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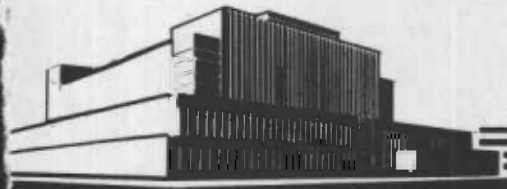

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FOREST SERVICE
In Cooperation with the University of Wisconsin

COLOR TEST FOR EARLY STORAGE DECAY IN SOUTHERN PINE

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Summary

A simple color test has proved useful for detecting early infection by the common decay fungus, Peniophora gigantea, in the sapwood of round products of southern pine in storage. The test is a qualitative one, that is, it indicates the presence or absence but not the stage of decay. To apply the test, a small amount of a water solution of Alizarine Red S is sprayed on freshly exposed end-grain surfaces. Infected sapwood is stained yellow by the solution, but uninfected sapwood turns pink to red in color. Presence of staining or molding fungi does not complicate the test. The indicator should be helpful in avoiding excessive decay prior to treatment of poles and posts, which would help insure the long service life expected from treated products.

Introduction

Stored round products in the southern pine region are subject to early attack by decay fungi. Damage is most rapid during the warm period of May to October, but it continues slowly even during the winter months. As a result, large round products cannot be fully air-seasoned with safety in this region. Attempts to prevent the decay by surface applications of fungicidal solutions have been unsuccessful because checks soon open the way for infection.

The most common storage decay in southern pine poles, posts and pulpwood is caused by Peniophora gigantea. In fact, significant early decay in these products seems to be caused almost entirely by this

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[1] Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

fungus. The infection is difficult to detect in the initial stage, because only slight changes in color and strength accompany it. In late stages, the wood may be greatly softened, particularly in the springwood part of growth rings, but definite pockets of rot are seldom formed. The prevalence of Peniophora has long been recognized but early investigators usually regarded it as harmless[2]. However, later laboratory and field tests disclosed that this fungus causes important losses in the strength and specific gravity of southern pine[3,4].

Improved detection of storage decay in southern pine is especially important for round products that are to be treated with preservatives. Such infections may eventually lead to nonuniform permeability and distribution of moisture in the wood. The result in treated wood is that variations in penetration and absorption of preservative solutions are likely to be increased. There also is the factor that advanced decay caused by Peniophora may produce important losses in the strength of wood.

Trials of Color Indicators for Decay

The fact that an increase in acidity of wood accompanies infection by decay organisms has stimulated numerous independent trials of colorometric pH indicators to distinguish infected from sound wood. Such trials have been unsuccessful to the extent that no single indicator has proved satisfactory for all woods and species of decay fungi. However, there has been evidence that suitable indicators might be found for specific problems involving one type of wood and decay fungus. For this reason, a number of pH solutions were evaluated as indicators of early storage decay in southern pine.

The solutions employed in the comparison were either supplied or suggested by T. C. Scheffer of the Forest Products Laboratory. Initial trials were made on southern pine of pole size that had been stored for 1 to 3 months at Saucier, Miss. Later comparisons of the most promising indicators were made on partially or fully air-seasoned poles at two commercial treating plants. Varying amounts of infection by Peniophora, as well as by sapstaining and molding fungi, were represented in these poles.

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[2] Humphrey, C. J. The Decay of Ties in Storage. Amer. Wood Pres. Assn. Proc. 16:217-249, 1920.

[3] Richards, C. A. and Chidester, M. S. The Effect of Peniophora gigantea and Schizophyllum Commune on Strength of Southern Yellow Pine Sapwood. Amer. Wood Pres. Assn. Proc. 36:24-31, 1940.

[4] Lindgren, R. M. Deterioration of Southern Pine Pulpwood During Storage. For. Prod. Res. Soc. Proc. 5:169-180, 1951.

Although several pH indicators showed some promise, the best one proved to be a 0.75 percent solution of sodium alizarine sulfate (Alizarine Red S) in distilled water. Such a solution, which changes color in the pH range of about 3.7 to 5.2, already has been recommended as a means of distinguishing between heartwood and sapwood in Douglas-fir[5]. When this indicator was applied by a hand atomizer to end faces, areas in the sapwood infected with Peniophora were colored yellow, whereas sound sapwood became pink to red in color (fig. 1). These color changes were striking in both unseasoned and partially seasoned wood, provided the solution was applied to freshly cut end surfaces. Weathered, old or side surfaces usually showed poor color differentiation, probably because any initial differences in acidity of the wood had been obliterated by rain or other weathering effects. Likewise, heartwood and knots showed inconsistent coloration, but such areas are easily distinguished and should not complicate the use of the method.

Poles tested with Alizarine Red S at commercial plants were often infected by sapstain and mold fungi, sometimes in combination with Peniophora. Areas having all three types of infection became yellow in color and, therefore, reacted similarly to wood having Peniophora alone. However, wood infected only with stain and mold fungi showed the pink to red color that was typical of sound sapwood. Such differences in reaction confirm a recent report that staining and molding organisms have little effect on the acidity of wood[6].

Early infection by Peniophora that would often be overlooked by visual inspection was strikingly revealed by Alizarine Red S. Differences in intensity of the yellow color were not sufficient to serve as a criterion of the stage of decay. Therefore, the color test was qualitative in that it disclosed the presence but not the degree or stage of infection.

Discussion

The hazard of decay in poles, piling and other large products of southern pine has led to the common use of steaming of green material in place of air-drying before preservative treatment. However, immediate treatment often is not possible; therefore, the question of whether infection by decay fungi is present during storage is an important one to plant operators. If already present, longer storage may lead either to rejection

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[5] Color tests for Differentiating Heartwood and Sapwood of Certain Oaks, Pines, and Douglas-fir. U. S. Forest Products Laboratory Tech. Note 253, June, 1954.

[6] Mangenot, F. - Acidite Ionique et Populations Fongiques Des Bois. Rev. Gen. Bot. 61:721, p.p. 133-153, 1954.

of stock for treatment or to adverse effects on the performance of the treated product. Therefore, a simple indicator that reveals infection earlier than any other known method should be a useful tool.

The present tests indicate that Alizarine Red S provides a simple method of detecting the early stages of infection by Peniophora that often are overlooked in stored southern pine round stock. The presence of small areas of infection as disclosed by the indicator does not necessarily mean that the wood has been seriously damaged. However, the fact that a decay-producing fungus is present indicates that holding the stock much longer before treatment would be dangerous. Therefore, the use of the indicator should help plant operators to guard against losses due to excessive decay in stock to be treated. Furthermore, it should aid in insuring more uniform preservative treatment and longer service life from some types of treated products.

Decay caused by Peniophora is also a problem in the storage of southern pine pulpwood. Losses in specific gravity and pulp yields due to decay may reach 10 percent in rough pulpwood that has been stored 6 months. The detection of such decay at its inception should help to determine safe storage periods for given batches of pulpwood and whether excessive storage has taken place prior to arrival of the pulpwood at the mill.

A few exploratory trials on other woods indicated that Alizarine Red S cannot be used successfully to distinguish between all types of infected and sound wood. The chances of developing such a general indicator seem slight, because woods vary in pH, and decay fungi also differ in the extent to which they increase acidity of wood[6]. However, certain indicators, including Alizarine Red S, could easily prove helpful in other specific problems of detecting infection by decay fungi in early stages. Such possibilities have not been explored sufficiently, probably because too much emphasis has been placed on indicators of general value.

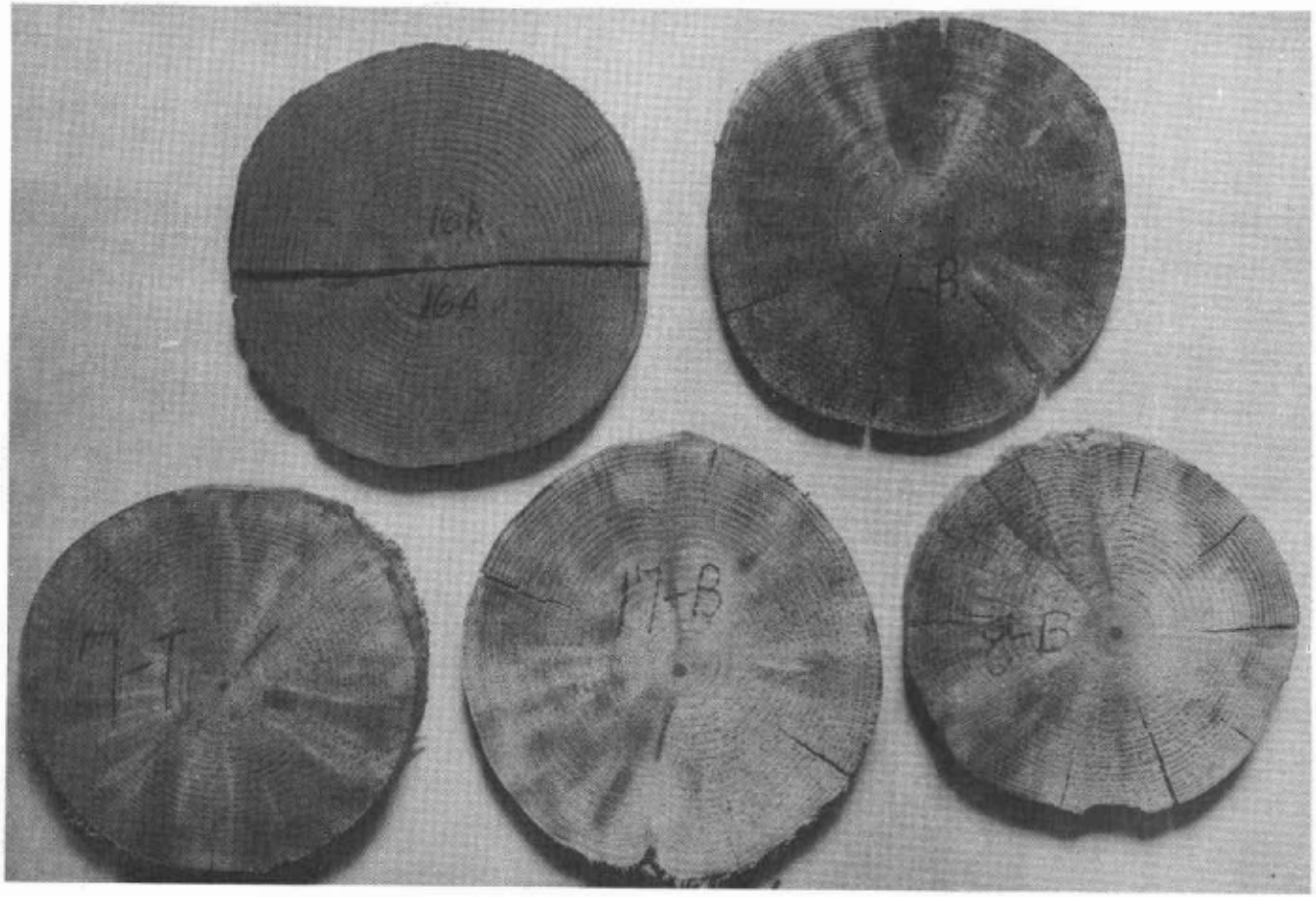

Figure 1.--Pole sections with varying amounts of infection by Peniophora (light-colored areas) disclosed by spraying end surfaces with Alizarine Red Solution. Section 16A was cut from freshly felled sound wood; the remaining sections were taken from pole material stored for from 6 weeks (1-B) to 13 weeks (8-B).

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