Physical and mechanical properties of thermo-mechanically densified Poplar

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The main aim of the presented research work was to enhance the technical performance of the poplar wood (*Populus x euramericana cv. 'Pannonia'*). Poplar plantations with high growing rates deliver valuable raw material for different sectors in the wood industry (plywood, WPC's, construction wood, and even solid wood for different applications). However there are some disadvantageous properties like low mechanical strength, low surface hardness, and nevertheless the unexciting texture and appearance. The last mentioned properties restrict the use of poplar in many fields of applications, e.g. the furniture and the flooring industry. By upgrading the unfavourable properties of poplar wood new and very promising applications could be defined.

The idea of our research was to enhance the surface hardness, and the colour of poplar wood in other to make it suitable for furniture industry (fronts) and flooring (parquet).

Thermo-mechanical densification schedules using different temperatures (160°C, 180°C, 200°C), densification grades (15%, 30%, 45%), and durations (15 min, 30 min, 45 min) were applied to poplar wood.

After the treatments the colour, the average density, the density profile, moisture related properties, modulus of rupture and the surface hardness were analysed.

The colour of the surface became more and more vivid by longer durations and higher temperatures. The well visible changes are reflected in the CIELab colour coordinate as it follows: Δa^* (0 -+6), Δb^* (+3 -+6), ΔL^* (0 - -22). The total colour change ΔE reached values ranging from 4 to 25.

The density of the surface could be enhanced significantly, whilst the density in the core of the boards changed only small extent. The higher densification rate resulted in higher swelling, but no clear influence of temperature and duration of densification could be proved. A major positive result is the upgrading of the surface hardness, as the values could be raised by 60-130% (ca. 9 MPa for control and ca. 21 MPa for densyfied wood). The MOE could be increased by 15-60%.