behaviour between termite genera, and perhaps between termite species, as the commercialisation of the envelope treatment processes develops.

The below table outlines the results of these tests. The severity of the test protocol is evidenced by the amount of termite damage to the control blocks, (ie those treated with solvent only) in the control boxes and by the amount of fungal decay in some of the test boxes. The termite foraging pressure was severe and conditions suitable for sustained termite foraging and supportive of fungal decay.

Those blocks treated by the present invention, ie Permethrin or Delta envelopes resisted both termite attack and fungal decay very well compared with conventional techniques, eg Permethrin, LOSP (light organic solvent preservative).

The Delta/Permethrin compounds are conventional insecticides/termidicides used in Australia.

Table 6: Summary of Termite Trial

Box No.	Species	Heart/sap	Treatment	Test	Feeder	Trench
1	Radiata	Heartwood	Untreated	Fail***	Fail ***	1
2	Radiata	Heartwood	Permethrin envelope	Pass	Fail**	2
5	Radiata	Heartwood	LOSP Permethrin	Pass	Fail***	2
22	Radiata	Heartwood	Permethrin envelope	Pass	Fail*	1
21	Radiata	Heartwood	Delta envelope	Pass	Fail*	1
8	Radiata	Sapwood	Solvent	Fail*	Fail*	4
9	Radiata	Sapwood	Delta envelope	Pass	Pass	2
10	Radiata	Sapwood	LOSP Permethrin	Pass	Fail**	4

Box No.	Species	Heart/sap	Treatment	Test	Feeder	Trench
11	Slash	Heartwood #	Untreated	Fail***	Fail***	2
12	Slash	Heartwood	Permethrin envelope	Pass	Fail**	4
25	Slash	Heartwood	Permethrin envelope	Pass	Fail**	2
15	Slash	Heartwood	Permethrin LOSP	Pass	Fail***	1
13	Slash	Heartwood	Solvent	Pass	Fail*	4
14	Slash	Heartwood	Delta envelope	Pass	Fail***	4
26	Slash	Heartwood	Delta envelope	Pass	Pass	1
16	Slash	Sapwood	Untreated	Fail***	Fail***	2
17	Slash	Sapwood	Permethrin envelope	Pass	Fail***	1
19	Slash	Sapwood	Delta envelope	Pass	Fail*	1
20	Slash	Sapwood	Permethrin LOSP	Pass	Fail**	2
23	Slash	Sapwood	Permethrin envelope	Pass	Fail**	4
24	Slash	Sapwood	Delta envelope	Pass	Fail*	4

Box No.	Species	Heart/sap	Treatment	Test	Feeder	Trench
3	Radiata	Heartwood	Solvent	N/A	N/A	3^
4	Radiata	Heartwood	Delta envelope	N/A	N/A	3^
6	Radiata	Sapwood	Untreated	N/A	N/A	3^
7	Radiata	Sapwood	Permethrin envelope	N/A	N/A	3^
27	Radiata	Sapwood	Permethrin envelope	N/A	N/A	3^
28	Radiata	Sapwood	Delta envelope	N/A	N/A	3^
18	Slash	Sapwood	Solvent	N/A	N/A	3^

Test blocks with ends treated

* Attacked
** Moderate attack
*** Severe attack

\# High sapwood content
^ Lack of termite activity (trench had been used previously for boron trial)
N/A Not Applicable

Additional tests were conducted on the various samples from Example 6 and they are provided under Figure 13. This test was to determine the permethrin retention in the outer 5 mm of the treated samples. As mentioned above, the disclosed treatment

provides an envelope around the timber which acts as a barrier to termite and fungal attack.

The Australian Standard AS1604 for insecticide/termidicide content is 0.02%. Samples 168A, 211A and 129B were control blends and hence were not treated with permethrin. As can be seen from the remaining samples, however, most fell within or above the 0.02% standard (10% deviation).

The Applicant's target was to treat only the outer 5 mm of the wood within the 0.02% permethrin retention. This is in contrast to the Australian Standard AS1604 which calls for complete sapwood penetration and in the case of radiata pine, 5 mm heartwood penetration. The 5 mm envelope was achieved in both heartwood and sapwood of the radiata. For slash pine, where only sapwood penetration is required, a 5 mm envelope was also achieved.

Accordingly, it can be seen that the inventive material and treatment method provide not only adequate protection but does so in a more efficient and cost effective manner than conventional techniques.

Industrial Applicability

It can be seen that the present invention provides a significant advantage over the prior art. The aforementioned discussion should in now way limit the scope of the invention and various other embodiments can be provided without departing from the spirit or scope of the invention.

CLAIMS:

1. A material for treating wood comprising a preservative and a carrier, the carrier being selected such that it remains mobile within the wood and provides for migration of the preservative within the treated wood.

2. A material as claimed in claim 1, wherein the carrier is a drying oil.

3. A material as claimed in claim 1 or claim 2, wherein the carrier is linseed oil, fish oil or another drying oil.

4. A material as claimed in any one of the preceding claims, wherein the carrier includes extenders such as heating oil.

5. A material as claimed in any one of the preceding claims, wherein the carrier contains between 10 and 90% of extender.

6. A material as claimed in any one of the preceding claims, wherein the carrier contains between 30 to 70% of extender.

7. A material as claimed in any one of the preceding claims, wherein the carrier contains 40 to 60% of extender.

8. A material as claimed in any one of the preceding claims, wherein the preservative is an insecticide, termidicide, fungicide, mouldicide, or the like, or mixtures thereof.

9. A material as claimed in any one of the preceding claims, wherein the preservative is an insecticide or termidicide selected from the group consisting of synthetic pyrethroid, permethrin, cypermethrin, imidachloprid.

10. A material as claimed in any one of the preceding claims, wherein the preservative is a fungicide or mouldicide selected from the group consisting of iodopropynylbuthylcarbamate (IPBC), organic tin compounds such as tributyltin napthenate (TBTN), organic copper compounds such as copper 8 quinolinolate and copper napthenate, organic zinc compounds, quaternary ammonium compounds, tertiary ammonium compounds, isothiazolones, triazoles such as tebuconazole, boron compounds or mixtures thereof.

11. A material as claimed in any one of the preceding claims, wherein the material for treating wood includes drying agents to accelerate drying of the drying oil.

12. A material as claimed in claim 11, wherein the drying agent is selected from the group consisting of cobalt, manganese, zirconium, copper napthenate or mixtures thereof.

13. A material as claimed in any one of the preceding claims, wherein the preservative content in the treatment material is below 5%.

14. A material as claimed in any one of the preceding claims, wherein the preservative content is less than 2% of the mixture.

15. A material as claimed in any one of the preceding claims, wherein the preservative content is less than 1% of the mixture.

16. A material as claimed in any one of the preceding claims, wherein the carrier is selected to remain mobile within the wood such that it provides for redistribution or migration of the preservative to exposed surfaces of the wood.

17. A material as claimed in any one of the preceding claims, wherein the carrier is selected to remain mobile within the wood for up to several months.

18. A material as claimed in any one of the preceding claims, wherein the carrier is selected to remain mobile within the wood for up to about four weeks.

19. A material as claimed in any one of the preceding claims, wherein the mixture is a water in oil emulsion with up to 50% water content.

20. A material as claimed in any one of the preceding claims, wherein the mixture is a water in oil emulsion with up to 30% water content.

21. A material as claimed in any one of the preceding claims, wherein the carrier is selected to provide for migration along the grain of the wood and/or across the grain.

22. A method of treating wood comprising contacting the wood with a mixture of preservative and carrier, the carrier being selected to remain mobile within the wood after treatment such that it provides for migration of the preservative within the wood.

23. A method as claimed in claim 22, wherein the carrier is a drying oil.

24. A method as claimed in any one of claims 22 or 23, wherein the carrier is linseed oil, fish oil or another drying oil.

25. A method as claimed in any one of claims 22 to 24, wherein the carrier includes extenders such as heating oil.

26. A method as claimed in any one of claims 22 to 25, wherein the carrier contains between 10 and 90% of extender.

27. A method as claimed in any one of claims 22 to 26, wherein the carrier contains between 30 to 70% of extender.

28. A method as claimed in any one of claims 22 to 27, wherein the carrier contains 40 to 60% of extender.

29. A method as claimed in any one of claims 22 to 28, wherein the preservative is an insecticide, termidicide, fungicide, mouldicide, or the like, or mixtures thereof.

30. A method as claimed in any one of claims 22 to 29, wherein the preservative is an insecticide or termidicide selected from the group consisting of synthetic pyrethroid, permethrin, cypermethrin, imidachloprid.

31. A method as claimed in any one of claims 22 to 30, wherein the preservative is a fungicide or mouldicide selected from the group consisting of iodopropynylbuthylcarbamate (IPBC), organic tin compounds such as tributyltin napthenate (TBTN), organic copper compounds such as copper 8 quinolinolate and copper napthenate, organic zinc compounds, quaternary ammonium compounds, tertiary ammonium compounds, isothiazolones, triazoles such as tebuconazole, boron compounds such as trimethyl borate or mixtures thereof.

32. A method as claimed in any one of claims 22 to 31, wherein the material for treating wood includes drying agents to accelerate drying of the drying oil.

33. A method as claimed in any one of claims 22 to 32, wherein the drying agent is selected from the group consisting of cobalt, manganese, zirconium, copper napthenate or mixtures thereof.

34. A method as claimed in any one of claims 22 to 33, wherein the preservative content in the treatment material is below 5%.

35. A method as claimed in any one of claims 22 to 34, wherein the preservative content is less than 2% of the mixture.

36. A method as claimed in any one of claims 22 to 35, wherein the preservative content is less than 1% of the mixture.

37. A method as claimed in any one of claims 22 to 36, wherein the carrier is selected to remain mobile within the wood such that it provides for redistribution or migration of the preservative to exposed surfaces of the wood.

38. A method as claimed in any one of claims 22 to 37, wherein the carrier is selected to remain mobile within the wood for up to several months.

39. A method as claimed in any one of claims 22 to 38, wherein the carrier is selected to remain mobile in the wood for up to about four weeks.

40. A method as claimed in any one of claims 22 to 39, wherein the carrier is selected to provide for migration along the grain of the wood and/or across the grain.

41. A method as claimed in any one of claims 22 to 40, wherein the wood is contacted with a mixture of preservative and carrier by pressure application, spraying, dipping, rolling, painting, or combinations thereof.

42. A method as claimed in any one of claims 22 to 41, wherein the wood is dipped in a mixture of preservative and carrier from between a few seconds up to several minutes.

43. A method as claimed in any one of claims 22 to 42, wherein the wood is dipped in a mixture or preservative and carrier from around 5 seconds up to about 60 seconds.

44. A method as claimed in any one of claims 22 and 43, wherein the wood is contacted with a sufficient quantity of preservative and carrier to provide an uptake of between 10 to 100 L/m^3.

45. A method as claimed in any one of claims 22 to 44, wherein the method is applied to radiata pine heartwood, radiata pine sapwood, slash pine (pinus elliotti) heartwood or sapwood, or Douglas fir (psuedotsuga menziesii) heartwood and sapwood.

46. A method as claimed in any one of claims 22 to 45, wherein the method is applied to wood composites including particle board, plywood, medium density fibreboard (MDF) or oriented strand board (OSB).

47. A method as claimed in any one of claims 22 to 46, wherein the mixture is a water-in-oil emulsion with up to 50% water content.

48. A method as claimed in any one of claims 22 to 47,wherein the mixture is a water-in-oil emulsion with up to 30% water content.

49. A material for treating wood substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.

50. A method for treating wood substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.

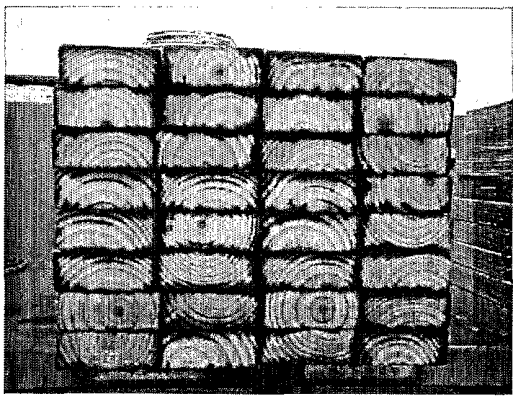


Figure 1.

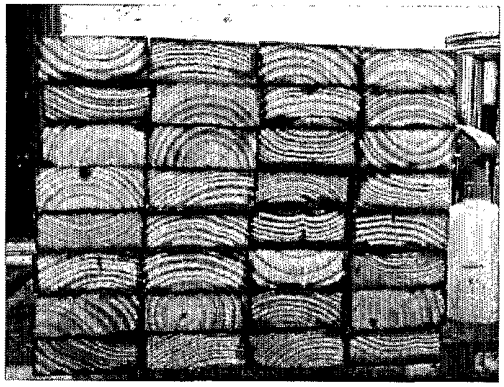
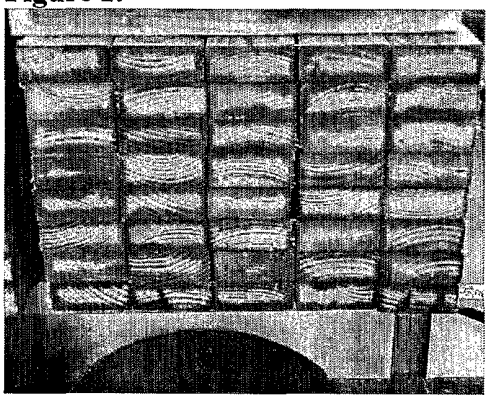


Figure 2.



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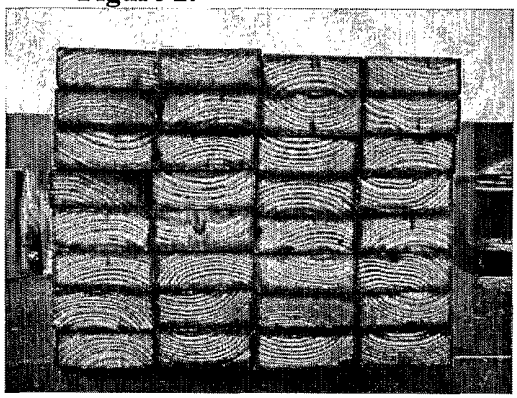

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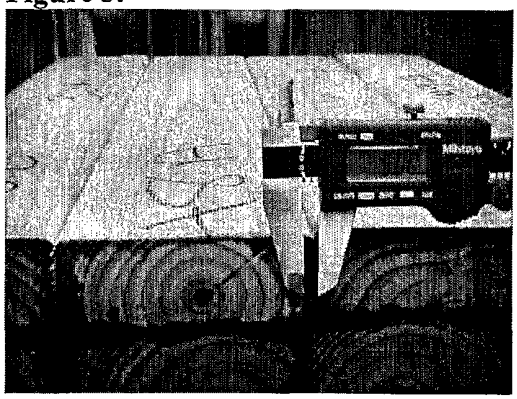

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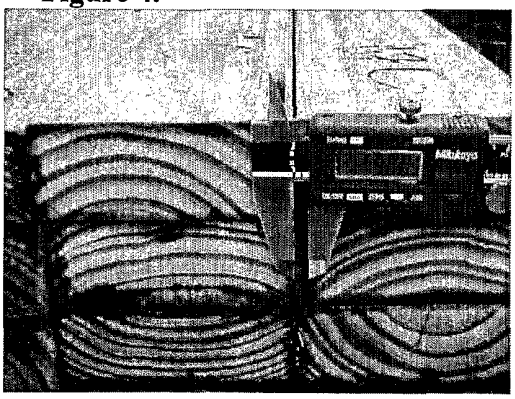

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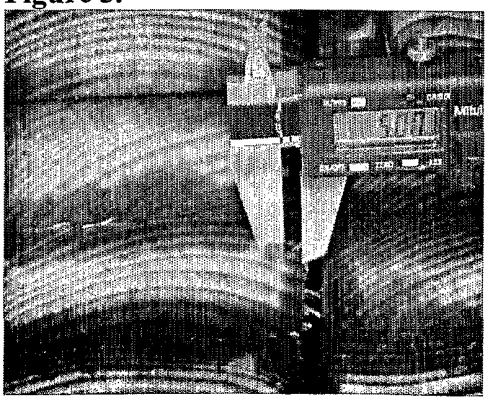

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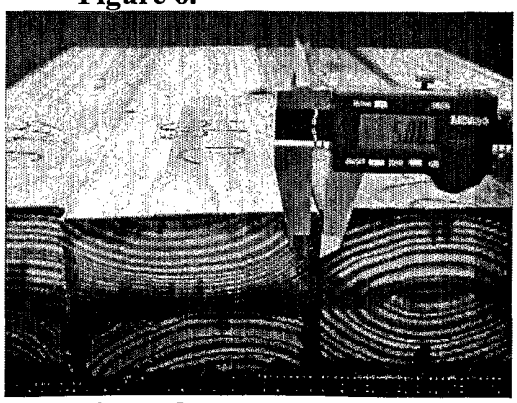

Figure 8.

Figure 9.

Figure 10.

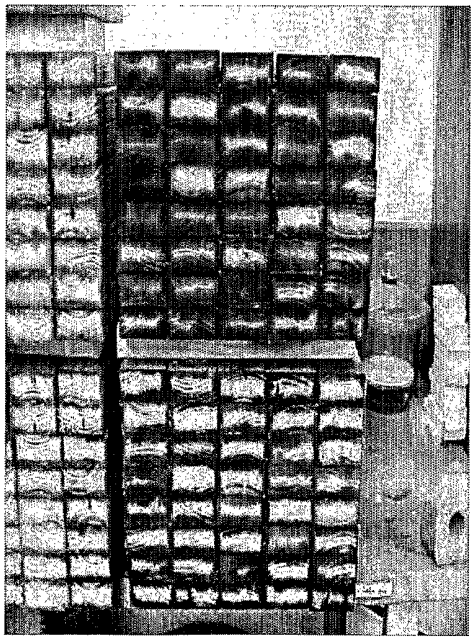

Figure 11.

Figure 12.

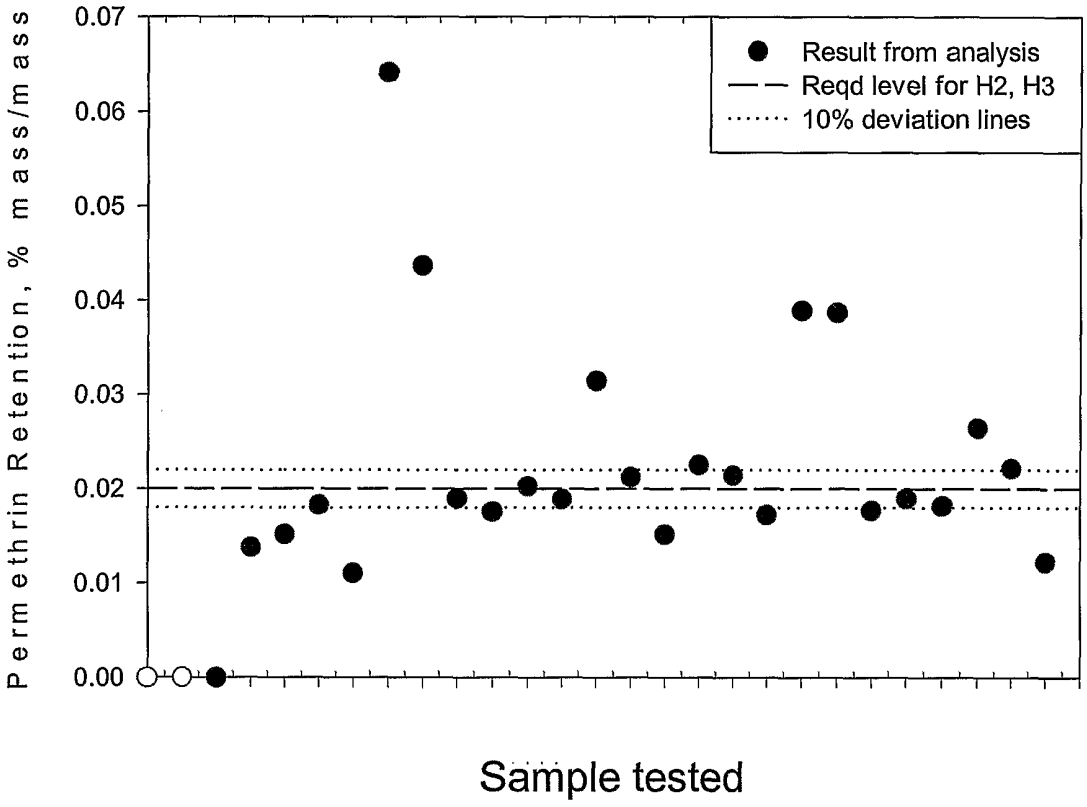
Permethrin Retention, % mass/mass
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Result from analysis
Reqd level for H2, H3
10% deviation lines
Sample tested

Figure 13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU01/01625

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: B27K 3/50

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC B27K 3/--

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI: IPC and (FISH, LINSEED, DRYING OIL, HEATING OIL, CARRIER, PRESERV+)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 227430 B (KOPPERS AUSTRALIA PTY LIMITED et al.) 24 July 1991 See page 6 lines 27-41	1-8, 13-29, 34-50
X	EP 451524 A (ACIMA AG) 16 October 1991 See entire document	1-9, 13-18, 21-30, 34-46, 49-50
X	US 4814016 A (ADKINS et al.) 21 March 1989 See column 8 lines 10-31, column 10 lines 1-61 and column 14 lines 44-47	1-3, 8, 11, 22-24, 19, 32

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 January 2002	31 JAN 2002
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer **R.P. ALLEN** Telephone No : (02) 6283 2134

INTERNATIONAL SEARCH REPORT	International application No. PCT/AU01/01625

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3837875 A (MURPHY) 24 September 1974 See entire document	1-8, 11-18, 21-29, 32-46, 49-50
X	WO 96/10914 A (TROY CORPORATION) 18 April 1996 See page 2 line 23 to page 3 line 3 and page 7 lines 1-11	1-8, 10-11, 13-29, 31-32, 34-50
X	WO 92/19429 A (SCHIRNIG) 12 November 1992 See page 2 lines 2-23 and examples	1-3, 8, 10-18, 21-24, 29, 31-46, 49-50
X	FR 2355451 A (SARPAP) 20 January 1978 See entire document	1-3, 8, 13, 16-18, 21-24, 29, 34, 37-46, 49-50
X	DE 19715664 A (BWG BUTZBACHER WEICHBAU GMBH) 22 October 1998 See abstract and examples	1-3, 8, 11-12, 16-24, 29, 32-33, 37-46, 49-50
X	DE 19841271 A (ENGELMAYER) 16 March 2000 See entire document	1-3, 8, 16-18, 21-24, 29, 40-46, 49-50
X	GB 670258 A (ANCIAUX) 16 April 1952 See entire document	1-5, 8, 16-18, 21-25, 29, 40-46, 49-50
X	Derwent Abstract Accession No.96-282010/29 ,Class A82, JP 08-118317 A (DAIKEN KOGYO KK) 14 May 1996 & JP 08-118317 A See entire document	1-3, 8, 11-12, 16-18, 21-24, 29, 37-46, 49-50
X	Derwent Abstract Accession No. 98-128974/12, Class D23, SE 9602034 A (KEMIINFORMATION AB) 24 November 1997 See abstract	1-3, 8, 13-24, 29, 34-50

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU01/01625

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
EP	227430	AU	66626/86	CA	1306663	NZ	218652
		WO	8703783				
EP	451524	CH	680575				
US	4814016	AU	23760/88	EP	314377	US	4923760
US	3837875	NONE					
WO	9610914	AU	36407/95	CA	2202892	CZ	9701098
		EP	784432	SK	462/97		
WO	9219429	AU	17890/92	DK	848/91	EP	576608
FR	2355451	NONE					
DE	19715664	AT	9043/98	AU	75241/98	LU	90459
		PL	336272	WO	9846403		
DE	19841271	NONE					
JP	8118317	NONE					
SE	9602034	NONE					

END OF ANNEX