

TECHNICAL NOTE NUMBER 225

DIVISION OF FOREST PATHOLOGY BUREAU OF PLANT INDUSTRY
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CAUSE AND PREVENTION OF BLUE STAIN IN WOOD

Blue stain is caused by fungi which grow in sapwood and use parts of it for their food. It is not a stage of decay, although the conditions that favor blue staining also very often lead to infection with decay-producing fungi. Excepting toughness, blue stain has little effect on the strength of wood.

To prevent blue stain it is necessary to produce unfavorable conditions for the development of the causal fungi. These fungi are disseminated either by spores, which are produced in great abundance and are carried about by wind and insects, or by direct growth from infected to uninfected wood. Their growth is dependent upon proper food, moisture, air, and favorable temperatures. If any one of these factors can be rendered inadequate or unfavorable sapwood will not stain.

The wood can be made unsuitable as food for fungi by introducing chemicals into it that are toxic to the fungi. This method of controlling stain in green lumber is used widely. The blue-stain fungi cannot grow in wood which has a moisture content of less than 20 percent nor in wood in which the cell cavities are absolutely full of water. Hence, the spread of stain can be prevented either by rapidly drying freshly exposed surfaces to a moisture content below 20 percent or by keeping the stock submerged in water. Blue-stain fungi grow most rapidly when the temperature is from 75° to 85° F. If the temperature of the wood is below 35° F. or above 100° F., no stain is likely to take place.

Controlling Blue Stain in Logs

Logs are often badly infected before they are sawed into lumber. Where immediate conversion of logs into lumber is impossible, a practicable method of controlling stain is provided by chemical treatment if insect infestations are not severe.

CHEMICAL TREATMENTS: Spraying the ends and barked areas of freshly cut logs with the following chemicals will substantially retard the occurrence of blue stain in hardwoods during storage periods as long as 3 months. With the exception of borax, the same treatments are suitable for softwood logs, but they may not give adequate protection for as long a period as with hardwoods.

The antiseptic can be applied with an ordinary garden spray. Treatment should not be delayed longer than 24 hours after the trees are felled.

To control end checking as well as stain, any suitable moisture-resistant coating can be applied after the spray treatment.

Solutions for chemical treatment of logs

Product and principal toxic chemical ¹	: Pounds ² per 100 : gallons of water
Borax ³	32
Dowicide G (sodium pentachlorophenolate) ⁴	30
Dowicide H (sodium tetrachlorophenolate).....	30
Dowicide P (sodium tetrachlorophenolate plus 2-chloroorthophenylphenolate).....	30
LE-6 (ethyl mercuric oleate and phenyl mercuric oleate).....	7
Lignasan (ethyl mercuric phosphate).....	8
Permatox 10S (sodium pentachlorophenolate plus borated materials).....	40
Santobrite (sodium pentachlorophenolate).....	30

¹Materials are named in alphabetical order.

The proprietary products are distributed by the following companies:

Dowicides)
Permatox 10S) - A. D. Chapman & Co., Chicago, Ill.

LE-6)
Lignasan) - E. I. du Pont de Nemours & Co., Wilmington, Del.

Santobrite -- Monsanto Chemical Co., St. Louis, Mo.

²The amounts given are the smallest that can safely be used ordinarily. In localities and seasons in which staining is especially severe the amounts, except for borax, may be advantageously increased by as much as one-sixth to one-third.

³Suitable for hardwoods only.

⁴The composition of materials designated by trade names may not always be the same; therefore past experience with a proprietary product can be used as a basis for judging future effects or results only insofar as its chemical composition remains unchanged.

All the chemicals mentioned are regarded as poisonous. Be sure to read the caution at bottom of next page before attempting to use them.

Controlling Blue Stain in Lumber and Timbers

The most effective method of preventing stain in lumber is to kiln dry the stock green from the saw. By this method moisture conditions are rapidly made unfavorable for the growth of fungi. Stock to be air seasoned can be protected against staining by treating the surfaces with chemicals that stop the development of the stain fungi or by employing

special piling methods, such as end racking or crib piling, that shorten the time required to dry the surfaces to a moisture content unfavorable for the growth of the fungi. Chemical treatment is cheaper and more effective because it is less dependent on weather conditions and, when it is followed by flat piling, the stock dries with less warping and twisting. Chemical treatment also is particularly useful for the temporary protection of green timbers.

CHEMICAL TREATMENT of lumber to prevent staining during the air-seasoning period is usually accomplished by dipping, either mechanically or by hand, depending largely on the output of the mill. At some mills the chemical is sprayed on the lumber but this procedure, for the most part, is limited to treatment of green timbers and dimension items which cannot conveniently be handled in an ordinary dipping vat.

Preparations most commonly employed at present for use on lumber and timbers are the same as those listed for log treatments. However, with the exception of borax, the concentrations needed are considerably less. On lumber, Dovicide H is recommended only for hardwoods in the South, but is suitable for all species in western and northern states. For timber sprays, the concentrations recommended by the distributors for lumber treatment should be increased by at least one-half. For maximum effectiveness and safety in handling, directions furnished by the distributors should be carefully followed.

Precautions

For satisfactory results with any dipping or spraying treatment, careful consideration should be given to the following: (1) Stain-free logs. Surface treatment of boards from infected logs will not stop the development of fungi already present. (2) Prompt treatment. Treatment preferably should not be delayed longer than 24 hours after sawing; delays are frequently responsible for interior stain. (3) Thorough coverage of the stock. Sufficient attention should be given to the quantity of dipping solution, or the condition of the spray nozzles, to insure complete wetting of the surfaces at all times. (4) Adequate concentration of the chemical. Solution concentrations should never be lower than those recommended, but during unfavorable weather they sometimes can be increased to advantage. (5) Protection of the treating solution and treated stock from rain. (6) Good seasoning practices. The treated stock should be piled so that it will dry as rapidly as possible without undue warping or checking. Yard piles should be as narrow as practical, properly elevated, well spaced, and adequately roofed. The use of stock boards as stickers, especially those over 4 inches wide, increases the liability of sticker stain. Narrow, dry stickers are greatly to be preferred. Chemically treated stickers last longer than untreated ones and are less likely to carry infection to the lumber.

All of the chemicals mentioned are regarded as poisonous. However, with reasonable care they can be used without known danger. Persons whose skin is found to be particularly sensitive to the chemical being used should avoid it entirely. In any case the chemicals, with the exception of borax, should not be permitted to get on the skin more

than necessary, and not at all until they are fully diluted. For hand dipping and handling of the lumber immediately after dipping, waterproof aprons and rubber gloves are advised. The gloves can be protected against wear by means of canvas covers or leather pads.

Chemical Treatment of Miscellaneous Wood Products

Antistain chemicals can be applied advantageously to a number of materials other than logs and lumber. Their use is being extended to green posts, veneer, hoop stock, shingles, lath, and similar products as a means of keeping them bright during seasoning.

PROTECTION OF DRY WOOD: Seasoned wood again becomes susceptible to staining upon wetting; consequently, it must be kept in a reasonably dry condition (20 percent moisture or less) if discoloration is to be avoided. Surface applications of chemicals for stain control during air seasoning provide no permanent protection. Chemical treatments are effective for long periods only when they are made to penetrate deeply into the wood, as, for example, in properly pressure-treated wood.

Reference

More detailed information on this subject may be had in U. S. Dept. Agr. Tech. Bull. 714, "Stains of Sapwood and Sapwood Products and Their Control," which is available from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 20¢, stamps not accepted.