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Timber Advisory Note

Timber Advisory Centre

ANTI-SAPSTAIN TREATMENT FOR LOGS AND SAWN TIMBER

G.K. Brennan

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT, HARVEY

GENERAL

Sapstain, mould and decay fungi represent a large diverse group of organisms, which can cause serious financial losses in the timber industry. These organisms infect felled logs, and sawn timber often has to be downgraded from appearance grade. Heartwood is not usually affected and there are wide variations in the susceptibility of sapwood among different timber species. While the action of sapstain fungi and moulds has a negligible effect on the strength of the timber, it does result in the discolouration of the sapwood, particularly of softwoods and pale-coloured hardwood species. Freshly cut sapwood is particularly vulnerable to attack because its high moisture content and available supply of simple nutrients provide an excellent substrate for fungal growth.

The time taken for the fungal attack to appear depends on climatic conditions, and warm moist conditions are the most favourable for fungal development. Under suitable conditions the grey, blue or black discolouration of sapstain can develop within one week, the superficial white or green moulds within two days and the yellow-brown discolouration of decay after about four weeks. Green or black surface moulds which sometimes appear on timber are usually harmless and can simply be brushed or planed off the surface, but sapstain is more difficult to control. Fungal staining in softwoods is commonly referred to as blue stain, owing to the characteristic blue-grey discolouration in the sapwood caused by the dark hyphae, but some fungi produce different colours.

Treatment to prevent this fungal growth is known as anti-sapstain treatment and must include a broad spectrum of chemicals toxic to fungi because of the diversity of organisms involved. This requirement, combined with the need to meet tough environmental and health regulations, makes finding good preventative measures a challenge.

Modern anti-sapstain formulations are based on low toxicity agricultural fungicides which have limited effectiveness against wood-degrading fungi when used as single component formulations. Fungicides need to be combined into a multi-component formulation to offer a broad spectrum of protection. The sodium pentachlorophenate (NaPCP) and 'Captafol' treatments used in the past are no longer available owing to health and environmental concerns.

Anti-sapstains are not required when timber is kiln dried at high temperatures soon after milling. This rapid drying reduces timber moisture contents to

below that suited to fungal development, and the high temperatures used effectively sterilise the timber.

Control methods

The following methods are suggested:

(i) Mill the logs as soon after falling as possible - ideally within one week - because treatment will be ineffective once logs are infected.

(ii) Maintain a high moisture content by storing logs under water sprays.

(iii) Apply a fungicide to the surface of debarked round logs.

(iv) Following sawing, immediately treat sawn timber with fungicide or else kiln dry the timber to below 20 per cent M.C.

PROTECTION OF LOGS

Prompt processing

Where possible logs should be milled without any delay, because even if no discolouration has occurred, there may be enough infection of the log to interfere with successful treatment of sawn timber against sapstain if fungal hyphae colonise the rays. The actual time lapse which can be tolerated between felling and conversion varies with timber susceptibility and temperature, with rapid fungal development at 24°C and negligible development at temperatures below 10°C. Log moisture contents above 20 per cent are required for fungal growth.

Under Australian conditions, except during the winter months in the southern States, even a delay of two to three days between felling and conversion may allow infection to occur. However, logs will not be extensively discoloured in this short period.

Water storage

A properly designed and operated water spray system giving stockpiled logs a complete water cover or storing logs under water is extremely effective in preventing fungal attack in both hardwood and softwood logs. An additional benefit is that end splitting and checking is reduced, and in the case of regrowth eucalypts the amount of growth stress can be reduced, resulting in less bow and spring in flitches and sawn boards. Applying water to logs will maintain a high moisture content in the sapwood, preventing fungal attack because of shortage of air in the wood. Even if the moisture content has

sprays will often restrict further fungal development.

Water spray systems can be large agricultural spray systems or perforated plastic hoses, with the objective of keeping all wood surfaces at high moisture contents. Care must be taken that prevailing winds do not blow the spray

away from one side of the stockpile for long periods. The amount of water required will vary widely with the watering schedule used, and will also be affected by height of the stockpile, the climatic conditions and the strength of prevailing winds.

Chemical treatment

If prompt milling is impracticable, in exceptional circumstances sapstain may be controlled by covering all exposed wood surfaces with a protective fungicide before the staining fungi have time to penetrate into the wood . For chemical treatments to be most effective, treatment of exposed surfaces needs to be almost immediate. If the bark is generally intact, protective treatment is only required on areas of damaged bark or on the cut ends of the logs, and may be combined with an anti-splitting end coating. Where areas of bark have been removed from pine logs, attack by the pinhole borer (*Ips grandicollis*) is also possible and the entire log would need to be sprayed. Unfortunately, it is impractical to spray in the forest, and this method is not recommended.

PREVENTION IN SAWN TIMBER

Sawing of green timber exposes large areas of moist susceptible sapwood to infection by staining fungi, which are very prevalent in the air around sawmills and seasoning yards. The attack will not have time to develop where the boards are kiln dried at high temperatures shortly after sawing, but may be quite serious if boards are air-dried or where block stacked flitches are either shipped or stored green for subsequent re-sawing.

Good housekeeping at the sawmill is essential for anti-sapstain control. This encompasses all practices which minimise the likelihood of biodeterioration, including on-site quality control, appropriate preservative application technology and maximum physical control techniques.

The control principles needed are :

(a) Using fungicides

Achieving the broad spectrum of anti-fungal activity necessary for anti-sapstain formulations, whilst meeting tough environmental and low toxicity requirements, often requires the use of more than one active ingredient. That is, the fungicide must be able to control different types and species of fungi.

(b) Quality control

It is essential that quality control managers closely monitor anti-sapstain treated timber during storage and drying, to observe the first signs of the development of mould, sapstain and decay. The application rates and efficiency should be monitored, which may indicate that raising the concentration of the anti-sapstain

preservative, adding extra anti-sapstain active ingredients or covering timber during wet weather may be required.

Physical control techniques can also be used to prevent mould, sapstain and decay. These include all practices designed to maximise the timber drying rate and minimise the chances of timber becoming infected with fungi. Drying rates can be increased by correct stripping and stacking of timber to allow good air movement through the timber, and covering timber during excessive wet weather. Using clean preservative-treated or non-susceptible timber strippers and keeping the sawmill site clean and free of timber with any signs of fungal degrade is important. As stated previously, any technological advancement such as high temperature drying which reduces the time between sawing and timber entering service will reduce problems of controlling mould, sapstain and decay.

(c) Appropriate preservative application technology

Many anti-sapstain formulations are water dispersants or emulsions requiring vigorous agitation in dip tanks or holding tanks of spray facilities. Maintaining of these tanks is essential. Clogging of recirculating systems, and filtering out the active ingredients or losing those ingredients below deep layers of settled sawdust in the tanks must be prevented. Breakdown of either the agitation or sawdust removal systems, a fairly common occurrence, will result in sub-threshold concentrations of preservatives being applied to timber. Whatever application system is employed, its operation requires the same level of monitoring as other facilities at sawmills, because failure can be just as economically damaging.

Chemical treatments

Where rapid drying is impracticable, the boards should be protected from infection by dipping or spraying with a suitable preservative. A number of suitable formulations are available and these are listed below. The wood should be treated as soon as possible after sawing, and the time that timber remains protected will be reduced during warm, and wet or humid conditions which can occur during late spring, summer and autumn unless concentrations are increased.

Timber surface conditions may need to be considered when determining the concentration to use. For example, if skip-dressing was done, dressed timber would retain less solution than rough-sawn timber. For example, while about 20 L/m^3 remains on the surface of a rough-sawn 100 x 50 mm board after dipping, only about half that volume will remain on the smoother surfaces of dressed timber. Therefore, to protect dressed timber, the solution

If newly-treated wood is exposed to rain, some of the anti-sapstain chemical may be washed off. It is recommended that such wood should be stacked and stored under cover, with good ventilation to promote rapid air drying.

The table overleaf summarises anti-sapstain chemicals listed in the Western Australian Department of Agriculture's Pesticide Register. The anti-sapstain chemicals available in Western Australia will change as new formulations are developed and if use of currently used chemicals becomes inappropriate.

Details on mixing chemicals, application rate and health and safety aspects are available from the chemical suppliers in the Safety Data Sheets supplied with the preservative.

Applying chemicals

Two common methods of applying anti-sapstain chemicals are dipping and spraying. Both application methods have their drawbacks, and the potential problems are chemical wastage, and settling-out of non-water-soluble formulations It is essential that safety data sheets are used and approved work practices are followed to remove possible health hazards for workers.

When small pieces of timber are to be treated, they may be dipped by gloved hands in a trough fitted with splash boards and a drainage rack to reduce wastage of solution. It may be desirable to dip timber in bundles; if so, care should be taken that the solution penetrates between all boards in the bundle. Frequent replenishment of the solution will be needed, and the use of a small separate mixing tank for accurate mixing of chemicals is essential.

Treatment against sapstain is intended to provide only surface protection during drying and can be rendered ineffective by cutting or checking. Foam and low-volume spray systems have been developed overseas which improve application and reduce chemical wastage, but are not yet used in this State.

The solution concentration for treating rough sawn and dressed timber varies and this needs consideration. For example, to protect dressed timber the solution concentration should be increased two or threefold compared with rough sawn timber.

Freshly-treated timber should be protected from rain after treatment to prevent the preservative from washing off.

Dipping

- Use a V-shaped trough and convey the timber on a green chain through the chemical solution.
- Use hanging rollers or wheels to completely immerse the timber during treatment.
- Cover troughs to prevent dilution by rain, and clean regularly to remove sawdust.
- Dip small amounts of timber by hand in a trough fitted with splash boards and a drainage rack.

Trade Name	Active Ingredient	Suitable Application Method	Dilution Rate	Application Rate	Cost (Nov 1994)	Available From
Busan 300 W.B. * Sapstain Preventative)	- (thiocyanomethlythio) enzothiazole (TCMTB)	Dipping or spraying *	Softwood - 1 to 4 % (10 to 40 kg/1000 L) Hardwoods - 0.5 to 1.0 %	Green chain dip - complete emersion of timber Block stacked bundle - 2 minute dip with agitation.	$19.66/kg (25 kg drum). $18.66/kg (210 kg drum).	Buckman Laboratories (Wagga Wagga)
*Busan 1009	lethylene bis. hiocyanate) (MBT) and CMTB	Dipping or spraying *	Softwoods - 0.5 to 2 % (5 to 20 kg/1000 L) Hardwoods - 0.5 %	Spray - complete coverage of all surfaces.	$16.89/kg (25 kg drum), $15.89/kg (210 kg drum) (prices ex Wagga Wagga N.S.W.)	
Koppers NP-1 Sapstain Control Chemical	idecyldimethyl ammonium hloride -iodo-2-propynyl-butyl arbamate	Dipping or spraying	Sawn softwood up to 50 mm thick - 1:100 to 1:200. Sawn softwood greater than 50 mm thick - 1:75 to 1:150. **	Green chain dip - 5 sec. dip with 10 - 15 L of diluted NP1 per m^3 of timber. Spraying systems must deliver the same rate as dipping.	$16.10/L (20L drum) $15.50/L (200L drum)	Koppers-Hickson Timber Protection (North Sydney)
Boracol 100 RH	Disodium octaborate etrahydrate Benzalkonium chloride	Brushing, spraying or dipping	No dilution required	1L per 2 - 6 m^2 of timber surface (125 - 500 ml per m^2).	$11.50/L (1 L drum) $9.00/L(5 L drum) $7.75/L(20 L drum)	Chemicca Ltd (Nufarm) Kwinana, W.A.Hardware Midland or Hale Rd Hardware Forrestfield.
Trade Name	**Active Ingredient**	**Suitable Application Method**	**Dilution Rate****	**Application Rate**	**Cost (Nov 1994)**	**Available From**
Hylite 711 Timber Preservative	arbendazim inc naphthenate	Dip or spray	**4:1000 to 6:1000 sawn timber - normal condition (winter or short stockpiling) - 6:1000 to 8:1000 sawn timber - severe condition (summer or long stockpiling) - 8:1000 Roundwood/poles - 8:1000 (boron bath+)	Dip - complete immersion of timber for 150 sec. to allow thorough coverage and penetration. Spray - complete coverage of all surfaces.	$13.50/L (20 L drum) (Large quantities) $18.00/L (20 L drum)	Chemicca Ltd (Nufarm) Kwinana. Hale Rd Hardware, Forrestfield.

Notes:

(i) Overseas Bu 30 WB is marketed, but Australian regulations require the active ingredient to be expressed as g/kg.

(ii) It is preferabl premix Hylite 711 with approximately 3 times its own volume of water with vigorous agitation, then add the remaining water into the treatment tank, e.g. premix 4 L plus 12 L wat a large bucket then add to the treatment tank.

(iii) Hylite can be bined with 'Borax'/boric acid in the one bath to prevent *Lyctus* spp attack. If there is delay before 'Borax' treatment, HYLITE should be applied immediately after sawing.

(iv) Higher rates ecommended for hardwood and for mould control in softwoods.

(v) Regular quali ntrol of all chemicals will determine if the application rate is correct.

Spraying

- Use spray systems for large cross sections.
- Use large droplet sizes, but with effective screening of spray chambers to prevent any fine mist of preservative solution causing a health hazard to operators.
- When using a spray system, recirculating pump, storage tank and a tank to collect chemical runoff are required. The intake of the recirculating pump should be well above the base of the collecting tank and should be well screened. Filters should be incorporated in the spray lines.

Health and Safety

The following requirements are essential in using anti-sapstain chemicals

- Remember that in concentrated form, most anti-sapstain chemicals are skin irritants.
- Wear protective clothing (rubber gloves, overalls, apron and goggles) and a face mask when mixing anti-sapstain chemicals.
- When handling freshly treated timber, wear a waterproof apron and gloves and do not smoke or eat while handling the timber, and wash thoroughly afterwards.
- Work in a well ventilated area to avoid inhaling any chemical vapour.
- Use the health and safety information provided by the chemical supplier.

Reference

Department of Agriculture of Western Australia (1991). Pesticides registered in Western Australia at August 1, 1991. Department of Agriculture, W.A. Bulletin No. 4232.

Disclaimer

Information on treating sapstain and some of the available chemicals for treatment are given in this technical sheet. Neither FIFWA nor the Department of Conservation and Land Management shall be liable for any loss, injury, damage or death whether consequential or otherwise whatsoever or however arising from the incorrect use or application methods specified in this sheet. Suppliers of the chemicals listed in this sheet are responsible for providing the health and safety procedures which must be followed.

Timber Advisory Centre, PO Box 4002, WEMBLEY WA 6014, Tel: (09) 380 4411

Department of Conservation and Land Management, PO Box 104, COMO WA 6152, Tel: (09) 334 0410