COST ACTION FP1303 Workshop / Management Committee Meeting

Designing with bio-based building materials – Challenges and opportunities

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INTERIOR DESIGNING WITH THE SURFACE DECORATIVE VENEERS MADE OF BLACK LOCUST (*Robinia pseudoaccacia* L.)

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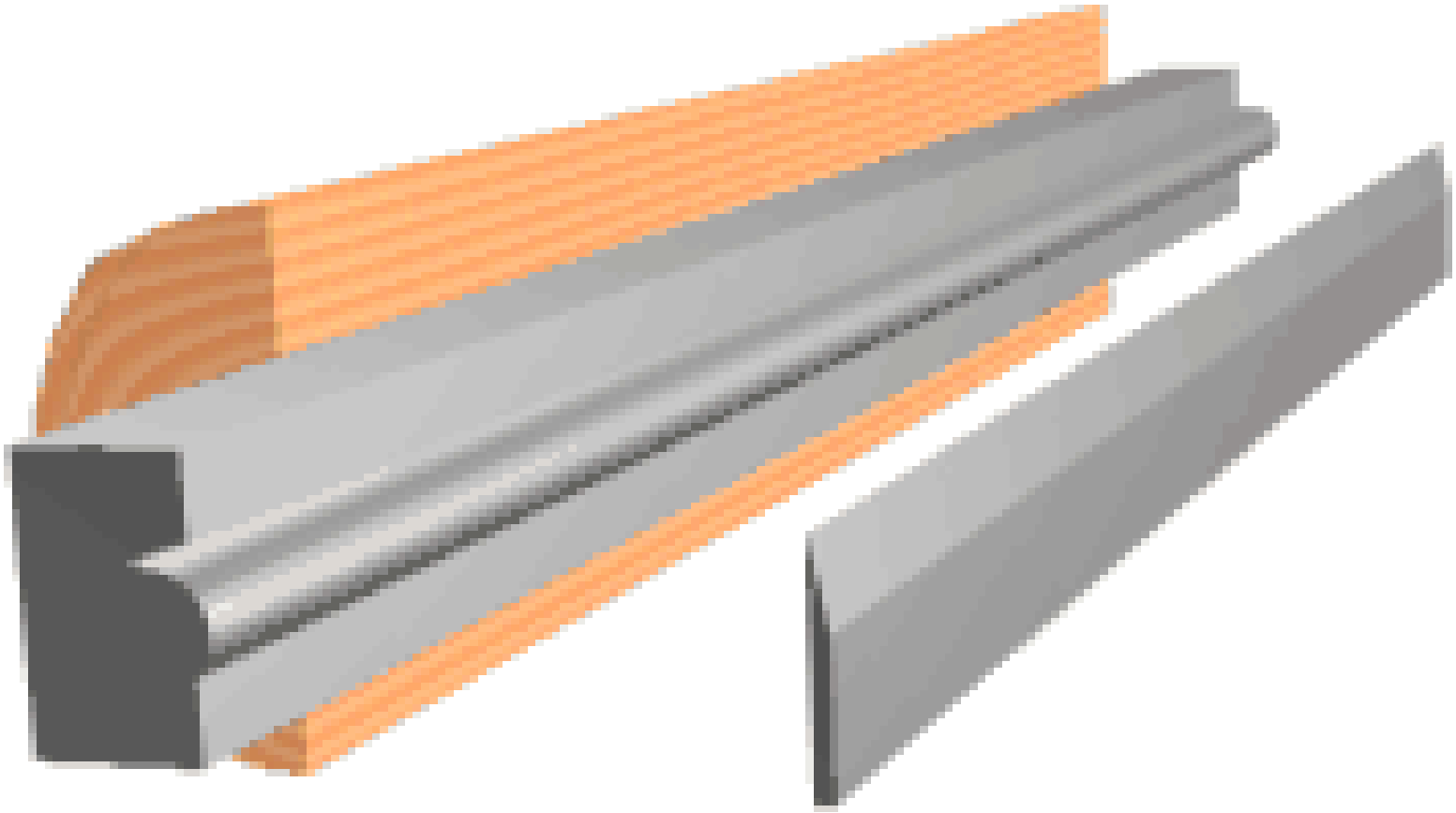
- **Black locust (*Robinia pseudoaccacia* L.)** - interesting species for wood processing worldwide
- fully recommended for the European woodworking industry
- the quality of decorative veneers made from black locust does not differ from the quality of the commonly used veneer for veneering in furniture industry when correct thickness is selected
- In Europe, because of the shortage of the high quality traditional raw material for decorative purposes, it is the time to start to utilize the suitable minor trees from the European forests

- Black locust - an introduced species for Central European wood-processing industry
- introduced to (West and) Central Europe from North America (Pennsylvania, Georgia, Alabama, Arkansas, Missouri, Tennessee, Kentucky, Virginia and West Virginia)
- Black locust is a member of the family *Leguminosae*

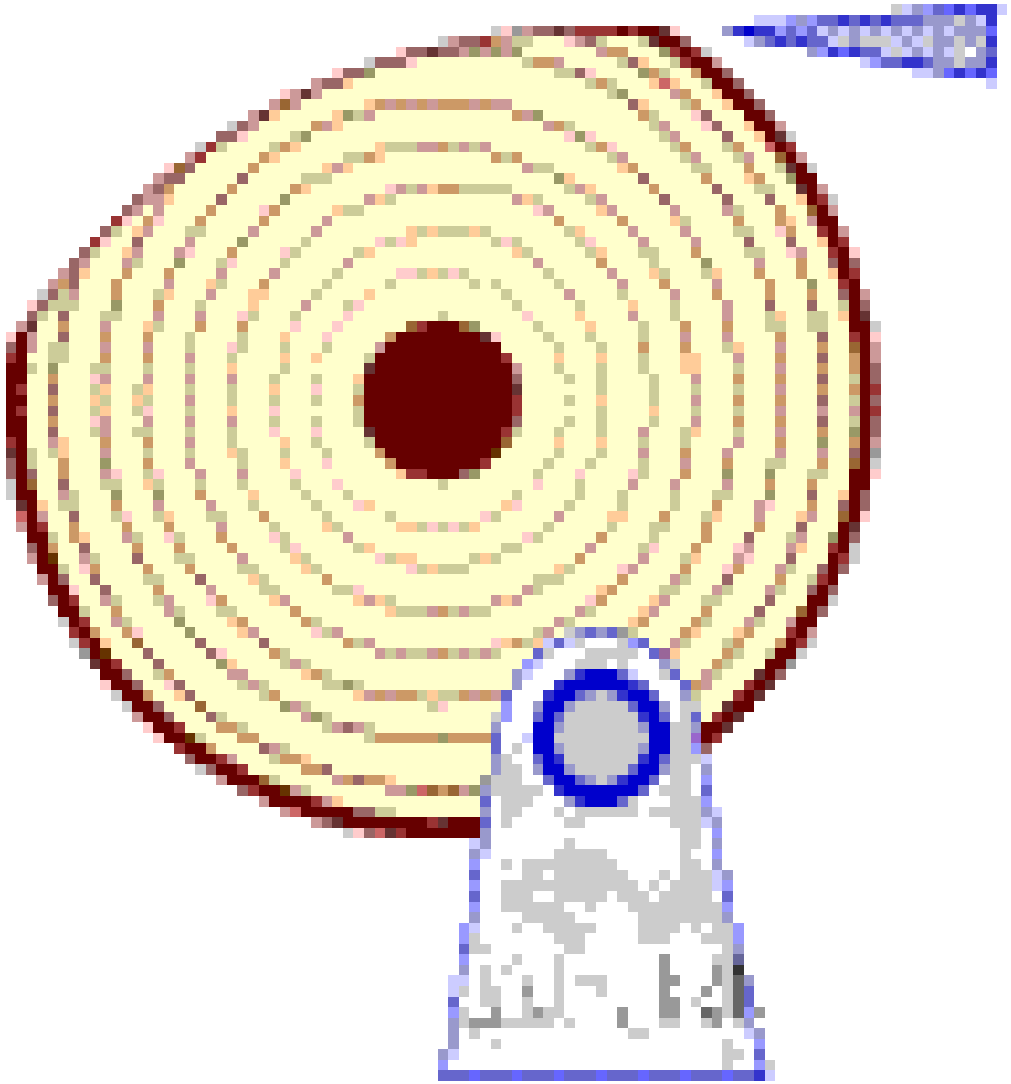
MATERIALS AND METHODS

- raw material for this research - Slovak origin
- from Arborétum Mlyňany
- 6 veneer logs with a length of 138-140 cm and with a diameter of 30 – 36 cm were not conditioned
- veneers were manufactured by off-center rotary cutting in the Development workshops and laboratories of the Technical University in Zvolen (Slovakia)
- new and interesting grains and textures of black locust were obtained
- veneers with the thicknesses of 0.5, 0.6, 0.7, 0.8, 0.9 and 1.0 mm were dried up to a moisture content of 7 ± 1 % by drying at a temperature 130 °C

Off-center rotary cutting



Off-center rotary cutting



- veneers were subjected to a number of technological test procedures
- aim - to determine the most appropriate thickness of off-center cutting (eccentrically peeled) black locust decorative veneer and the values of optimal glue mixture spread which is needed for veneering technology

- **Specific glue penetration to the veneered area**
- it was tested the range from 100 to 200 $g.m^{-2}$
- veneering with urea-formaldehyde glue was carried out under the following conditions:
    - press pressure: 0.6 MPa
    - pressing temperature: 130 ° C
    - pressing time: 4 min

Table 1. Results of the specific glue penetration to the veneered area in dependence on the spread thickness

Veneer Thickness (mm)	Glue Spread ($g.m^{-2}$)								
	140	150	160	170	180	190	200		
0.5	0.75	1.25	1.50	1.50	-	-	-		
0.6	-	-	1.50	1.50	-	-	-		
0.7	-	0.25	0.25	0.25	0.50	0.50	0.75		
0.8	-	0.50	0.75	1.00	1.00	1.75	1.75		
0.9	-	0.50	1.00	1.25	1.25	1.50	2.25		
1.0	-	-	0.50	1.00	1.75	1.75	2.00		

- no substantial glue penetration within the spread range 140 – 150 $g.m^{-2}$
- there is no danger of devaluation of the veneered elements
- glue spread 140 – 150 $g.m^{-2}$ was proposed for particleboard

- **Veneer Adhesion to the Particleboard Substrate**
- adhesion between the veneers and the construction material was monitored
- heart of the test lies in the determination of the strength necessary for severing the veneer from the construction material by means of a cylinder made of light metal in a caliber of 19,8 $\pm$ 0,1 mm covered with epoxide glue
- for testing, samples of 50 x 50 mm in size were used

Table 2. Evaluation of Veneer Adhesion to Particleboard Substrate [MPa]

Glue Spread ($g.m^{-2}$)	t = 0.6 mm			t = 0.7 mm			t = 0.8 mm			t = 0.9 mm		
	Ø	min.	max.	Ø	min.	max.	Ø	min.	max.	Ø	min.	max.
100	1,88	1,20	2,40	1,32	0,93	1,88	1,38	1,14	1,59	1,42	1,14	1,61
110	1,33	1,20	1,56	1,76	0,96	2,26	1,32	0,88	1,62	1,74	1,32	2,00
120	1,57	1,38	1,76	1,71	1,36	2,10	1,53	1,27	1,79	1,70	1,25	1,93
130	1,25	0,98	1,43	1,68	1,53	2,03	1,45	1,23	1,69	1,72	1,19	2,14
140	1,83	1,41	2,26	1,67	1,41	1,84	1,88	1,62	2,18	1,75	1,32	1,92
150	1,83	1,53	2,18	1,64	1,17	2,03	1,98	1,36	2,34	1,98	1,40	2,36
160	1,91	1,59	2,28	1,96	1,33	2,34	1,71	1,59	1,88	1,26	0,89	1,46
170	1,71	1,43	1,97	1,31	1,01	1,61	1,31	1,17	1,43	1,87	2,11	1,66
180	1,35	0,91	1,89	1,17	0,75	1,10	1,13	0,89	1,43	1,47	1,56	1,43
190	1,54	1,37	1,79	1,25	0,94	1,48	1,35	0,84	1,59	1,58	1,66	1,49
200	1,78	1,50	2,10	1,22	0,97	1,62	0,99	0,75	1,30	1,36	1,23	1,59

- adhesion of all four veneer thicknesses of black locust to particleboard substrate highly exceeds required value

- Technological Properties of Veneer from the Aspect of Surface Finish

- transparent paints and systems commonly used for finishing in furniture industry
- three-layer particleboard reversibly veneered 300 x 600; 150 x 300 and 100 x 100 mm in size was used
- there exist two reasons for the use of final coating material; aesthetics and protection from the end use environment
- esthetics of the final product varies in many ways, depending upon the selection of the various topcoats available and upon how the final topcoat is handled

- Specimen were regularly subjected to laboratory tests related to the manufacturing's quality:

- **Determination the Local Thickness of the Paint**
- **Determination of the Paint Adhesion by Means of the Screen Method (Cross Hatch)**
- **Determination of the Resistance to Hot Steam**
- **Determination of the Resistance to a Burning Cigarette (Burn Resistance)**
- **Determination of the Resistance to Chemicals and Selected Consume Liquids (Spot Resistance)**

- Technological Properties of Veneer from the Aspect of Surface Finish

- three types of clean topcoats were used:

A. Polyurethane Lacquer LBA 26 + LGA 22 (Milesi)
B. Nitrocellulose Lacquer C 1175 + LGA 22 (Milesi)
C. Water-dilutable Lacquer (Purlet)

- during surface finishing the panel with veneer was sanded to “knock down” any fibers that have been raised by the application of the finishing material and for further the uniformity of the panel surface

- Technological Properties of Veneer from the Aspect of Surface Finish

- technological properties of black locust veneer from the aspect of surface finish were studied with a help of the veneer 0.6 mm thick
- this thickness showed to be a convenient thickness according to the test of specific glue penetration to the veneered area

a. Determination the Local Thickness of the Paint

- results of this test represent mean values from measurements performed at comparable places

Table 3. Evaluation of Paint Thickness

Specimen	**A**	**B**	**C**
Paint Thickness (mm)	**0.1275**	**0.07625**	**0.09625**

b. Determination of the Paint Adhesion by Means of the Screen Method (Cross Hatch)

Table 4. Paint Adhesion by Means of the Screen Method

Specimen	Adhesion Degree				Resulting Adhesion Degree
A	1	1	1	1	A1
B	1	1	1	1	A1
C	1	1	1	1	A1

- all finished types of paints provide adhesion degree A1 independently of the type of paint used pointing to excellent or very good properties of black locust veneers with regard to the paint adhesion

c. Determination of the Resistance to Hot Steam

Table 5. Evaluation of the Paint Resistance to Hot Steam

Specimen	Type of Injury	Intensity of Injury
A	Specimen slightly waved at the edges, No change of color, scalding or blister occurred	1
B	Specimen slightly waved at the Edges, darker color, no blisters	2
C	Specimen slightly waved at the Edges, darker color, no blisters	2

- resistance to hot steam is purely the matter of coating compositions applied
- hot steam did not affect the quality of black locust veneer

CONCLUSIONS

- selected introduced woody species suggest good perspectives in the coming years and the future quality and volume of production may be secured providing systematic and intense tending of forest stands takes places
- black locust is suitable for veneering of composites (particleboard, MDF)
- it is suitable for application in the furniture industry either as a replacement for some commonly used woody species or as a woody species widening the assortment of woody species utilized in furniture industry

Thank you for your attention.

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