SOCIETY OF WOOD SCIENCE & TECHNOLOGY

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THE INFLUENCE OF OIL UPTAKE ON MOISTURE EXCLUDING EFFICIENCY IN THERMALLY TREATED WOOD

INTRODUCTION

The oxygen exclusion during thermal treatment is achieved by different methods – heat treatment in steam, nitrogen atmosphere, or vegetable oil. The last mentioned acts not only as oxygen-excluding but also as heat-transfer medium. Oil heat treatment, in contrast to other methods, typically leads to weight increase due to oil uptake, which is very variable and depends on the period of heating, the final temperature, the permeability of wood species, sample cooling (in or outside a bath) or the sample size. The oil uptake always resulted in significantly higher weight/density of samples, especially in permeable wood species. This change can distort results and influence the interpretation of moisture content of treated wood, since it is based on weight change calculation.

MATERIAL & METHODS

Four groups of beech wood (*Fagus sylvatica*) were used for this experiment - the reference (REF), hemp oil impregnated (OI), thermally modified (TM), and hemp oil impregnated and thermally modified (OI+TM). Samples were vacuum impregnated (2 hours at 20 kPa) and/or thermal treated (3 hours at 200°C within steam environment, Figure 1). Weight percentage gain (WPG; impregnation) and mass loss (ML; thermal treatment) were determined.

Half of samples were exposed to standard conditions (20°C, 65%) and the rest was held above the water level. The moisture content change was observed by regular weighing. Moisture excluding efficiency (MEE) of individual treatments was calculated.

Vessels with hemp oil were held under conditions of 97% and 20°C (saturated solution of K_2SO_4) and were regularly weighed to determine the mass change.

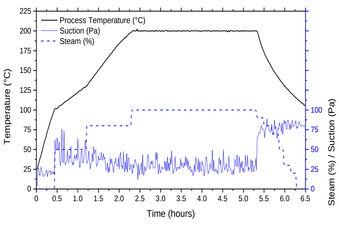

Figure 1 Thermal modification process parameters

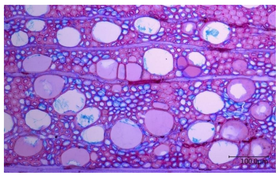

Figure 2 Hemp oil in cells of beech wood (after decay test)

RESULTS AND DISCUSSION

ML of beech wood was around 2.5%, whereas WPGs after oil impregnation were about 50-60 % (Table 1). The untreated beech wood reached moisture content of nearly 12% under standard conditions and 27% in saturated air condition. All treatments resulted in reduced MC (Table 2).

Table 1 Samples oven dry density, mass loss after thermal treatment and weight percentage gain of oil

	ρ_0 (kg/m^3)	WPG (%)	ML (%)
REF	673 (4.0)	-	-
TM	667 (3.2)	-	2.5 (20.0)
OI+TM	844 (6.2)	51.2 (11.5)	16.1 (21.1)
OI	1055 (3.7)	61.1 (13.2)	-

The MEEs of treated beech wood and their change during exposition to saturated air condition are shown in Figure 3. Results showed that all treatments are more effective in short-term expositions, where combined process reached almost 60% reduction in moisture content compared to untreated wood.

Nevertheless, if we considered that oil heat treatment is connected with often substantial sample mass increase due to oil uptake, the value comparison can be misleading, because the counted moisture contents are related to the initial sample weight.

The mass increase (expressed in g, Figure 4) in the case of OI+TM specimens was comparable with the untreated ones. Oil impregnated specimens showed even a higher value. In case of oil treated samples, the mass increase is not related only to moisture content increase.

Table 2 Equilibrium moisture content and sample weight change of untreated and treated wood under different conditions

	(20°C, 65%)	(20°C, ~100%)
REF	11.5 (2.6)	27.4 (1.5)
TM	9.5 (2.1)	23.7 (8.3)
OI+TM	7.9 (2.5)	19.9 (7.0)
OI	9.7 (3.1)	22.3 (6.1)

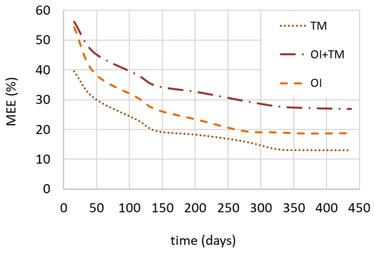

Figure 3 Moisture excluding efficiency of treated beech samples during exposition above water level

Hemp oil itself is not hygroscopic, but increased its mass due to oxygen bonding during drying process. The difference in mass between reference and oil treated sample and analogically between heat treated and combined process treated samples is presumably related to oil oxidation, which occurs during conditioning of samples.

The drying of oil is slowed down or even stopped in high relative humidity conditions. No oil mass increase was observed during 70 days.

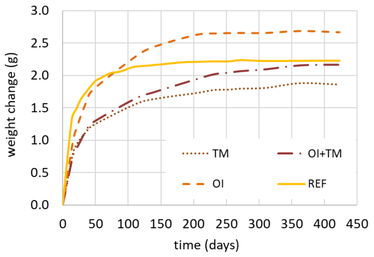

Figure 4 The sample weight change during exposition above water level

CONCLUSIONS

Reduction of EMC of all treated samples in both environments.

Higher absolute weight change after conditioning in the samples containing oil compared to non-oil reference samples.

Misinterpretation of moisture content results of oil treated wood - weight change due to oil uptake (treatment process) and weight change due to oxygen uptake (oil drying)

ACKNOWLEDGEMENT

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