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Effect of Heated and Non-Heated Treatment of Cinnamomum porrectum Extract on Rubberwood and Oil-Palm Trunk Veneer against Fungi

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Abstract. Rubberwood veneers and oil palm trunk (OPT) veneers currently widely used as a finishing in the timber industry. Various technique of treatment was used nowadays to maintains the durability of these materials. In this study the susceptibility test of rubberwood veneers and OPT veneers was exposed to wood deteriorating fungi. This study conducted to investigate the effect of heated treatment and non-heated of extractive to the weight of veneers. Two wood rotting fungi (brown-rot and white-rot) were cultured into the veneers being treated with either heated or non-heated *C. porrectum* extract. The result of attacking pattern was observed by light microscope. The weight losses due the exposure were compared. Veneers treated with heated extractives tend to have lowest percentage of weight loss with 20.08% for rubberwood veneer and 39.35% for OPT veneer compare to veneers that treated with non-heated extractive with 23.11% for rubberwood and 39.85%. This study indicates with advent of heat it helps the rate of absorption of extractive into the veneers to control the fungal deterioration on rubberwood veneers and OPT veneers.

INTRODUCTION

Veneer is a sheet of wood made rather than logs [1]. This material is cut from logs and processed in such a way. With this processing, logs become more efficient to use and their use will be more flexible. Some products can be produced further from this material such as parquet, boards to wallpaper. This material is widely used as a coating for interior products such as furniture and some building components. Often the application of this material is intended for offices, hotels and etc. However, definitely the application for household needs can still be used. The furniture industry itself has long used veneers in producing its products. Generally, this material is used to coat wood products with lower aesthetics. Examples are for applications on plywood and medium-density fiber board (MDF).

However, veneers that made from rubberwood wood and oil palm trunk (OPT) are tend to infected by fungi [2]. To overcome this complications, chemical substance was introducing to be used as preservatives. Preservatives that

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was produce from chemical substances are effectively but due to the highly cost and environment and health awareness, new alternatives using natural preservatives that derived from natural plant extract were introduce [3]. In the wood preservation industry, natural plant extracts and tannins are well-known substitutes for intended purposes [4]. To treat non-durable wood species, extractives obtained from naturally durable species may be used.

Cinnamomum porrectum (Medang Kemangi) tree is well known as one of naturally durable species that up to 45 m tall, medium-sized to huge. The bole is smooth, cylindrical and, often buttressed, up to 105 cm in diameter. In lowlands to montane forests, this species generally occurs on fertile and poor soils, typically in well-drained areas. When exposed to the weather or in direct contact with the soil, the wood is moderately robust [5]. Among the medang tribe, *C. porrectum* is ranked as the most durable species [6]. In previous research, the chemicals content from extractives derived from *C. porrectum* tree was proven can be used as preservative [7]. However, there are no laboratory tests that have been conducted on its effectiveness as a wood preservative. Thus, in this research the microscopy observation was conduct on veneer treated by *C. porrectum* extractive to determine its effectiveness.

MATERIALS AND METHODS

Wood Materials

The wood of *C. porrectum* were purchased from local seller from Kota Bahru, Kelantan and were identify its species following the International Tropical Timber Organization (ITTO) description and were confirmed by tree expert from Universiti Malaysia Kelantan. The wood then was air dried in oven with temperature 105 ± 2 °C for 24 hours until it reaches the equilibrium moisture content (EMC). Then the wood was grinding with grinder to turn it into powder-like form. Rubberwood and OPT veneers were purchased from local distributor from Sungai Petani, Kedah were respectively cutting into 1cm × 1cm dimension block [8]. The weight of each veneer block then was recorded

Extraction Process of *C. porrectum* Wood

The 15 gram of *C. porrectum* powder form was weighed and were inserted into thimble. The thimble then inserted into the extraction chamber of Soxhlet extractor. 300 ml of ethanol were used as the extraction solvent in the boiling flask. The extraction was runs for 8 hours and the extractive was cooled down and stored in chiller for further used [9,10].

Treatment of Rubberwood and OPT Veneer

The treatment of veneer blocks was carry on with immersion the blocks into the *C. porrectum* extractive. The extractives were divided into two methods, which are non-heated and heated. Heated treatment where the extractive was heated to 70 ºC and non-heated treatment with room temperature at 27 ºC. Veneers block was immersed for 10 minutes, 30 minutes and 60 minutes to let the extractive permeate in the veneers [11]. Then, veneers were let dry with room temperature for 24 hours.

Antifungal Assay of Rubberwood and OPT Veneer with C. porrectum Extract

The antifungal assay was conducted in Microbiology Laboratory of Universiti Malaysia Kelantan. The treated veneers were exposed two different Basidomycetes fungi according to ASTM D2017 (2005) standard [12]. White rot fungi, *Pycnoporos sanguineus* (*P. san*) and brown rot fungi, *Gloephyllum Trabeum* (*G. tra*) was used in this experiment. Both of fungi were obtained from Forest Reseach Institute Malaysia. The fungi then were cultured into potato dextrose agar (PDA) medium into pre-sterilized petri dish and were kept at 25 ± 2 °C until the media surfaces were completely colonized with fungi. The treated rubberwood and OPT veneer blocks were identifying each of it and were placed into each of colonized petri dish. The untreated veneers blocks were used as control. The veneers then were let exposure with fungi for 16 weeks in the incubator and the surface of veneer was cleaned from mycelium and the veneer was weighed immediately. Percentage of weight loss were calculated from each veneers blocks before and after the antifungal assay. This method was repeated with 3 replications to calculate the percentage weight loss. The percentage loss of weight loss was calculated by using equation 1.

$$\%\, weight\ loss = \frac{\mu W^{1} - \mu W^{2}}{\mu W^{1}} \times 100 \quad (1)$$

Where μW^{1} = Mean of Weight before antifungal assay, μW^{2} = Mean of weight after antifungal assay.

Microscopy Analysis of Veneers

Veneers that through the antifungal assay then was undergoing the microscopy analysis. Microscopic analysis was conducted using the light microscope (Olympus SZX7 stereo microscope). The side of each veneer was chose and marked to be placed under the light microscope and analyze at the magnification ×4.5 at 200μm.

RESULTS AND DISCUSSION

Percentage Weight Loss of Rubberwood and OPT Veneer

The weight loss caused by white rot, *P. san* and brown rot, *G. tra* after 16 weeks of exposure on veneer treated with two different parameters of extractives were given in fig. 1 and Fig. 2. Rubberwood veneers recorded lowest percentage with 20.08% and 23.26% of mass loss when treated for 60 minutes in heated extractives with exposure of *P. san* and *G. tra*. OPT veneers recorded lowest percentage mass loss with 42.01% and 39.35% when treated for 60 minutes in heated extractives with exposure of fungi.

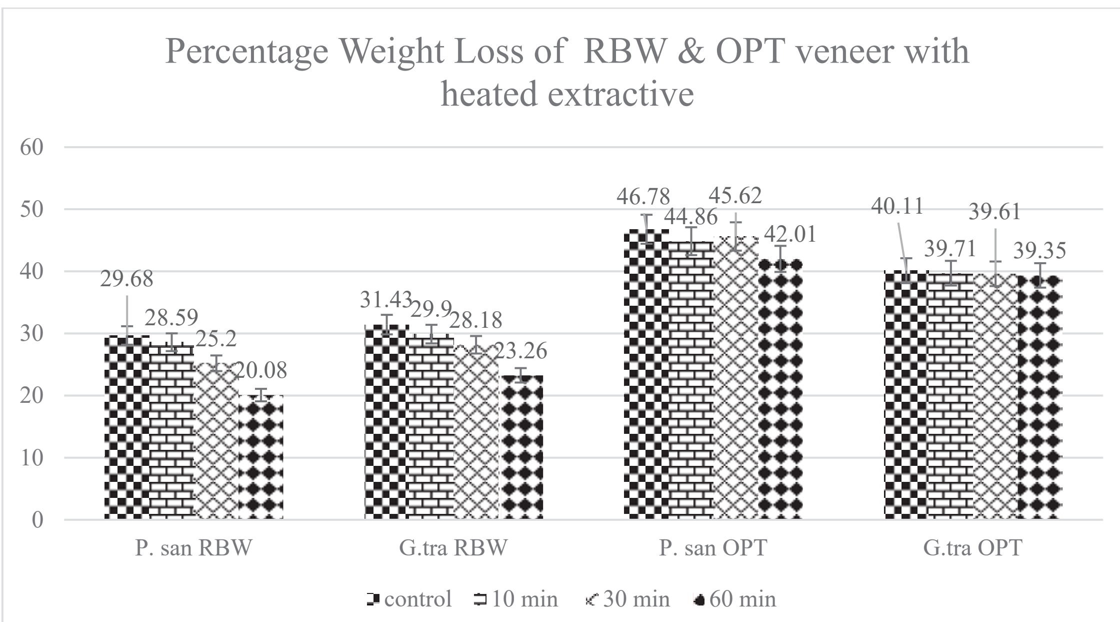


FIGURE 1. Result of veneers treated with heated extractive after 16 weeks of exposure to *P.san* and *G. tra*.

Comparing veneers treatment with room temperature extractives for 60 minutes, rubberwood veneers recorded 23.11% and 30.64% of mass loss when exposure with *P.san* and *G. tra*, and OPT veneers 45.25% and 39.85% of weight loss when being exposed with these fungi. From the result of mass loss for fig.1 and fig.2, veneer that received heated extractives gives lowest percentage weight loss compare to veneer that using room temperature extractives referring to control result.

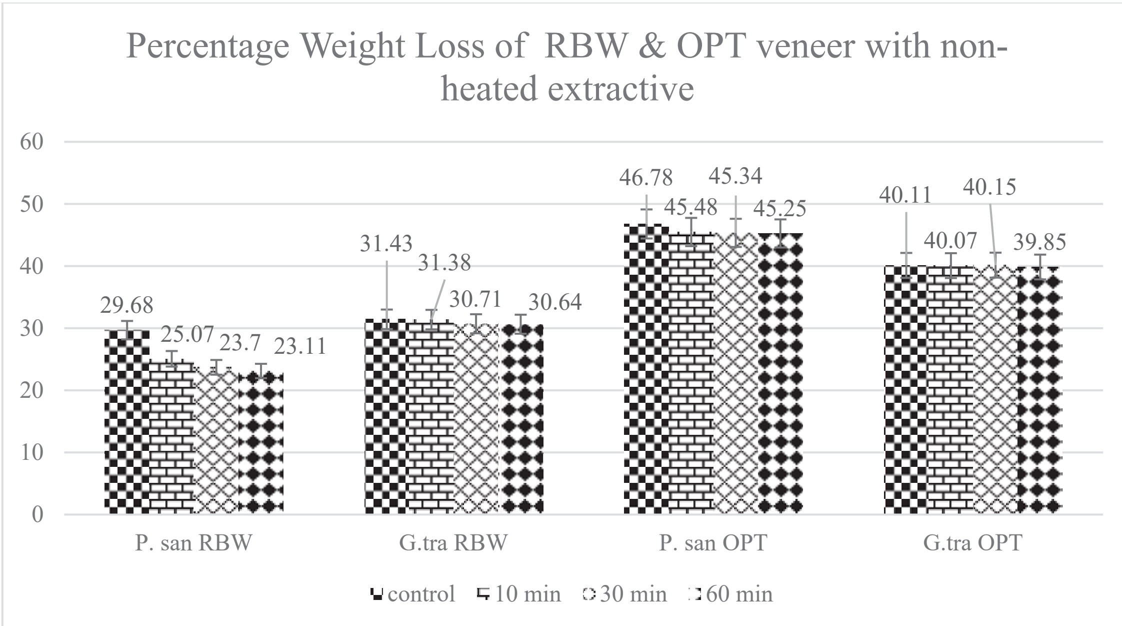


FIGURE 2. Result of veneers treated with non-heated extractive after 16 weeks of exposure to *P.san* and *G. tra*.

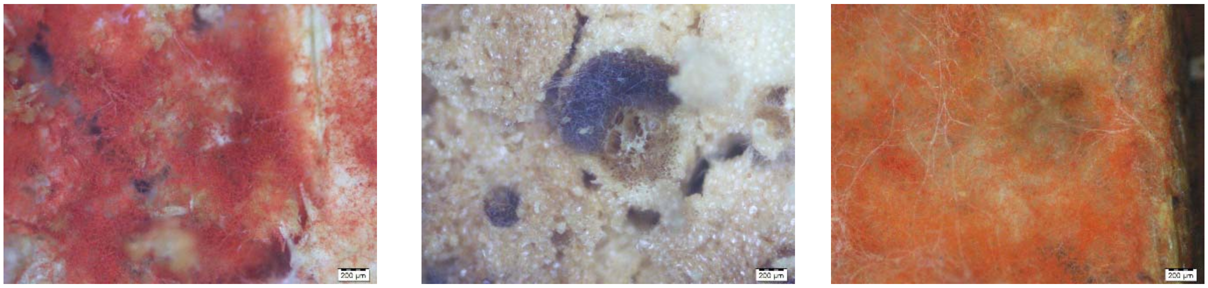
During the heating phase, air expands in the wood and others are pushed out. Heating increases preservative absorption. When the temperature going down, air contracts in the wood, producing a partial vacuum, and more preservative drives atmospheric pressure into the wood [13]. Thus it makes the extractives absorb in veneers higher compare when only immersed into non-heated extractives. Higher content of extractives in veneers means lower the possibility of weight loss due to extractives prevent growth of fungi.

Light Microscopic Analysis for Rubberwood and OPT Veneer

The microscopic study of veneers was conducted by using light microscope (Olympus SZX7 stereo microscope) at Universiti Sains Malaysia, Malaysia. The captured figure of veneers of rubberwood and OPT exposed with white-rot, *P. san* was showing in Fig. 3 and Fig. 4 and of rubberwood and OPT exposed with brown-rot, *P. san* was showing in Fig. 5 and Fig. 6.

(a) (b) (c)

FIGURE 3. Rubberwood veneers exposed with *P. san* under light microscope, (a) control, (b) rubberwood with heated extractive, (c) rubberwood with non-heated extractive.



(a) (b) (c)

FIGURE 4. OPT veneers exposed with *P. san* under light microscope. (a)control, (b) OPT with heated extractive, (c) OPT with non-heated extractive.

(a) (b) (c)

FIGURE 5. Rubberwood veneers exposed with *G. tra* under light microscope, (a) control, (b) rubberwood with heated extractive, (c) rubberwood with non-heated extractive

(a) (b) (c)

FIGURE 6. OPT veneers exposed with *G. tra* under light microscope, (a) control, (b) rubberwood with heated extractive, (c) rubberwood with non-heated extractive

By comparing Fig.3(a) with Fig.3(b) and Fig.3(c), it can be said that the growth of fungi on veneers with heated extractive is less than that of veneers with non-heated extracts. Same situation if compared with Fig.4(a) with Fig.4(b) and Fig.4(c) whereas growth of fungi on veneer with heated extractive fewer than non-heated extractive. Same result when referring on Fig 5(a),5(b) and 5(c) and Fig 6(a), 6(b) and 6(c) whereas when veneer exposed with *G. tra* with different condition it showing the fungi growth on veneer with heated extractive fewer than veneer with non-heated extractive. Based on the previous study, heat treatment of wood results in the reduction of hydrophobicity and the improvement of dimension equilibrium [14]. But in this study, the extractive was heated. When extractives were heated, it improves the penetration of the extractive toward veneers. Thus, the amount of extractive that contains in the heated treatment veneer is higher than amount of veneer treated with room temperature extractive. As the result with the capability of extractive to reduce the fungal growth on veneer is greater when veneer was treated with heated extractive.

CONCLUSION

Heated extractive of Cinnamomum porrectum showing higher effectiveness than non-heated extractive when treated with the veneers. The higher the time of veneer treatment showing that the lower the weight loss due to fungi deterioration because of the capability of extractive to penetrate the veneer if heat imposed. Result from light microscope showing the efficacy of heated treatment to lower the fungi growth on the surface of veneer. With the result, further advanced study will be explored with C. porrectum extractive to study about its potential and implication towards reducing usage of non-ecofriendly preservative.

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