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EFFECT OF FUNGICIDE COMPOUND APPLICATION ON FLAME BURNING OF WOOD

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Abstract:
Objective of this paper is to investigate the effect of fungicidal compounds applied on wood specimen by observing the flame spreading ability in experimental conditions. Specimens consist of one type of softwood and one type of hardwood i.e. Scots pine (Pinus silvestris) and Sessile oak (Quercus petrae) wood treated with fungicidal compounds that are subsequently compared to untreated equivalents of the tested specimens. The experiment was conducted under STN EN ISO 11925-2, Reaction to fire tests - Ignitability of building products subjected to direct impingement of flame - Part 2: Single-flame source test. Results of the tests show different influence of the fungicide agent on soft and hardwood with rather positive tendency on fire protective features.

Key words: *fungicide; flame burning; pine; oak; wood protection.*

INTRODUCTION

Wood in general is an essential material used in constructions however it´s also known for its combustibility, but it is not the only negative feature of wood. Biological degradation caused by insects or fungi is one of them among others. As long as the wood is not treated with fungicide or insecticide the risk of infestation is growing which can degrade its qualities. Fungicide agents are fit for use in interior as well as exterior, however it is not recommended to apply them on surfaces that come in direct contact with food, water, feed as well as children´s furniture and toys. It is still unclear whether fungicide affects the combustibility of the wood.

The main hypothesis in this paper is that fungicide agent will positively affect the mass loss and flame spread of the treated wood specimens.

TESTED MATERIALS

Impregnating fungicide agent Lazurol S1033 along with wood specimens of Scots pine (*Pinus silvestris*) and Sessile oak (*Quercus petrae*) were chosen for the experiment. Selection of both fungicide and wood specimens were influenced by price, availability and frequency of use in constructions.

Scots pine (Pinus silvestris)

Scots pine is one of the most common trees (applied to central Europe) and also one of the least demanding of trees as it grows on inhospitable surfaces from wetlands to sandy subsoils, adapted for droughts and extreme temperatures. Scots pine grows in most of the European countries. Crown of young tree is conical and it changes to rather open in elder subjects. Lower part of the trunk is reddish or brown-gray changing to terracotta in higher parts (Borovica lesná-sosna 2019).

Pine wood is used especially in constructions, creating both auxiliary and final structures and also frame structures of panel wooden constructions.

Sessile oak (Quercus petrae)

Sessile oak is a deciduous tree with relatively slender trunk reaching up to 30 meters in height. It usually grows in an upland areas achieving age of 400-500 years. Oak wood is very durable and is considered a hardwood, heavy and resilient. It´s hard to pickle and impregnate (Naše stromy 2018).

Sessile oak wood is mainly used for production of furniture, parquets, beams but it has also been used for production of railway sills thanks to its quality (Toma & Suchomel 2018).

Fungicide agent – LAZUROL

Lazurol is a synthetic fungicide impregnant. This impregnant is a dilution of alkyd resin in impregnant that contains fungicide. Coating is used for chemical surface protection of wood from mold infestation, wood-degradating fungi and wood-degradating insects. Lazurol is used for timber hazard class 1 and 2 in interiors and for class 3 in exterior. It´s applied directly to wood, particleboard and fibreboard under oily, synthetic and water-dilutable wood coatings. Purchase of this fungicide agent is available for general public.

EXPERIMENT

All tests were conducted under STN EN ISO 11925-2, Reaction to fire tests - Ignitability of building products subjected to direct impingement of flame - Part 2: Single-flame source test (STN-EN-ISO11925-2).

Measurements were conducted in test chamber with gas burner as source of ignition. The chamber is constructed out of stainless steel with fireproof glass installed on the door. This glass serves for observation and manipulation of the tested specimen. Inside of the testing device there is a specimen holder, stand and a burner.

First step was to choose proper specimens for the experiment. 20 specimens were required for these measurements where half of them were scots pine and other half were sessile oak. All the specimens were subsequently divided in half again where first half was treated with fungicide agent Lazurol and the other half was left untreated. Dimensions of the specimen was 250 x 90 x 20 mm. Specimens coated with Lazurol were coated twice where weight of the specimens was monitored before and after each application and before the testing itself.

Tempering of the specimens was conducted under laboratory conditions in ambient temperature of 20°C. Specimens were weighed in 7-day intervals until their weight became constant. Specimens were placed vertically on the holder secured with screws to prevent it from deformation. Distance of 40mm from the lower edge was outlined to mark the contact point of the specimen and the source of flame. Another line was marked on the specimen in 150mm distance in vertical direction. Distance-adjusting device was used to set proper distance of specimen and flame source which was set in 45° angle. After the burner was lit we let the flame to stabilize and set the flame height to 20mm ± 0,1mm. Flame height was checked after each measuring.

Flame source was placed so that it was touching the centre the 40mm mark and was let to impinge for period of 30 seconds after which we have removed it. If the specimen kept on burning even after the flame source removal, we waited for it to stop burning before removing it from the testing chamber and weighed it afterwards to find out its mass loss and carbonized layer thickness. Mass loss represents amount of material or water combusted or evaporated from the specimen in estimated period of time which was calculated with formula (1).

$$\delta m(\tau) = \frac{m(\tau) - m(\tau + \Delta\tau)}{m(\tau)} * 100 \tag{1}$$

where: $\delta mr(\tau)$ – mass loss rate in time (τ) [%],

$m(\tau)$ – weight of sample in time (τ) [g],

$m(\tau + \Delta\tau)$ – weight of sample in time (τ + $\Delta\tau$) [g] (Mitrenga, 2015) (Vácval, Havko & Müllerová 2016).

Flame spread distance is one of the most important criterion for assessing reaction to fire class of a construction material. The higher this value is the faster the fire spreads to another construction material or construction within the same fire section (Makovická Osvaldová 2017) (Osvald & Flachbart 2017).

Scots pine after the exposition to source of flame is displayed in Fig. 1 and 2. After-test sessile oak specimen are displayed in Fig. 3 and 4.

The critical mark on the top of the specimens was reached by flame on 4 of untreated and 3 treated specimens as we can see in Fig. 1 and 2. In the case of untreated specimens the fire only spread in the way of the grain however it spread also in perpendicular way in specimens treated with fungicide agent.

We can see from Fig. 3 and 4 that there are two specimens in both groups which reached the 150mm critical mark on the top.

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Fig. 1.
Untreated specimens of scots pine - after the test.

Fig. 2.
Specimens of scots pine treated with Lazurol - after the test.

Fig. 3.
Untreated specimens of sessile oak - after the test.

Fig. 4.
Specimens of sessile oak treated with Lazurol - after the test.

EVALUATION OF RESULTS

Statistical evaluation of average mass loss rates is displayed in Fig. 5 and evaluation of average flame spread distance is displayed in Fig. 6.

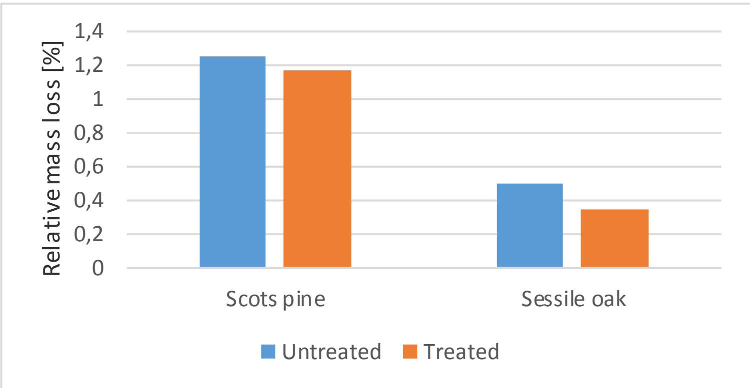

Fig. 5.
Chart of average mass loss of the specimens.

Average mass loss of the untreated scots pine specimens was estimated to 1.25%. Specimens treated with fungicide agent show minor decreas reaching 1.166%. Results of sessile oak specimens are even larger. Treated specimens show average mass loss of 0.347% while treated ones reach 0.502%.

Comparing the results from both types of wood we can state that fungicide agent Lazurol affects the burning process of wood resulting in the decrease of mass loss of the treated material in fire.

When comparing average flame spread distance of scots pine specimens we can see decrease in flame spread in the treated specimens from 132 to 118mm however sessile oak shows the opposite behavior where a slight increase in the flame spread distance can be observed, growing from 96 to 98.6mm.

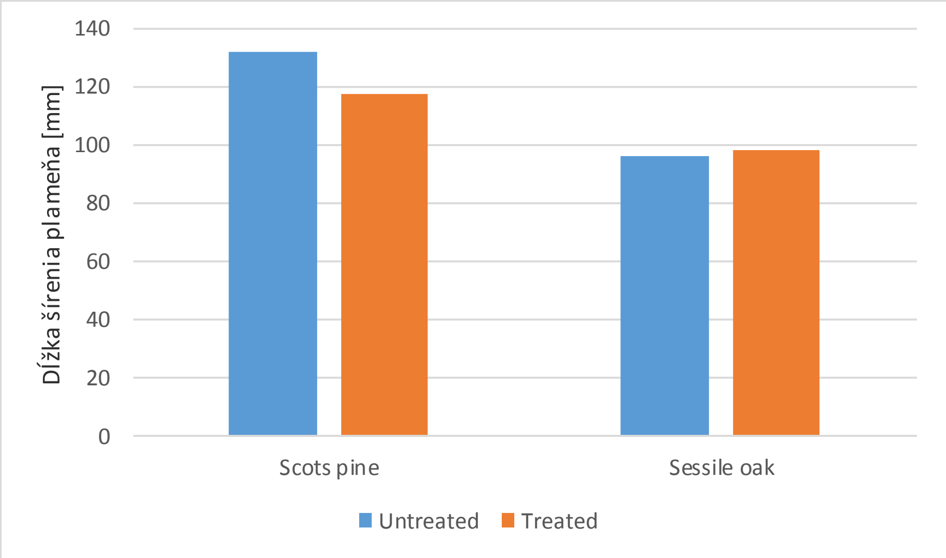

Fig. 6.
Chart of average mass loss of the specimens.

Despite the observed we can state that fungicide agent Lazurol does not have significant effect on the flame spreading on wood surfaces since results are relatively similar.

CONCLUSIONS

Representative specimens of the soft and hardwood underwent an experiment, which was used to observe effect of fungicide agent Lazurol on their mass loss and flame spread when exposed to source of flame.

Evaluating the mass loss we have found out that fungicide agent does not support spreading of the fire, on the contrary, it has a positive effect on both scots pine and sessile oak. Differences shown in the results represent ambient conditions which can not be applied on real fires however it's the tendency that is important.

Dealing with the flame spread distance we can see slightly different progress. Changes were observed however it appears that softwood has a different progress compared to hardwood. While we can see positive effect of the fungicide agent on the scots pine (softwood), sessile oak (hardwood) shows a minor negative that is within a 5% interval which can mean that the difference can be cause by statistical error. More experiments with various types of soft and hardwood shall be done in order to find out whether there is a different effect of fungicide on these two basic types of wood.

A strong odour was observed in the preparation process of the fungicide agent therefore further investigation of possible impact on human health is necessary to prevent any injury.

REFERENCES

Borovica lesná-sosna (14. Január 2019) Dostupné na Internete: http://slnieckova.sk/bylinky/borovica-lesna-sosna/

Makovická Osvaldová L (2017) Influence of fire retardant on selected thermal insulation materials on natural basis-wooden fibreboard. *M2D2017* (s. 1633-1640). INEGI/FEUP.

Mitrenga P (2015) Vyhodnotenie úbytku na hmotnosti a rýchlosti odhorievania ako parametra testovania sadrokartónových dosiek po vystavení tepelnému namáhaniu. *Krízový manažment*, 22-27.

Naše stromy (16. December 2018) Dostupné na Internete: Dub zimný: http://stromy.wz.sk/dub_zimny.htm

Osvald A., Flachbart J (2017) Požiare fasád výškových budov. *Krízový manažment*, 55-63.

STN-EN-ISO11925-2 (dátum neznámy). Skúšky reakcie na oheň. Zapáliteľnosť stavebných výrobkov vystavených priamemu pôsobeniu plameňového horenia. Časť 2: Skúška jednoplameňovým zdrojom. *Technická norma*.

Toma P, Suchomel J (16. December 2018) *Národné lesnícke centrum*. Dostupné na Internete: Základné charakteristiky lesných drevín: http://www.nlcsk.sk/files/1708.pdf

Váczal J, Havko J, Müllerová J (2016) Sledovanie závisloti uvoľňovania tepla a rýchlosti úbytku hmotnosti meraných na kónickom kalorimetri na základe analýzy pôvodných parametrov. *Riešenie krízových situácií v špecifickom prostredí*, 669-676.