Annals of Warsaw University of Life Sciences - SGGW
Forestry and Wood Technology № 85, 2014: 72-75
(Ann. WULS - SGGW, For. and Wood Technol. 85, 2014)

The charring rate of exotic species wood covered with protective preparations on the basis of natural oils.

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Abstract: *The charring rate of exotic species wood covered with protective preparations on the basis of natural oils.* The purpose of this study was to examine the impact of the oil coating on the fire characteristics of the selected exotic wood species, especially changes the charring speed of wood in different anatomical directions at a distance of 5 cm from source of radiant heat. Results from the distance of 5 cm imposed minimum oils improve on the fire properties of test samples. Imposed oils minimum in a way securing against loss of wood thickness, weight or slowed down the process of charred, and temperatures measured during the tests proved to be lower than for unsecured samples. These preparations, however, were not significant for the protection of wood came to agreement to bring but also do not contribute to its increased flammability.
Keywords: charring rate, charring speed, flammability, exotic wood,

INTRODUCTION

Increasing the use of wood in construction, exotic species and cover it oil-based preparations, he puts the question of the impact of such security on fire safety. Thermal degradation issues and fire resistance are often overlooked in everyday use of wood products. Despite the many studies carried out the complexity of the flammability processes still have many gaps in gaining a full understanding of thermal degradation and flame behavior of wood (White, Dietenberger, 2001). One of the ways to know combustible properties of wood is to examine the carbonization speed or charring rate.

About exotic wood we talk when we are dealing with a wood material not found in natural instead in our climatic zone. It is brought to our market mainly due to the tropical zone in the simplification of the area between the Tropic of Cancer and Capricorn. A significant increase in the participation of the wood on the Polish market poses many questions about its properties in everyday use, including security-related issues as well as the fire characteristics of this material.

Charring rate is defined as the rate of weight loss at any given time [g/min] or as an indication of loss of thickness along a certain axis [mm/min] (Lau, White, Zeeland 1999). Charred layer makes difficult the flow of heat into the interior of the wood, causing temperatures to produce corresponding to the decomposing wood. This contributes to high fire resistance and hence can be independent of expiration. This happens because the coefficient of thermal conductivity of charcoal is several times smaller than wood (White, Nordheim, 1992). The overall role of charcoal shall cease as soon as the carbon glowing. As a general rule, this phenomenon is the increased severity of fire as the wood under a layer of carbon is so strongly heated that decomposition temperature is reached (Metz, 1953).

The aim of this work was to determine charring speed of exotic wood species, both raw and covered with oil-based preparations.

MATERIALS AND METHODS

The study uses wood from the following tree species: *Pterocarpus soyauxii* Taub (African Padouk), *Shorea negrosensis* Foxb. (Red Meranti), *Tectona grandis* Linn. F (Teak). Test sample were seasoned (humidity 8%), cut to the dimensions of 25 x 25 x 50 mm (the last dimension in the tangential direction). For testing we used two types of commercial

preparations based on natural oils A and B. The application of oil was made by hand with a brush to the previously weighed and measured the samples. Rouge was painted after those oils in the manner recommended by the manufacturers. After each applied layer of the sample was weighed in order to determine the quantity of oil on its surface.
A measure of the charring speed is the loss of thickness of the sample in time unit or the thickness of the charred layer at the time. Previously prepared samples were placed in the heating chamber at a distance of 5 cm from the source of radiant heat to a heat source. For each variant were used 5 samples. Research was carried out in two directions: cut along and across fibers, by setting the appropriate sample: perpendicular and parallel to the source of radiant heat.
Before the first measurement chamber was heated for 15 min and the next cooled to 30 ±2° C. This treatment allows avoiding error due to heat loss for heating over the chamber during the combustion of samples. The distance set by using the screws on the rack. To specimen was mounted the thermocouple in the surface no directly exposed to the impact of heat. Temperature measurements were made for 20 minutes every 0.5 min, after the end of the test the sample was seasoned in a desiccator, weighted on the laboratory weight to within ± 0,001 g. Charred wood layer was gently removed using the blade until the border dividing line express a part of the uncharred wood. The thickness of the wood was measured with caliper in the central part of the sample. Carbonization speed was calculated from a difference in thickness before and after removal of the carbonized sample from the chamber (not charred part of the sample) by the formula:

$$Z=(g1-g2)/t$$

Where:
Z-carbonization speed [mm/min]
g 1-dimension of the sample before testing [mm]
(g) 2-dimension of the sample after the test [mm]
t-test time [min]

RESULTS
For Meranti wood samples values obtained with different oils are very close (fig. 1). Slightly better in this analysis is A oil, whose speed of carbonization is 0,647 mm/min and is about a mm/min 0,028 lower from the second of the oil. In a longitudinal direction result of 0,333 mm/min and the oil turns out to be better than B, which oil is oil in a given direction has been the speed of carbonization to 0,343 mm/min. completely different carbonization speed has a control material, which surrendered to where at a rate exceeding 1 mm/min. is almost twice faster in parallel and 3 times faster along the fibers than in samples secured. The difference between the lines is 0,085mm/min.

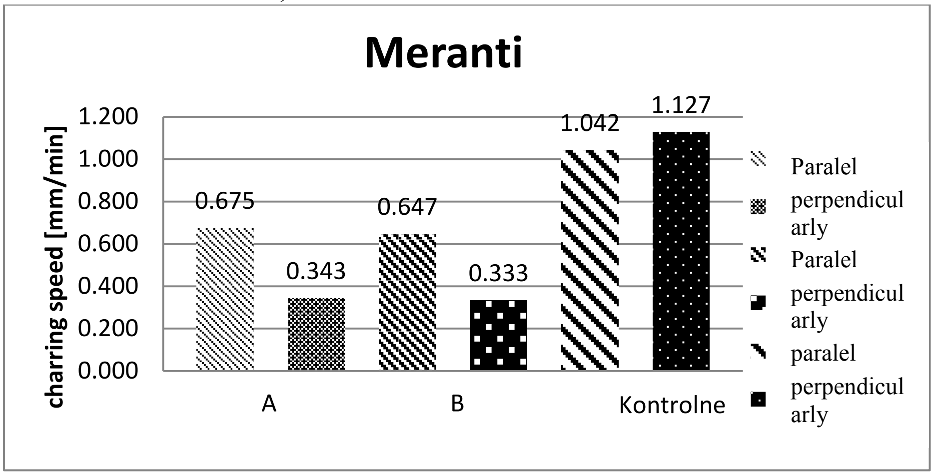

Fig. 1. Charring speed for samples of Meranti wood in heating chamber, at a distance of 5 cm

The smallest rate of charring on the A oil-coated wood has Padouk (fig. 2). This is 0,291 mm/min in a transverse direction and 0,207 mm/min in a longitudinal direction. B oil only in longitudinal direction approaching the low carbonization speed reaching 0,268 mm/min. in a transverse direction is not so favorable the result (more than 0,452 mm/min). The difference in speed between the lines in this scenario is close to 60%, where the difference by wood protected with A oil is just 30%. In control samples speed of charring in a transverse direction is only 0,876 × da mm/min and is less than the second direction of more than 0,16 mm/min.

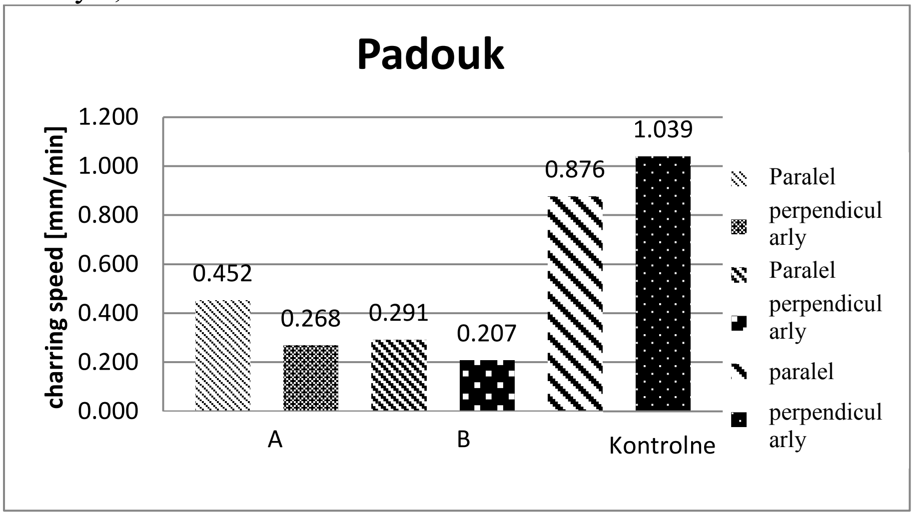

Fig.2. Charring speed for samples of Padouk wood in heating chamber, at a distance of 5 cm

The smallest charring speed has in the case of Teak wood with oil A cover (fig. 3). This is 0,398 mm/min in a transverse direction and 0,238 mm/min in a longitudinal direction. The B oil in these directions shows the speed of 0, 432 mm/min and 0,243 mm/min or 0,034 mm/min and 0.005 mm/min faster than A. In the case of Teak we are dealing with a control material, which alone shall not exceed the value of 1 mm/min in any of the possible variants. The value of 0,578 mm and 0,705 mm/min are the lowest at this distance with obtained carbonization.

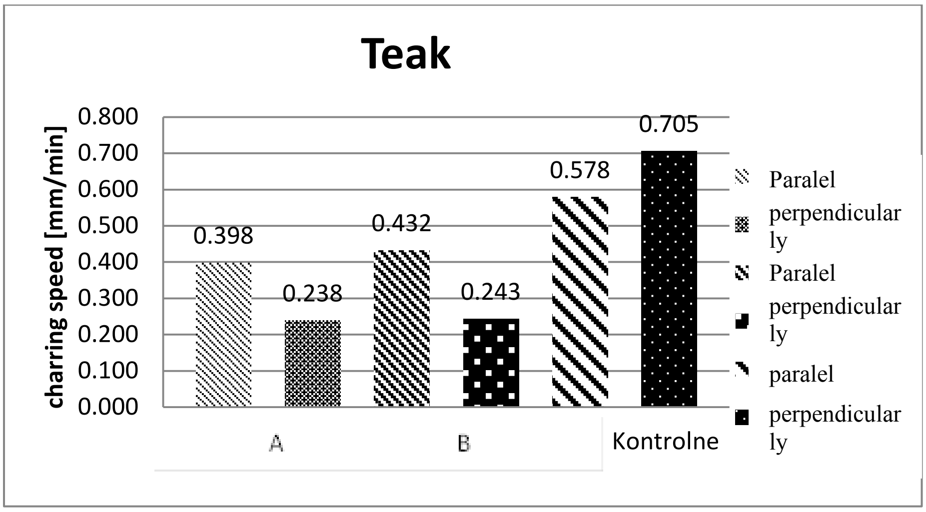

Fig. 3 Charring speed for samples of Teak wood in heating chamber, at a distance of 5 cm

CONCLUSIONS

1. Applied oils positively impacted on fire properties of test samples. They had a smaller loss of mass and thickness.
2. Selection of a suitable oil preparation for a particular species is of great importance in the case of modifications of the wood charring speed.

3. The charring speed and temperature distribution observed on selected exotic wood samples confirms their higher resistance to fire.
4. Teak wood in the case of control samples is characterized by greater resistance to thermal radiation compared to other tested species.

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Streszczenie: *Szybkość zwęglania drewna gatunków egzotycznych pokrytego preparatami ochronno-dekoracyjnymi na bazie olejów naturalnych.*Celem niniejszej pracy było zbadanie wpływu powłoki olejowej na cechy palnościowe wybranych gatunków drewna egzotycznego na podstawie zmian szybkości zwęglania drewna w różnych kierunkach anatomicznych przy odległości 5 od źródła promieniowania cieplnego. Badania zostały przeprowadzony w komorze grzewczej

Przy badaniu w odległości 5 cm nałożone oleje minimalnie poprawiły właściwości palnościowe badanych próbek. Nałożone oleje w minimalny sposób zabezpieczył drewno przed utratą grubości, masy czy też spowolnił proces zwęglana, a temperatury mierzone podczas badań okazywały się niższe niż dla próbek niezabezpieczonych. Preparaty te jednak nie stanowiły znaczącej ochrony przeciwogniowej drewna, ale też nie przyczyniały się do jego zwiększonej palności.

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