Journal of Tropical Forest Science 1(1) : 51 – 55.

DECAY RESISTANCE OF EXTRACTIVES FROM CHENGAL *(NEOBALANOCARPUS HEIMII)*

K. Yamamoto

Forestry & Forest Products Research Institute, Tsukuba, Japan.

L. T. Hong

Forest Research Institute Malaysia, Kepong, 52109 Kuala Lumpur, Malaysia.

Received March 1988, accepted August 1988.

YAMAMOTO, K. & HONG, L.T. 1988. **Decay resistance of extractives from chengal *(Neobalanocarpus heimii)*.** Neobalanocarpus heimii a durable timber of Peninsular Malaysia was found to contain hot-water and methanol extractives after 12 *h*. of extraction. Impregnation of these extractives into rubberwood conferred a certain degree of resistance to the fungus *Coriolus versicolor,* while chengal wood blocks extracted with water or methanol retained its resistance to the same fungus.

Key words: Chengal – *Coriolus versicolor* – decay – extractives.

Introduction

Copper-Chrome-Arsenic (CCA) has been widely used for protection of wood against decay fungi and insects. However, the disposal of CCA wastes and CCA treated wood materials after use are posing problems: burning of wood containing arsenic compounds would release small amounts of arsenic into the atmosphere (Woolson 1986) which is against pollution control regulations.

Non-toxic methods of preserving timbers are being pursued by various workers, example acethylation of the wood itself (Goldstein *et al.* 1961) or the removal of thiamin groups from the wood (Gjovik & Baechler 1968). Other natural organic compounds with low mammalian toxicity are also being investigated. Among these are extractives from tropical timbers having anti-fungal properties (Reis 1972, Takahashi & Kishima 1973, and Hong & Abdul Razak 1983). The timber chengal (*Neobalanocarpus heimii*) has high natural durability (Mohd. Dahlan & Tam 1985) and has high extractive content. In this study, the timber and the extractives were tested against a decay fungus, *Coriolus versicolor.*

Materials and methods

Extractions

Cold water extractions were carried out at room temperature (25°*C*) using four pieces each of air-dry chengal of dimensions 20 x 20 x 5 *mm* for 24, 48 and 192 *h*. The four pieces of air-dry chengal varied in weight by about 3%. Hot water extractions at 104°*C* in an autoclave and methanol extractions using a soxhlet extraction set up (Yamamoto & Hong, unpublished) were similarly carried out for 3, 6 and 12 *h* each.

Impregnation

All extractives were concentrated to 30 *ml* and impregnated separately into rubberwood test samples by vacuum (20 *mm* Hg) for 1 *h*. After impregnation, samples were removed and weighed to determine amounts of extractives absorbed.

Decay test

The four replicates each of the treated rubberwood samples were subjected to decay by the white-rot fungus, *C. versicolor* for 12 weeks according to a modified sand-jar test method of JIS Z2119 (Anonymous 1977). Sand obtained from the nursery at Kepong was washed with water until the wash was clear. The sand weighed 175 *g*/100 *ml*, a pH of 5.98 and 25% water-holding capacity. Glass jars (300 *ml* capacity) were filled with 100 *ml* sand, and about 30 *ml* of culture fluid containing 5% glucose, 1.5% malt extract and 0.3% peptone. The surface of the sand was then covered with a filter paper to serve as fungal feeder strip. The methods of sterilisation, inoculation and incubation are described elsewhere (Yamamoto & Hong, unpublished).

Results and discussion

The amount of extractives obtained by using cold water, hot water and methanol extractions are shown in Table 1. Extractives from wood blocks were lower than those obtained from sawdust. The cold water extractives from blocks were low while the methanol extractives were higher. But those obtained by the latter example after 6 *h* of extraction were only half of those extracted similarly from sawdust.

After exposure to *C. versicolor*, extracted chengal did not suffer any weight loss except for the methanol extracted samples, whereas extractive-impregnated rubberwood lost a portion of its original weight (Table 2). This suggests that the anti-fungal components of chengal are not soluble in water and are only slightly soluble in methanol. Chengal blocks extracted with methanol for 12 *h* showed a slight weight loss of 9%. Kondo and Imamura (1986) also found that methanol extracted hinoki (*Chamaecyparis obtusa*) heartwood blocks were rapidly decayed by the fungi *Tyromyces palustris* and *C. versicolor*. Takahashi and Kishima (1973) found that extractive rich tropical timbers were more resistant to *C. versicolor* and *Chaetomium globossum*. Their study also showed that chengal blocks extracted for eight *h* with methanol suffered 6.75% weight loss caused by *C. versicolor*, while the value for control samples was only 0.78%.

Table 1. Extractives from chengal wood blocks and sawdusts

Extractive	Extraction time *(h)*	Percent extractive from	
		Block	Sawdust
Cold water	24	1.8	–
	48	2.0	20.8*
	192	3.6	–
Hot water	3	5.9	23.0
	6	7.9	–
	12	10.7	–
Methanol	3	10.9	–
	6	15.0	32.6
	12	23.4	–

* values from Yamamoto & Hong (unpublished)

Table 2. Weight loss caused by infection of *Coriolus versicolor* on extracted chengal samples and rubberwood impregnated with chengal extractives

Extracted with	Extraction Time *(h)*	Mean Weight loss (%)		Antifungal** index
		Extracted chengal	Rubberwood	
Control	0	0	53 (0) *	–
Cold water	24	0	54 (0.3)	0
	48	0	54 (0.5)	0
	192	0	49 (0.7)	6
Hot water	3	0	32 (1.5)	39
	6	0	30 (1.9)	43
	12	0	18 (2.4)	66
Methanol	3	0	40 (1.9)	24
	6	2	32 (3.0)	40
	12	9	13 (5.4)	75

* % retention by weight of extractives in sample.

** calculated by using $1 - \frac{\text{sample weight loss \%}}{\text{control weight loss \%}} \times 100$

Rubberwood impregnated with hot water and methanol extractives had gradual decrease in weight loss as the retention of extractives increased (Table 2). Control samples of rubberwood suffered 53% weight loss. The degree of resistance calculated as an anti-fungal index was highest (75) for impregnated blocks containing 5.4% of methanol extractives (Table 2). The decrease in weight loss in the impregnated samples could also be partially attributed to the removal (during impregnation) of soluble substances which would enhance fungal growth. This phenomenon has been observed by Hong (1982) for rubberwood subjected to decay by four different fungi. Hot water extractives appeared to confer a slightly higher resistance than methanol extractives per unit percent retention in the test samples against *C. versicolor* (Figure 1). Cold water extracts appeared to have no effect and gave similar weight loss values as the control samples (Table 2). The highest amount of cold water extractives obtained was 3.6% and the highest retention of cold water extractive-impregnated rubberwood blocks was 0.7% when compared to values of more than 1.5% for the other two extractions (Table 2). It appeared that retentions of greater than 1.5% of chengal extractives would have an inhibitory effect on *C. versicolor*. Aqueous wood extractives have been known to contain mainly polyphenols which have fungal inhibitory properties (Hart and Hillis 1972).

Conclusions

This study shows that water and methanol soluble extractives from chengal wood have some anti-fungal properties which could be exploited for use as wood preservatives. However, much work is still needed to determine which fraction or compound confers the highest decay resistance and whether it is feasible to synthesize such compounds in commercial quantities at reasonable costs.

References

ANONYMOUS. 1977. Method of test for decay of wood. JIS Z2119-1963. *Japanese Standards Association*.

GJOVIK, L.R. & BAECHLER, R.H. 1968. Field tests on wood dethiaminized for protection against decay. *Forest Products Journal* 18 : 25 – 27.

GOLDSTEIN, I.S., JEROSKI, E.B., LUND, A.E., NIELSON, J.F. & WEAVER, J.W. 1961. Acetylation of Wood in Lumber. *Forest Products Journal* 11 : 363 – 370.

HART, J.H. & HILLIS, W.E. 1972. Inhibition of wood-rotting fungal by ellagitannins in the heratwood of *Quercus alba*. *Phytopathology* 62 : 620 – 626.

HONG, L.T. 1982. The decay of tropical hardwoods II. Mass loss and degradation of cell-wall components of *Hevea brasiliensis* caused by *Ganoderma applanatum*. *Poris* sp., *Schizophyllum commune* and *Trametes corrugata*. *Malaysian Forester* 45 : 124 – 126.

HONG, L.T. 1982. The decay of tropical hardwoods II. Mass loss and degradation of cell-wall components of *Hevea brasiliensis* caused by *Ganoderma applanatum*, *Poria so.*, *Schizophyllum commune and Trametes corrugata*, *Malaysian Forester* 45 : 124 – 126.

HONG, L.T. & ABDUL RAZAK MOHD ALI. 1983. Anti-fungal properties of methanol extractives from some tropical hardwoods. *Malaysian Forester* 46 : 138 – 140.

KONDO, R. & IMAMURA, H. 1986. Antifungal components in heartwood extractives of Hinoki *(Chamaecyparis obtusa* Endl.). *Juumal of Japan Wood Research Society* 32 : 213 – 217.

MOHD. DAHLAN JANTAN & TAM, M.K. 1985. Natural durability of some Malaysian Timebrs by stake tests. *Malaysian Forester* 48 : 154 – 159.

REIS, M.S. 1972. Decay resistance of six wood species from the Amazon basin of Brazil. *Phytopathology* 62 : 784.

TAKAHASHI, M. & KISHIMA, T. 1973. Decay resistance of 65 South East Asian timber specimens in accelerated laboratory tests. *Tonan Ajia Kenkyu* 10 : 524 – 541.

WOOLSON, E.A. 1986. Burning cacodylic acid-treated oak trees : how safe? *Forest Products Journal* 36 : 49 – 52.

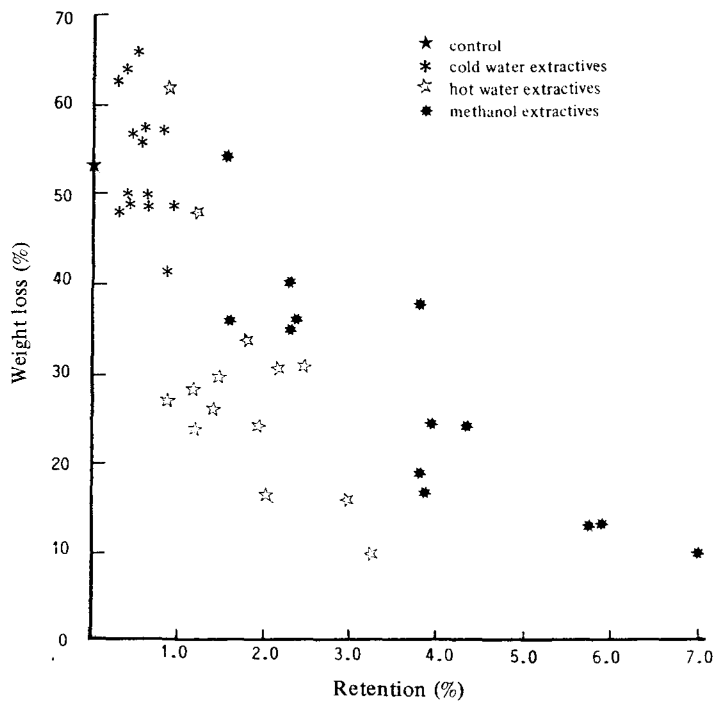

Figure 1. The relationship between retention of extractives and weight loss of rubberwood impregnated with chengal extractives subjected to decay by *Coriolus versicolor.*