LABORATORY EVALUATION OF PRESERVATIVE TREATED RUBBERWOOD AGAINST FUNGI*

M. Balasundaran & R. Gnanaharan

Division of Pathology and Wood Science, Kerala Forest Research Institute, Peechi 680653, Kerala, India

Received March 1990

BALASUNDARAN, M. & GNANAHARAN, R. 1990. Laboratory evaluation of preservative treated rubberwood against fungi. Rubberwood treated with two preservatives, namely Boric acid-Borax (BB) and BB+Sodium pentachlorophenoxide (NaPCP), by diffusion process, was tested for durability against *Ganoderma applanatum* and *Lenzites palisotii*, two white rot fungi using accelerated laboratory test. Both the treatments provided high resistance against the fungi. The sapstain fungi grown over the treated specimens during diffusion storage were identified as *Botryodiplodia theobromae, Fusarium decemcellulare, Aspergillus sydowii* and *Penicillium citrinum.*

Key words: Rubberwood - durability - preservatives - sapstain - mould

Introduction

Although rubberwood is suitable for furniture, panel products, *et cetera*, its susceptibility to fungal and insect attack limits its wider use. However, diffusion treatment of rubberwood using boric acid-borax (BB) and sodium pentachlorophenoxide (NaPCP) was found to impart resistance against insect and termite attack (Gnanaharan *et al.* 1983, Varma & Gnanaharan 1989). Gnanaharan (1984) evaluated the effectiveness of (i) BB, (ii) BB+NaPCP and (iii) BB+ 'Akzo' ES 255, an alkyl ammonium compound, against mould and sapstain fungi during diffusion storage and found that BB+NaPCP was the most effective combination against mould (92%) and sapstain (98%). BB alone gave only 2% control against mould and 97% against sapstain. In the present study, rubberwood subjected to diffusion treatment with the two preservative combinations, namely BB and BB+NaPCP was tested for durability against two white rot fungi. Also, the surface moulds and sapstain fungi growing over treated specimens during diffusion storage were identified.

Materials and methods

Preservative treatment

Freshly sawn rubberwood pieces of size 2.5 × 2.5 × 30 *cm* were treated with (i) 10% boric acid equivalent (BAE) solution, and (ii) 10% BAE solution supplemented with 0.5% sodium pentachlorophenoxide by immersing for

* *KFRI Scientific Paper Number 201*

40 *min* (Gnanaharan 1982). After draining the solution, the treated samples were kept in polythene bags for four weeks for diffusion to proceed. The test specimens were then air-dried to a moisture content of about 12 to 15%. The treated samples had a dry salt retention of 3.0 $kg\ m^3$.

Durability

The procedure outlined in ASTM (1981) for Accelerated Laboratory Test was suitably modified to evaluate the resistance of preservative-treated rubberwood against the two decay fungi. The test was continued till the *Bombax ceiba* reference blocks attained 60% weight loss.

In Malaysia, Ali *et al.* (1980) found that *Ganoderma applanatum* and *Lenzites palisotii* could be suitable fungi as test organisms for evaluating preservatives on rubberwood as these fungi were shown to cause high degree of degradation in rubberwood. Hence these two fungi were used for durability test.

Preweighed wood pieces of 2.5 × 2.5 × 1.0 *cm* size, taken from the preservative treated wood pieces were steam sterilised and then inoculated with the two white rot fungi, namely *G. applanatum* and *L. palisotii.* The inoculated wood pieces were incubated asceptically over moist, sterilised soil taken in a closed bottle. Simultaneously, wood pieces of *B. ceiba* inoculated with the same fungi were also incubated in another set of bottles as reference blocks. The percentage weight loss of test blocks was assessed when 60% weight loss occurred in reference blocks. According to Bakshi *et al.* (1967) and ASTM (1981), if the weight loss of test blocks is less than 10%, such timbers are considered highly resistant against the particular decay fungus. If the weight loss is between 10 and 25%, it is resistant wood; between 25 and 45%, it is moderately resistant and above 45%, non-resistant.

Mould and sapstain

The mould and sapstain fungi growing on treated rubberwood during diffusion storage were isolated and identified at the Commonwealth Agriculture Bureau International Mycological Institute, London.

Results and discussion

Durability

Evaluation of natural durability of untreated rubberwood in Kerala Forest Research Institute using *Gloeophyllum trabeum* and *Polyporous versicolor,* a brown rot and white rot fungus respectively, had shown that it was not resistant against these decay fungi, the weight loss being more than 50% (M. Balasundaran & R. Gnanaharan unpublished). Hence rubberwood has to be treated with preservatives to make it durable.

The average weight loss of treated wood caused by the two white rot fungi in both the treatments was much less than 10% (Table 1). This indicated that rubberwood became highly resistant against both the white rot fungi after treatment with Boric acid-Borax or Boric acid-borax and NaPCP. There is no significant difference between the effectiveness of the treatments against both the fungi. This is expected because boric acid-borax preservative itself is highly toxic to decay fungi. This shows that BB, without the addition of NaPCP, is adequate for protecting rubberwood against decay fungi.

Table 1. Weight loss in test blocks of rubberwood

Fungus	Mean weight loss (%)		Weeks taken to attain 60% weight loss in reference blocks
	Treatment		
	BB	BB+NaPCP	
Ganoderma applanatum	1.24[a]	2.25[a]	23
Lenzites palisotii	2.87[a]	1.60[a]	13

[a] Figures superscribed by the same letters are not significantly different at $p = 0.05$ level

Mould and sapstain

Gnanaharan (1984) evaluated the effectiveness of BB and BB+NaPCP against mould and sapstain growing on rubberwood during diffusion storage. However, the species of fungi involved were not isolated. In the present study, the fungi were isolated and identified up to species level.

The most common fungi growing over the BB treated (98% of the surface area affected) and BB+NaPCP treated (8% of the surface area affected) samples were *Botryodiplodia theobromae* Pat., *Fusarium decemcellulare* Brick (IMI No. 292622), *Aspergillus terreus* Thom (IMI No. 292623), *Aspergillus sydowii* (Bainier & Sartory) Thom & Church (IMI No. 292624) and *Penicillium citrinum* Thom (IMI No. 292625). Except *A. terreus*, other fungi caused stain. *F. decemcellulare* produced a slightly reddish stain while others produced light blue to black colouration on the specimens. It is reported that *F. decemcellulare* produced rose pigmentation in culture medium also (Booth 1971), while *A. sydowii* imparted bluish green and *P. citrinum*, bright yellow colouration to the medium. *B. theobromae* is a blue stain causing fungus of wide occurrence (Kaarik 1980). Ali *et al.* (1980) also tested eleven antifungal chemicals against *B. theobromae*, *Aspergillus* sp. and *Penicillium* sp. and found that only NaPCP gave cost effective control against blue stain fungi.

A study carried out in Kerala Forest Research Institute has shown that *B. theobromae* causing blue stain is the most common sapstain fungi growing on rubberwood (E.J. Maria Florence, personal communication). If the natural pleasing colour is to be retained for furniture grade rubberwood, it should be stain free. Though boric acid-borax alone will give protection against decay fungi, addition of NaPCP will be required to give protection against sapstain fungi, especially *B. theobromae,* during diffusion storage. Also, earlier studies had indicated that BB+NaPCP combination is more efficient in protection against *Sinoxylon anale,* the insect borer which causes serious economic loss in rubberwood (Gnanaharan *et al.* 1983), and against termites (Varma & Gnanaharan 1989). So, addition of NaPCP to BB is still the ideal combination for protecting rubberwood against biodeterioration.

References

ALI SUJAN, TAN, A.G. & STEVENS, M. 1980. Some studies on fungal deterioration of rubberwood (*Hevea brasiliensis*). *International Research Group on Wood Preservation, Document No: IRG/WP/2140.* 5 pp.

ASTM. 1981. Standard method of accelerated laboratory test of natural decay resistance of wood. ASTM D 2017-71 (Reapproved 1978). Pp. 639-645 in *Annual Book of American Society for Testing and Materials Standards, Part 22.* Philadelphia.

BAKSHI, B.K., PURI, Y.N. & KHAN, S.N. 1967. Accelerated laboratory investigation on durability of wood. *Final Technical Report.* Forest Research Institute and Colleges, Dehra Dun. 57 pp.

BOOTH, C. 1971. *The genus Fusarium.* Commonwealth Mycological Institute, Kew, England. 237 pp.

DOMSCH, K.H., GAMS, W. & ANDERSON, T. 1980. *Compendium of soil fungi Volume 1.* Academic Press, London. 859 pp.

GNANAHARAN, R. 1982. A simplified boron diffusion treatment for rubberwood. *International Journal of Wood Preservation* 2: 169-172.

GNANAHARAN, R. 1984. Evaluation of an alkyl ammonium compound as a fungicide to control sapstain and mould during diffusion storage. *International Research Group on Wood Preservation, Document Number IRG/WP/3282.* 4 pp.

GNANAHARAN, R., GEORGE MATHEW & DHAMODARAN, T.K. 1983. Protection of rubber wood against the insect borer *Sinoxylon anale* (Coleoptera: Bostrychidae). *Journal of the Indian Academy of Wood Science* 14: 9-11.

KAARIK, A. 1980. *Fungi causing sapstain in wood. Document Number IRG/WP/199.* The Swedish University of Agriculture Sciences, Department of Forest Products. 112 pp.

VARMA, R.V. & GNANAHARAN, R. 1989. Field evaluation of preservative treated rubber wood (*Hevea brasiliensis*) against subterranean termites. *Material und Organismen* 24: 287-290.