INFLUENCE OF HYDROTHERMAL PROCESSING ON QUALITY OF WOOD VENEER FROM *ROBINIA PSEUDOACACIA L.*

Ewa Dobrowolska

Abstract

Influence of hydrothermal processing on quality of wood veneer from Robinia pseudoacacia L. According to recently conducted research Robinia wood moisture during 30 minutes of brewing process rises up to 35%. However attempt of prolonging hydrating process up to 90 minutes does not cause any major change in wood moisture. Hydrothermal processing is lowering cutting unit resistance. Highest drop occurs after 30 minutes of brewing treatment. Prolonged treatment does not influence the rate of unit resistance while lathing. Thirty minute long processing smoothen surface roughness up to 4 %, after 60 minutes even up to 10% in comparison to dry wood. In contrary too long processing – 90 minutes – results in unfavorable roughness increase.

Key words: *roughness, brewing process, cutting resistance unit*

In Poland for veneer production oak, beech, ash, elm, maple, any birch fruit tree wood including walnut and coniferous such as pine and larch are most widely used. Linden, poplar and alder woods ere mostly used for structural veneers. False-acacia wood is being rarely used for veneer production. Mentioned species growing widely in Hungary and Romania is quite common in Poland, mostly in Warta river estuary. Dynamically spreading and growing false acacia could easily replace commonly used species in veneer production

For fancy veneers, coloring, pattern and surface quality are most important. Independently on cut type and wood species veneers may be tangential, radial, striped, patterned, flowered, glanced or pyramidal (according to PN-85/D-97001).

Veneer grade determination takes into account production defects, by expample surface roughness or uneven thickness.

Basic measured surface parameters described in PN-84/D-01005 are profile height (R_y, R_m), profile height measured in 10 points (R_z), average profile height spacing (S_m).

Wood surface quality after peeling or cutting is being influenced by material properties and structure, tool condition and overall technical properties of the machinery.

In case of wood, its complicated structure and cutting methods cause chip splitting, tearing and breaking of grains. This mainly causes low surface quality [Orlicz 1988].

Wood machineability, its temperature and hydrothermal treatment are most important factor in obtaining high grade veneers.

Main aim of the work was to determine basic cutting parameters and hydrothermal treatment method for false acacia wood (*Robinia pseudoacacia* L.) allowing production of high grade veneers by slicing. Optimal boiling time and cutting properties of wood were determined.

RESEARCH METHOD

Test samples were cut of false acacia *(Robinia pseudoacacia* L.*)* boards, with dimensions 1-2 meters by 350 – 400 mm and 70 mm thickness. Density of wood was determined, for further research pieces of 630 kg/m^3 (V=5,78%) density was chosen and cut into test samples measuring 15×65×300 mm.

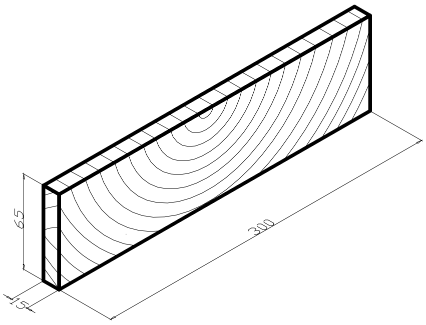


Fig. 1 Cutting force test samples

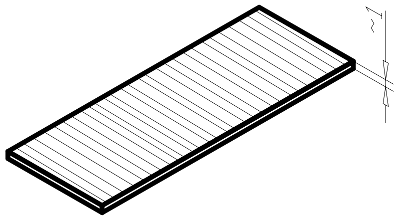


Fig 2 Surface quality test samples

Surface quality was determined on veneer cut during cutting force tests. Veneer thickness was 1,0 mm.

Wood was cooked at 100°C by 30, 60 i 90 minutes. To minimize influence of boiled off wood ingredients water was changed every 15 minutes. 35 samples were chosen for the test. After cutting force determination surface quality of veneer was tested.

Fig 3 Surface quality tester "Surftest 501"

After each cooking process moisture content of samples was tested.

Cutting force was tested on laboratory slicer with force sensors and data acquisition system. Each sample went thru full test cycle, which means slicing when dry and after 30, 60 and 90 minutes cooking.

Cutting resistance was calculated accordingly to following formula:

$$k = \frac{P}{A} \quad [\text{MPa}]$$

where:
P – cutting force [N];
A – chip crossection area [mm^2]

Roughness test was performed on sliced veneer samples glued to flat MDF surface. Each sample was measured several times on 8 mm measuring distance. Measurements were made with Mitutoyo „SURFTEST 501" surface tester (Fig 3), with roughness and waviness testing ability. Maximal profile height R_y was measured with diamond head with radius 5 μm and with head pressure 4 mN.

Veneers surface was also visually evaluated with Nikon microscope in laser light.

TEST RESULTS

Moisture content changes after each cooking procedure is presented in table 1.

Table 1 Average moisture content in veneer

Cooking time (min.)	0	30	60	90
Moisture content (%)	9	34	35	36
Standard deviation (%)	0,30	1,24	0,74	1,32
Variation coefficient (%)	3,55	3,63	2,10	3,71

Basing on the test results it was determined that moisture content from initial 9% grows to 35% after 30 minutes of cooking. Further cooking even with tripled time causes only 1% of moisture content change.

Cooking time changed false acacia coloration from bright green thru brownish hues up to brownish-black. Despite frequent cooking water changes it was noticed that coloration becomes more intense in outer wood layers.

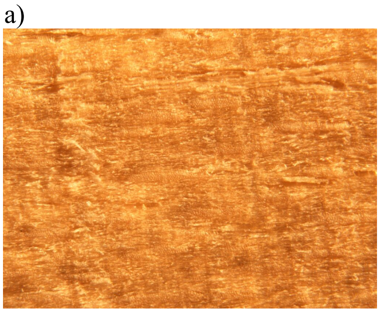
Cutting resistance tests showed that hydrothermal treatment causes drop in cutting resistance. It is especially visible when comparing uncooked and 30 minutes cooked samples, after that cutting resistance does not seem to change significantly. Along with cutting resistance tests, measurements of surface roughness were made.

Table 2 Cutting resistance of cooked false acacia wood

Cooking time (min)	Cutting resistance (MPa)	Standard deviation (MPa)	Variation coefficient (%)
0 - dry	5,3	0,4	7,24
30	4,5	0,2	4,45
60	4,5	0,3	5,89
90	4,4	0,1	1,70

Research showed that extended to 1 hour cooking time lowers veneer surface roughness, after that roughness increases rapidly, veneers cooked for 90 minutes show 30% roughness gain in comparison to uncooked samples.

a)



b)

c) d)

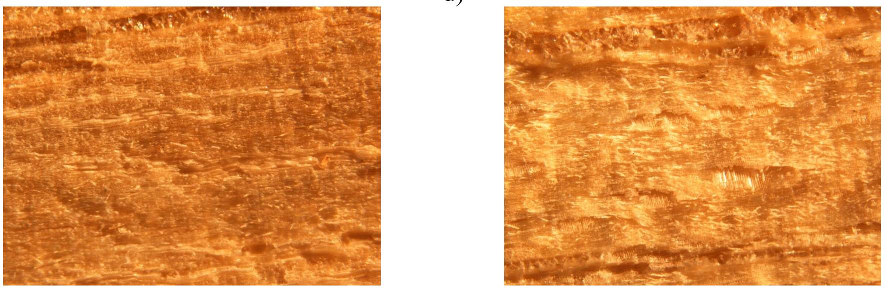


Fig. 4 Surface of veneers after following cooking time:
a) uncooked, b) cooked for 30 min, c) 60 min, d) 90 min

In effect of prolonged cooking after 90 minutes R_y parameter grows rapidly. After 30 minutes cooking roughness drops by 4%, and after 60 minutes by 10% in comparison to uncooked samples

It is necessary to mention very high deviation of measured cutting resistance. Variation coefficient for any cooking time tested reaches 30%, with standard deviation 32,14 – 46,3 µm.

Table 3 Dependence of surface roughness on cooking time

Cooking time (min)	Profile height (µm)	Standard deviation (µm)	Variation coefficient (%)
0 - suche	117,7	43,0	36,56
30	113,2	37,5	33,14
60	106,0	32,1	30,33
90	154,2	46,3	30,03

Veneers surface quality was additionally elaborated by microscope observation in laser light. Microscopic analysis shows that worst surface quality was obtained after 90 minutes of cooking, as can be seen on fig 4 showing considerable amount of torn and broken grains. Probably after prolonged cooking anatomical elements of wood loose their structural consistency. Best quality was observed after 60 minutes cooking, samples show uniform surface with negligible amount of loose grains.

CONCLUSION

Following conclusions may by withdrawn on the basis of the performed research:

1. Best cooking time for false acacia wood (*Robinia pseudoacacia* L.) equals 60 minutes, after that time lowest cutting resistance and surface roughness of sliced veneers were gained.
2. Hydrothermal processing of false acacia (Robinia pseudoacacia L.) lowers cutting resistance of wood. Resistance in wood cooked for 60 and 90 minutes drops by 17 % in comparison to unprocessed samples.
3. Cooking of false acacia (*Robinia pseudoacacia* L.) causes significant change in coloring. It should be taken into account with veneer production because coloration intensifies in outer layer of wood.

REFERENCES

1. Dobrowolska E.: *Stosowanie drzewnych wiórów wtórnych i gipsu z odsiarczania w półsuchej technologii wytwarzania płyt gipsowo – wiórowych*. Wydawnictwo SGGW, Warszawa 2002
2. Galewski W., Korzeniowski A.: *Atlas najważniejszych gatunków drewna*. Państwowe Wydawnictwo Rolnicze i Leśne, Warszawa 1958
3. Gromadzki J.: *Technologia produkcji oklein i obłogów*. Państwowe Wydawnictwo Rolnicze i Leśne, Warszawa 1969
4. Krzysik F.: *Nauka o drewnie*. Państwowe Wydawnictwo Naukowe, Warszawa 1978
5. Ławniczak M.: *Zarys hydrotermicznej i plastycznej obróbki drewna*. Akademia Rolnicza, Poznań 1995
6. Orlicz T.: *Obróbka drewna narzędziami tnącymi*. Wydawnictwo SGGW – AR, Warszawa 1988
7. Starecki A., Drouet T., Leśnikowski A., Oniśko W.: *Technologia tworzyw drzewnych*. Wydawnictwo Szkolne i Pedagogiczne, Warszawa 1994
8. Szczuka J., Żurowski J.: *Materiałoznawstwo przemysłu drzewnego*. Wydawnictwo Szkolne i Pedagogiczne, Warszawa 1994

Normy:

1. PN-84/D-01005 Chropowatość powierzchni drewna i materiałów drewnopochodnych. Terminologia i parametry
2. PN-77/D-04100 Drewno. Oznaczenie wilgotności
3. PN-77/D-04101 Drewno. Oznaczenie gęstości
4. PN-85/D-97001 Forniry. Okleiny i obłogi. Terminologia. Wspólne wymagania i badania