PROPERTIES OF PARTICLEBOARDS INTENDED FOR THE PRODUCTION OF COUNTERTOPS

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MOTIVATION

Kitchen furniture is the most cost-effective branch of all industries from the wood furniture manufacturing group (Ellefson et al. 2010). Only in the United States, homeowners remodel upwards of 10.2 million kitchens each year and the cost of purchasing a new countertop account for 10% of kitchen remodelling total cost (Koenig 2017). According to study of The Freedonia Group (2017), global demand for countertops is projected to rise 2.3% annually through 2021, to nearly 500 million square meters, which means a continuous growth in the global production of wood-based boards. However, the manufacturing capacity in wood-based materials industry depends on the access to global resources of timber which is limited. This results from growing deficit of wood, international economic competitiveness, demographic changes etc. The previously-mentioned difficulties lead to search for the new materials that can be used for the particleboards production. The primary purpose of this work was to determine possibility of using sawmill industry by-products to manufacture innovative panels which can be used in the production of countertops.

EXPERIMENTAL

The study involved two types of experimental boards made of sawmill industry by-products (A1 and A2). For comparison purposes, commercial panels widely used for the production of countertops have been used. Properties of all variants of the tested panels are shown in Table 1.

Table 1. Properties of tested particleboards

Symbol	Type	Average thickness [mm]	Average density [kg×m^{-3}]	Type of finish
A1	Experimental	30	700.14	Raw surface
A2	Experimental	30	584.13	Raw surface
A3	Commercial	38	586.49	Raw surface
A4	Commercial	28	621.13	Raw surface
A5	Commercial	29	625.12	Laminated

The manufactured experimental panels and commercial particleboards were tested in accordance with the respective standards as listed in the followings: density in accordance with EN 323, swelling in thickness (TS) after 2 and 24 hours in accordance with EN 317, bending strength (MOR - modulus of rigidity) and modulus of elasticity (MOE) in accordance with EN 310.

RESULTS & DISCUSSION

Based on the obtained results it can be concluded that all boards (aspecially those with raw surface) were characterized by a relatively high swelling in thickness after 2 and 24h soaking in water (Fig. 1).

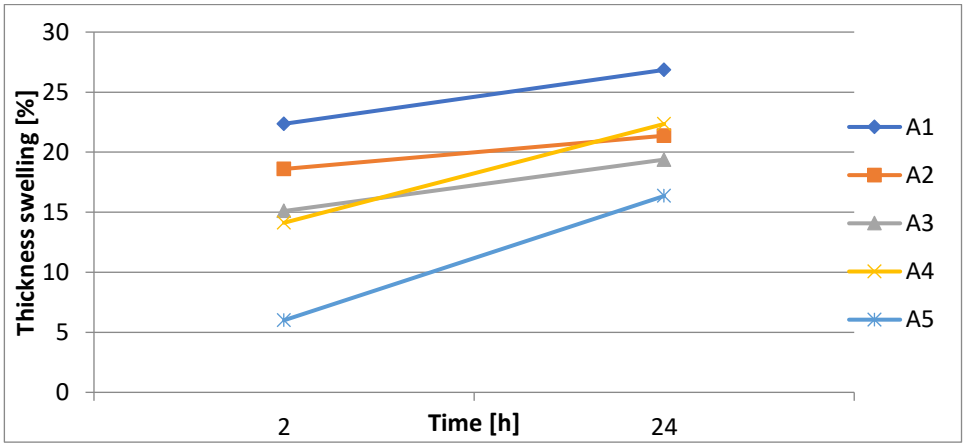

Figure 1. Thickness swelling after soaking in water

It seems that recorded values of swelling in thickness are typical for boards manufactured with no hydrophobic compounds added (Mirski et al. 2012). In the case of experimental panels, it was found that higher density boards were characterized by a larger thickness swelling. Moreover, covering the surface with a laminate effectively reduced the thickness changes due to soaking in water. As future works it would be interesting to analyze the effect of finishing the surface of the experimental panels.

On the basis of data presented in Table 2 it was found that the mechanical properties such as bending strength and modulus of elasticity of experimental panels were slightly worse compared to commercial boards.

Table 2. Modulus of elasticity and bending strength (MOR) of tested panels

Symbol	Average density [kg×m^{-3}]	MOE [N×mm^{-2}]	MOR [N×mm^{-2}]
A1	717.92	2235.14	8.57
A2	592.91	1107.43	4.14
A3	601.77	2407.92	9.50
A4	636.59	2803.33	12.27
A5	634.03	2767.11	9.71

Studies revealed that reduction of density in case of experimental boards caused a decrease in bending strength and modulus of elasticity by approx. 50%. The best results were obtained for particleboard with a thickness of 28 mm and unfinished surface. Moreover, contrary to thickness swelling results, the surface finish didn't have a significant impact on the mechanical properties of panels.

CONCLUSIONS

Research have shown that both experimental and standard panels were characterized by high swelling in thickness after soaking in water. The recorded values were much higher than those recommended by the standard. Perhaps the application of any hydrophobic agent e.g. paraffin emulsion would make it possible to decrease their swelling in thickness (Mirski et al. 2012). The experimental panels had worse mechanical properties compared to commercial particleboards. Furthermore, decrease of their density by approx. 100 kg/m^3 led to a significant reduction of bending strength and modulus of elasticity.

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