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Resistance of Engine Oil Treated Wood to Termite Attack.

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Abstract

Wood samples of *Ceiba pentandra, Antiaris toxicaria* and *Triplochiton scleroxylon* were treated with new and spent engine oils using three treatments methods; brushing, soaking for 24 hours and soaking for 48 hours. The treated wood samples and control were exposed to Termite attack for 16 weeks using graveyard method. Visual assessment and percentage weight loss were employed to evaluate the effectiveness of the preservative engine oil. Data collected were subjected to analysis of variance (ANOVA) at 0.05 probability level. The average weight loss for Ceiba pentandra, *Antiaris toxicaria* and *Triplochiton scleroxylon* ranged between 0.64-1.94%, 0.48-1.47% and 0.38-1.32% respectively. Wood samples treated using brush recorded highest weight loss for the three species and the two types of engine oil. Results of the statistical analysis ($p < 0.05$) showed that only the method of preservative application has significant effect on the weight loss per treatment combination while the type of engine oil spent and wood species are not statistically different. Prolonged soaking of wood in spent engine oil however gave a better result compared to new engine oil. Thus spent engine oil has potentials for wood preservation.

Key words: termite attack, preservatives, engine oil, wood

Introduction

Natural durability of many tropical wood species offers to a certain extent a degree of resistance to agents of deterioration but no wood can be used in all applications advantageously without eventual breakdown. For wood to perform well and stand the test of time during the service life, there is need to involve the addition of substance which may be toxic into wood so as to improve its resistance to agents of degradation which may be biological or environmental through a process known as wood preservation.

Wood preservation technique is an established practice which is done to prevent wood deterioration and extend the service life of the treated wood and at the same time promote efficient utilization of this tangible forest resource. Among the various methods of wood preservation adopted in the past were complete immersion of wood in salty water and covering of piles and other timbers for bridges with olive oils to prevent wood decay. (Richardson, 1978; Zabel and Morrell, 1993)

The evolutionary trend of wood preservation has led to the development of various wood preservatives and preservation methods. The efficiency of the treated wood depends largely on the toxicity, absorption, retention and depth of penetration of the preservatives which are influenced by wood anatomy, application methods and viscosity of the preservatives. (Ifebueme 1985, FAO 1986, Lebow and Morrell 1989, Adetogun 1998, Omole and Onilude 2000).

It has been established that there is no universal preservative suitable for use on every kind of wood in every sort of situation. For any particular purpose, the choice has always been limited and at times there could be only one preservative suitable for a particular job. In making choice of preservative to be used, care must be taken as to any special requirement imposed by the situation the treated wood will face in its service life.

In the present study, an effort has been made to show a grave yard comparative testing of new and spent engine oil as preservative against damage caused by termites on wood samples of *Ceiba pentandra, Antiaris toxicaria* and *Triplochiton scleroxylon* K. Schum. The end results were to show the effectiveness of engine oil as wood preservative against biodegradation. Such a development could lead to better techniques of wood preservative, which could effectively promote utilization of more of the country's forest resources for commercial purposes and also to serve as a strategy to beat the hardship being experienced by the economic meltdown by using materials that could be sourced locally for treating wood (Adetogun *et al*, 2009).

Materials and Method

The study was carried in an active termitarium found within the teak plantation in University of Ibadan, South west Nigeria.

Sample Preparation and Treatment of test Blocks: Planks of good quality and straight grained stock of Triplochiton Scleroxylon, Antiaris toxicaria and Ceiba pentandra were procured for a local plank market in Ibadan Nigeria. 140 sticks of an appropriate cross section (600mm) were obtained from each plank side matching them to ensure that the same group of growth ring is common to each side. The sticks were then planed accurately and test block prepared in accordance with modified EN 252:1989 standard to 500x50 x25mm cross section. Four hundred and twenty (420) test blocks were prepared for the three species of wood. The test blocks so prepared were then air dried to 12% moisture content. Each block was separately weighed and the weight obtained for each sample was taken as initial dry weight (Dw1). One hundred and twenty (120) test blocks were treated with spent engine oil and new engine oil (SAE 40) per species. Three preservative methods were employed; brushing, soaking for 24 hours and soaking for 48 hours. Twenty untreated test blocks served as control for each species. The treated test blocks were conditioned under room temperature for one month and weighed before incubation in the grave yard. The weight obtained was taken as the initial dry weight of treated samples (Dw2).

Grave yard test: The treated and untreated test blocks were buried within the active regions of the termitarium and left for 16 weeks in the grave yard. Weekly inspections were carried out to assess the effect of termites on the test blocks. At the end of the incubation period, the test blocks were evacuated from the grave yard. All adhering substances were carefully removed. The excavated test blocks then air dried under room temperature for three days. The weight obtained was taken as final dry weight of treated samples (Dw3). Two criteria were used to evaluate the efficacy of the preservatives against termite attack: Visual method and percentage weight loss. The extent of termite tunneling was scored in accordance with EN 252: 1989 as stated below.

Rating	Description of attack
0	No attack
1	Slight attack
2	Moderate attack
3	Severe attack
4	Failure (test blocks crumbled)

The percentage weight loss was determined using the relation;

$$\% \text{ Weight loss} = \frac{Dw2-Dw3}{Dw2} \times \frac{100}{1}$$

Source; Adetogun 1998

Statistical analysis

The data collected were subjected to Analysis of Variance (ANOVA) procedure for factorial experiments in a Completely Randomized Design.

Results and Discussion

Visual assessment rating of the treated and untreated test blocks exposed to termite attack after 16 weeks of incubation is presented in Table 1. The weight loss of test samples of *Ceiba pentandra Antiaris toxicaria* and *Triplochiton scleroxylon* after 16 weeks of exposure to termite attack is presented in Figures 1, 2 and 3 respectively. The statistical analysis of the results is presented on Table 3.

Table 1: Visual assessment rating of the treated and untreated test blocks exposed to termite attack after 16 weeks of incubation.

Species	Control	Spent Engine Oil	New Engine Oil
Ceiba pentandra	4	0	0
Antiaris toxicaria	4	0	0
Triplochiton scleroxylon	4	0	0

Table 2: Analysis of variance for comparing weight of test blocks exposed to termite attack after 16 weeks of incubation.

Source of Variation	D.F	SS	MS	F
Species	2	0.05	0.03	2.08*
Method (M)	2	9.37	4.69	390.83*
Preservative (P)	1	0.03	0.03	2.5^{ns}
MP	2	0.06	0.03	2.5*
Error	10	0.12	0.012	
Total	17	9.65		

*= significant at 0.05 level of significance
ns= not significant at 0.05 level of significance

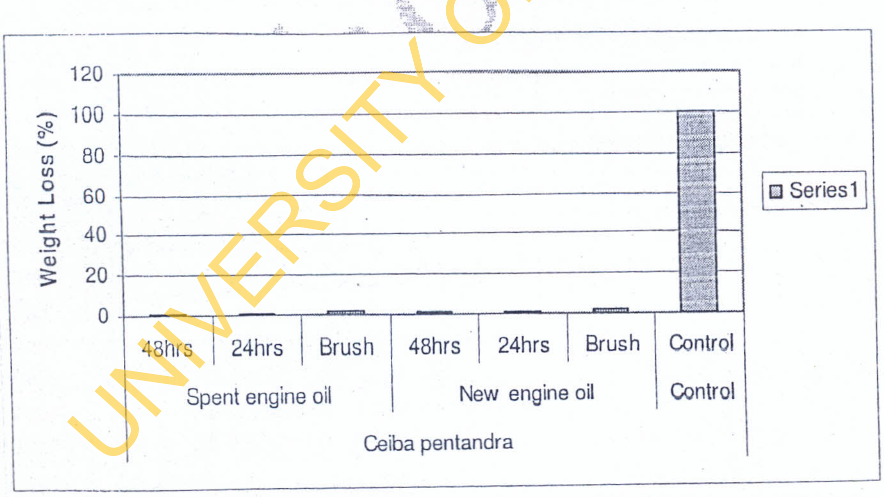

Figure 3: Loss in weight of *C. pentandra* test blocks exposed to termite attack after 16 weeks of incubation

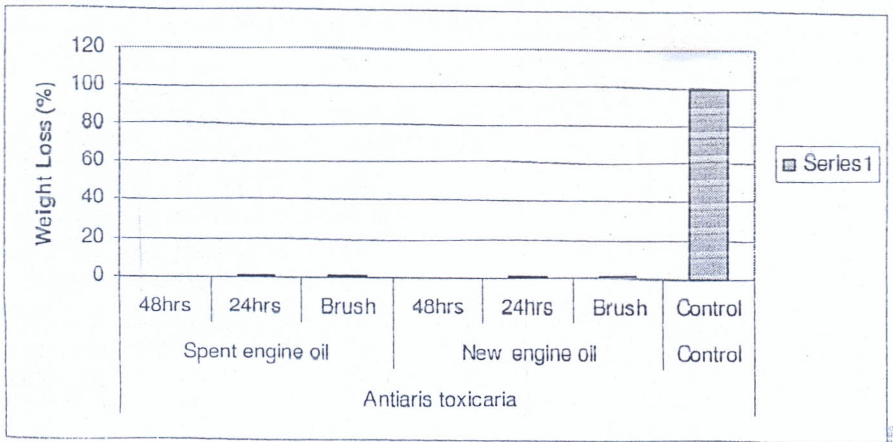

Figure 3: Loss in weight of *A. toxicaria* test blocks exposed to termite attack after 16 weeks of incubation

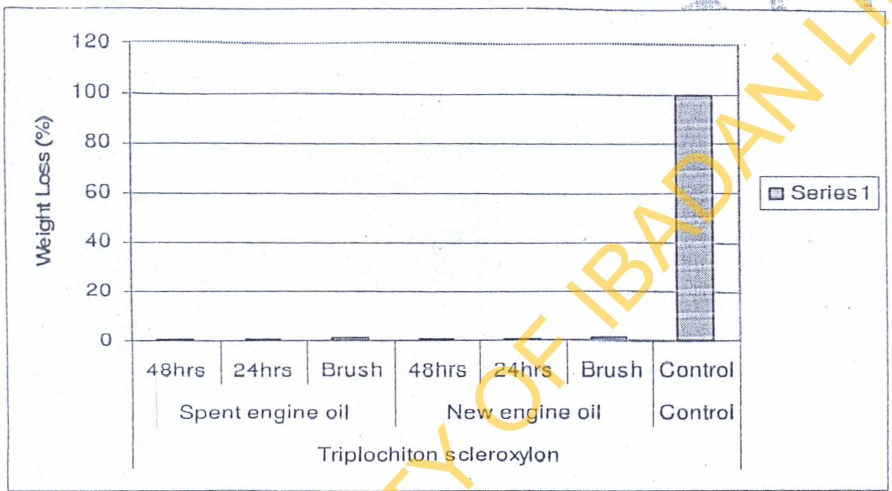

Figure 3: Loss in weight of *T. scleroxylon* test blocks exposed to termite attack after 16 weeks of incubation

The highest weight loss of 1.94 and 1.89 percent were recorded from *Ceiba pentandra* samples treated with new and spent engine oil respectively using brush as against the least of 0.38 and 0.44 percent recorded for *Triplochiton scleroxylon* samples soaked for 48hrs in used and new engine oil respectively.

On the other hand, the control samples were seen to have recorded a loss of 100 percent for Ceiba, 99.5 percent for Antiaris and 98.9 percent for Triplochiton samples. Thus it could be inferred that treatment of wood samples with engine oil (spent and new) greatly reduced the attack of termite on the wood samples reducing wood loss from about 100 percent to almost zero percent. Critical observation of the Table showed that methods of preservative application influenced the percentage weight loss after grave yard test. This could be attributed to the fact that highly penetrated samples soaked for 24 and 48hrs serve as inhibitor to biodeteriorating agents and the attack on the wood by the termites. This argument is in line with the report of Znot *et al* (1988) that high penetration of anti-oxidants into wood protects wood from biological destruction. The anti-oxidants act as inhibitor to aerobic respiration of microorganism thus preventing protein synthesis and wood decay.

The result of statistical analysis (Table 3) showed that methods of preservative application had significantly different effect with respect to weight loss of samples after the test period. The type of engine oil and the wood species are not significantly different. However highly penetrated samples exhibited better resistance than those that are mildly penetrated.

Allowing the control samples to last the 45 days test period resulted in total destruction of all the control test samples. All the treated samples of the 3 wood species were not attacked by termites during test period. From technical reports and literature, various factors could have contributed to the inability of the termites to attack the treated wood among which are the other elemental components of the lubricating oil such as sulphur, calcium, Zinc, and Magnesium. These elemental components of the engine oil could have given the treated samples additional resistance against termite attack. The sulphur odour for example might have repelled the insect while at the same time the metallic debris components in the spent oil may equally impart certain degree of resistance to the treated wood samples. According to Hunt (1979), used engine oil contains some metallic wear debris and asphaltic materials which could have been responsible for the used engine oil performing better than the new engine oil despite the difference in the absorption per unit volume.

Conclusions

Within the limit of the data collected in this study, it is therefore concluded as follows:

(i) Engine oil treated wood samples were resistant to termite attack while the control samples were completely destroyed using (grave yard test)

(ii) Loss in weight decreased with increasing depth of penetration of the preservation engine oil

(iii) Both spent and new engine oil compared favourably well in terms of performance but spent engine oil gave a better performance and may be used to protect wood against termite attack.

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