Bio Preservative Potential of *Ocimum Basilicum* L. Leaf Extract on *Triplochiton Scleroxylon* (K. Schum) and *Ceiba Pentandra* (L.) Gaertn. Wood Against Termite Attack

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Abstract

It has been reported that biopreservatives are toxic free and environmental friendly. Thus, this research paper gives account of preservative potential of Ocimum basilicum leaf extract against termite attack on Triplochiton scleroxylon and Ceiba pentandra wood. The wood sample were dimensioned by 5×5×30cm while the leaf extract was extracted using ethanol and diluted with kerosene at varying concentration ratio viz; 0:100, 25:75, 50:50, 75:25, and 100:0 %. The dimensioned wood samples were soaked for 72 hours with the prepared leaf extract hence preservative absorption rate and percentage weight loss of wood after exposure to termite were determined. Data obtained were subjected to analysis of variance at α0.05. The highest and lowest rate of absorption of the preservative was noticed with C. pentandra and T. scleroxylon having 94.48 kg/m and 38.49 kg/m respectively. The result obtained on percentage weight loss of wood samples shows that 100 % concentration of O. basilicum leaf extract had the best performance for both C. pentandra and T. scleroxylon with the lowest weight loss of 7.95 and 4.32 % respectively. Untreated wood samples of T. scleroxylon and C. pentandra recorded the highest weight loss 31.23 and 19.53 %. The result obtained show that O. basilicum leaf extract is most effective in reducing the biodegradation of T. scleroxylon and C. pentandra wood at 100 % concentration level.

Keywords: Leaf Extract Biopreservatives, Biodegradation, Absorption Rate, Weight Loss

Introduction

Wood as a material is prone to damage by bio deteriorating agents and need preservation. The restriction of certain wood preservative containing heavy metals such as CCA in some European countries, Japan, USA and Africa and the environmental concerns about broad spectrum biocides been given a serious consideration and this has lead to development environmentally friendly wood preservatives. This interest has been focused on some wood preservatives that have minimal toxicity to mammals and the environment.

A recent study shows few innovations that have been developed to use natural products to treat wood against insect and fungal attack. This has pronounced several advantages of using plant extracts as preservatives to enhance the service life of wood. Arango *et al.* 2005 reported that plant extracts are safe, non harmful to man, but still effective against plant pathogens.

Traditionally, basil has been extensively utilized in food as a flavouring agent, and in perfumery and medical industries (Telci *et al.* 2006). The leaves and flowering tops of the plant are perceived as carminative, galactogogue, stomachic and antispasmodic on folk medicine (Sajjadi, 2006). However, recently the potential uses of *Ocimum basilicum* essential oil, particularly as antimicrobial and antioxidant agents have also been investigated (Lee *et al.* 2005). The *Ocimum basilicum* essential oils exhibit a wide and varying array of chemical compounds depending on variations in chemotypes, leaf and flower colors, aroma and origin of the plants (Da-silva *et al.* 2003). A study of the essential oil showed antifungal and insect-repelling properties (Maurya *et al.* 2009). The chief constituents include chavicol methyl ether or estragole, linalool and eugenol and the literature has suggested linalool as the main active agent responsible for antimicrobial activity against wide range of Gram negative and Gram-positive bacteria, yeast, fungi and mold (Ravid *et al.* 1997 and Omidbaigi *et al.* 2003).

This study therefore find it necessary to evaluate the potential of *Ocimum basilicum* leaf extract against wood deteriorating agent *with the view to enhance the service life of wood and minimize environmental pollution.*

Materials and Methods

Preparation and dilution of leaf extract

The leaves of *Ocimum basilicum* were collected and blended to fine particles for easy extraction (Mukhtar and Tukur, 2000). 200 g of the *O. basilicum* leaves was weighed in two containers and soaked in 2 lit of ethanol and was left for 96 h after which it was filtered and left to evaporate at room temperature.

The volume method was used and involved 1 ml of *O. basilicum* extract in 99 ml of kerosene (solvent) is equivalent to 1 % dilution. The *O. basilicum* leave extract was used using 5 concentration levels viz; 0, 25, 50, 75, 100 % and solvent 100, 75, 50, 25, 0 to give 0:100, 25:75, 50:50, 75:25, 100:0 % and untreated samples as control.

Wood sample preparation and treatment

The wood samples were dimension into (5×5×30) cm (Makpa, 1988), and labeled. The wood samples were then dried in an oven at 103 ºC for 24 h until moisture content was removed.

Immersion method was used for the treatment of the wood test blocks. This allows wood sample to be completely immersed in cold leaf extract *O. basilicum* for an hour at different concentration level.

Absorption Rate

The rate of absorption of the wood samples when soaked in preservative was calculated based on the difference between the weight before and after soaking (ASTM, 1999).

$$\text{Absorption rate} = \frac{Total\ absorption \times concentration \times 10\ in\ kg/m}{Volume\ of\ wood \times number\ of\ wood\ samples.} \quad (1)$$

Percentage Weight Loss

At the end of the experiment, the remaining wood test blocks were carefully removed cleaned and oven dried and weighed to determine the weight loss of the wood. The percentage weight loss for individual test pieces was determined according to ASTM, 1999.

$$\text{Percentage weight loss} = 100\frac{(W_1 - W_2)}{W_1} \quad (2)$$

Where W_1= Weight after absorption

W_2= Weight after exposure to termite

Data Analysis

Data obtained were subjected to analysis of variance (ANOVA) for significant different that exist between concentration level of *O. basilicum* leaf extract and wood samples used while comparison of means was conducted using Duncan Multiple Range Test (DMRT) to identify which groups were significantly different at $\alpha_{0.05.}$

Results and discussion

Absorption Rate

The absorption rate of *Ceiba petandra* and *Triplochiton scleroxylon* wood in respect to preservative concentration level (0, 25, 50, 75, and 100 %) presented in figure 1. It was clearly indicated that the highest absorption was observed in *C. pentandra* with 94.48 kg/m at 100 % concentration level of *O. basilicum* leaf extract. The analysis of variance conducted (Table 1) shows that absorption of leaf extract differ significantly ($P \leq 0.05$) among the concentration level and also between the wood samples used. This could be attributed to variations in physical and anatomical characteristics of *C. petandra* wood. However, the wood of *C. petandra* is lighter softer in texture, lower in strength and coarser (Gibbs and Semir, 2003).

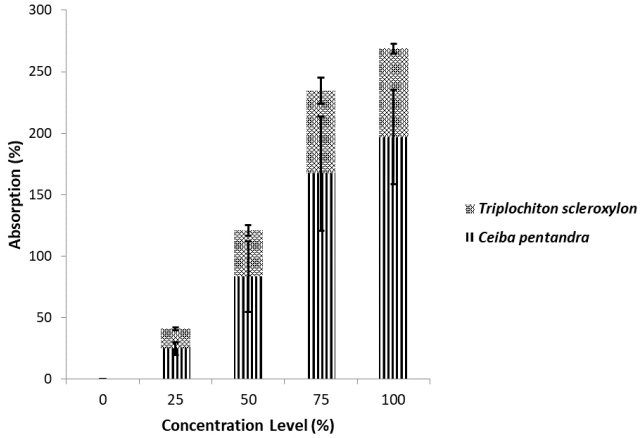

Figure 1: Absorption rate of O. basilicum leaf extract by wood samples

Weight loss (%)

The weight loss due to termite attack was evaluated and the result was presented in Figure 2. The result obtained so far reveals that untreated wood samples (control) of *C. pentandra* and *T. scleroxylon* loss more weight to termite attack with 31.23 and 19.55 % respectively. This is an indication that the level of attack of untreated wood samples by the termite is significantly more than that of the treated samples. With ANOVA conducted (Table 1), there was significant difference in concentration level and species of wood sample used ($P \leq 0.05$). However, the wood samples of *C. pentandra* and *T. scleroxylon* treated with *O. basilicum* leaf extract concentrate at 100 % had the lowest weight loss of 7.95 and 4.39 % respectively. It implies that there was more effectiveness in 100 % concentration of *O. basilicum* leaf extract as against the test wood samples. This can be attributed to some varying array of chemical compounds in the leaf (Da-silva *et al.* 2003).

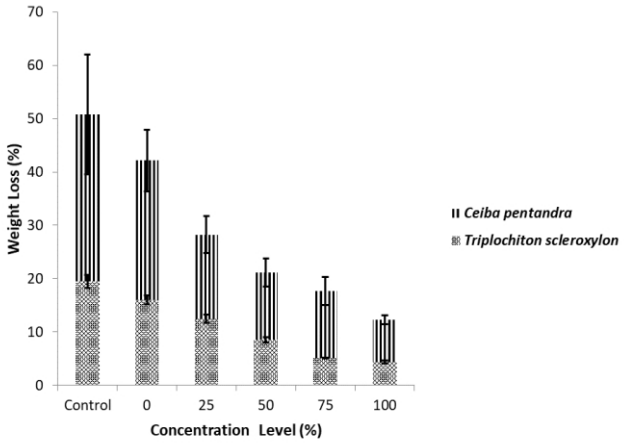

Figure 2: Weight loss of wood samples preserved with O. basilicum leaf extract

Table 1: F-cal for various ANOVA table

Source of Variation	Absorption Rate (kg/m)	Weight Loss (%)
Wood Species (WS)	68.28*	33.83*
Concentration Level (CL)	59.93*	28.04*
WS*CL	13.22*	1.65ns

**significant (P≤0.05); ns-not significant (P>0.05)*

Conclusions

This study showed that *O. basilicum* leaf extract has the potential to resist termite attack as an eco-friendly bio-preservative. It was concluded that at 100 % concentration level of preservation, the bio-preservative is most effective against bio-deteriorating agent. This research has been able to establish that at 100 % concentration level of *O. basilicum* leaf extract is most effective in reducing bio-degradation of *T. scleroxylon* wood than *C. pentandra* wood.

References:

1. Arango., A.R. Green F.I. Hintz K. Lebow P.K. and Miller B.R. (2005) Natural durability of tropical and native woods against termite damage by reticulutermers flavipes. USDA. Forest service. *International Biodetorioration and Biodegradation* **57:** 146-150
2. ASTM (1999). D1413-99 "Standard Test method for wood preservatives by laboratory soil Block cultures". ASTM International, West Conshohocken, PA
3. Da-Silva F. Santos R.H.S Diniz E.R, Barbosa L.C.A. Casali V.W.D. De- Lima R.R. (2003) Content and composition of basil essential oil at two different hours in the day and two seasons. *Braz. J. Med. Plants* **6(1):** 33-38

4. Gibbs P. and Semir, J. (2003) A taxonomy revision of the genus Ceiba Mill. (Bombacaceae). Anales del jardin Botanico da Madrid **60(2):** 259-300
5. Lee C. Vongkaluang C. and Lenz. M. (2007) Challenges to Subterranean Termite Management of Multi-Genera Faunas In Southeast Asia and Australia. *Sociobiology* 50 (1)
6. Makpa D.T. (1988) The effect of wood moisture on the absorption, penetration and retention of water borne wood preservative of two (2) Nigeria grown Hard wood species Pp.118
7. Maurya, Sharma, Preeti; Mohan, Lalit; Batabyal, Lata; Srivastava, C.N. (2009)."Evaluation of the toxicity of different phytoextracts of *Ocimum basilicum* against Anopheles stephensi and Culex quinquefasciatus". Journal of Asia-Pacific Entomology113–115
8. Mukhtar M.D. and Tukur A. (2000) Antibacterial activities of aqueous and ethanolic extract of Pistia stratioles. *Niser J.* **1(1):**51-59
9. Omidbaigi R., Hassani A. and Sefidkon F. (2003). Essential oil content and composition of sweet basil (*Ocimum basilicum*) at different irrigation regimes. *J. Essent. Oil Bearing Plants* **6:** 104-108.
10. Ravid U., Putievsky E. Katzir I. and Lewinsohn E. (1997) Enantiomeric composition of linalool in the essential oils of *Ocimum* species and in commercial basil oils. *Flavour Fragr. J.* **12:** 293-296
11. Sajjadi S.E. (2006) Analysis of the essential oils of two cultivated basil (*Ocimum basilicum* L.) from Iran. Daru, *14(3):* 128-130
12. Telci, I., Bayram E., Yilmaz G, Avci B (2006). Variability in essential oil composition of Turkish basils (*Ocimum basilicum* L.). *Biochem. Syst. Ecol.,* 34: 489-497