

Resistance of lime wood (*Tilia sp.*) impregnated with Paraloid B-72 resin against cellar fungus *Coniophora puteana* (Schum., Fr.) Karst

BOGUSŁAW ANDRES, PIOTR MANKOWSKI

Department of Wood Science and Wood Protection, Warsaw University of Life Science-SGGW

Abstract: Resistance of lime wood (*Tilia sp.*) impregnated with Paraloid B-72 resin against cellar fungus *Coniophora puteana* (Schum., Fr.) Karst. Work deals with resistance of Paraloid B-72 synthetic resin impregnated lime wood against cellar fungus *Coniophora puteana*. Resin solutions of 5, 10 and 20% concentrations were used. In laboratory conditions, impregnated samples were exposed to fungus for 16 weeks. It was determined that lime wood impregnated with Paraloid B-72 resin is not resistant against fungi.

Keywords: Paraloid B-72, *Coniophora puteana*, weight loss,

INTRODUCTION

Using of wood in inappropriate conditions leads to its destruction. Natural resistance of wood can be improved by impregnation, which means saturation of wood material with chemicals. Many antique objects, movable as well as architectural elements, because of advanced decay process, requires mechanical reinforcement. In this case, many chemical substances increasing resistance to decay are being used. In the beginning, wood was treated with mineral and plant oils, rosin, waxes, paraffin, aluminum potassium sulfate dodecahydrate, beet or cane sugar. In many cases these substances increased hydrophobic properties and dimensional stability, but could not restore its technical properties (Ważny, Kurpik, 2004).

From many years, in aim to strengthen wood structure, many impregnating treatments with resin solutions are being applied. Many researchers deal with this problem: Domasłowski, (1961), Domosławski and Zaręba (1968), Schaffer (1974), Czajnik i Ważny (1980), Paciorek (1993), Buksalewicz and others (1987), Ciabach (1998), Soldenhoff (2004). Testing of synthetic resins for wood preservation against decay were performed by Czajnik (1968).

Goal of the following work was to determine Paraloid B-72 saturated lime wood (*Tilia sp.*) resistance against cellar fungus *Coniophora puteana* (Schum., Fr.) Karst. In the following work, possibilities of Paraloid B-72 synthetic resin were tested, as treatment preventing of cellar fungus hyphae penetration into lime wood cells. During the test it was determined what solution strength sufficiently prevents fungus growth and increases lime wood resistance against decay.

MATERIALS AND METHODS

Testing was performed on 50×25×7 mm lime wood (*Tilia sp.*) defect less samples of 500 kg/m³ density.

Research was conducted in accordance to PN EN 113+A2 standard. Cellar *Coniophora puteana* coming from collection of Division of Wood Protection of Faculty of Wood technology WULS

For wood reinforcement Kremer Pigmente GmbH & Co Paraloid B-72 synthetic resin was used (catalogue no 67400) of 5, 10 and 20% solution strength. Dragon toluene was used as a solvent.

Samples were impregnated in vacuum thru 30 minutes at 70 mbar. Impregnated samples were seasoned for 1 week. Samples were sterilized by short-term submerging in 70%

ethyl alcohol solution and overburning with alcohol burner. Mycelium incubation was performed in culturing chamber at $20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and with $70 \pm 5\%$ relative air humidity. Time of fungus activity on tested wood reached 16 weeks.

RESULTS AND DISCUSSION

Table 1 shows average weight loss in all variants. Highest loss was noticed for control samples, lowest one occurred in samples saturated with 20% Paraloid B-72 solution.

Table 1. Percentage weight loss in tested samples

Sample type	Average resin retention [kg/m ³]	Average weight loss [%]	Standard deviation [%]
Control samples	0	62,13	2,94
saturated 5%	61,9	57,15	1,96
saturated 10%	77,6	52,52	1,86
saturated 20%	124,4	43,95	3,86

In aim to test significance of differences between variants of the test, variation analysis was also made. With assumption of normal distribution following statistical hypothesis were formulated:

$$H_0: m_k = m_{5\%} = m_{10\%} = m_{20\%},$$

H_1 : at least two averages differ significantly.

Table 2. Solution strength significance analysis on weight loss of samples caused by *C. puteana*

Variance cause	m_0			
	F_{emp}	p-value	$F_{0,05}$	$F_{0,01}$
Factor- A	57,5	$6,40 \cdot 10^{-16}$	2,8	4,22

With the help of Microsoft Office Excel statistics were calculated. Variation analysis showed occurrence of statistically important differences between averages of tested parameters (table 2). With Tukey test, three uniform groups were isolated (table 3).

Table 3. Isolation into uniform groups according to Tukey

Wood sample variants	Uniform groups
Control samples	a
saturated 5%	b
saturated 10%	b
saturated 20%	c

Basing on the obtained results, one may state that saturation of wood with resin hinders fungus hyphae penetration. Amongst samples saturated with resin, lowest weight loss was showed with these impregnated with 20% solution, Tukey test isolated this variant into „c”

group. Samples saturated with 5 and 10 % resin solution were classified into single „b” group, so Δm differences between these variants are statistically insignificant.

Except weight loss, visual evaluation of samples' decay was made. Figure 1 shows 4 samples showing average weight loss for each test variant. Control samples, not saturated with resin developed numerous, prismatic cracks. Samples fall apart under minimal compression force. Samples saturated with 5 and 10% solution showed similar behavior. Slightly better results were obtained with samples saturated with 20% resin solution, not showing cracks, not falling apart, but easily fracturable.



Fig. 1.

Comparison of samples decayed by cellar fungus: a) control sample, b) sample saturated with 5% solution, c) sample saturated with 10% solution, d) sample saturated with 20% solution.

CONCLUSIONS

1. Lime wood impregnated with Paraloid B-72 resin is not resistant against cellar fungus *Coniophora puteana*.
2. Paraloid B-72 resin restricts penetration of mycelium hyphae.
3. Samples saturated with 20% Paraloid B-72 solution showed lower weight loss than samples treated with 5 and 10 % solutions.
4. Paraloid B-72 resin of 20% solution strength increases fungus resistance of lime wood, but does not protect it in satisfactory degree.

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Streszczenie: *Badanie odporności drewna lipy (Tilia sp.) nasyconego żywicą Paraloid B-72 na działanie grzyba piwnicznego Coniophora puteana (Schum., Fr.) Karst. W pracy przedstawiono wyniki badań dotyczących odporności drewna lipy nasyconego żywicą syntetyczną Paraloid B-72 na działanie grzyba piwnicznego C. puteana. Zastosowano żywice o stężeniu: 5, 10 i 20%. W warunkach laboratoryjnych przez 16 tygodni próbki drewna poddane były działaniu grzyba. Wykazano, że drewno lipy nasycone żywicą Paraloid B-72 nie jest odporne na działanie C. puteana.*

Corresponding authors:

Bogusław Andres, Piotr Mańkowski,
Department of Wood Science and Wood Protection,
Warsaw University of Life Science-SGGW,
Nowoursynowska 159,
02-776 Warsaw,
boguslaw_andres@sggw.pl,
piotr_mankowski@sggw.pl