COLOR CHANGES IN SPRUCE WOOD DURING HEATING

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INTRODUCTION

Color is a very important characteristic of wood. The wood is usually used in its natural color or as well as with color treatment. In addition, the color can be changed by modifying wood structure of its main components (cellulose, hemicellulose and lignin) - mainly due to heat, humidity, light, or ultraviolet radiation. Those technologies are more environmentally friendly as chemical technology1-4. Technological processes where heat plays a major role are used for heating, drying and steaming wood. Arising from chemical changes in the structure of the wood have an impact on change of strength, density, modulus of elasticity in tension and bending5. Good correlation was found between mechanical properties and color of wood6.

COLOR AND COLOR DIFFERENCES

To quantify the color is most often used colorimetric system \( L^* a^* b^* \) (CIELAB). This color space is based on the fact that a color can't be simultaneously red and green (or blue and yellow), because these colors are opposite each other. Model of this system consists of three mutually perpendicular axes: axis \( L^* \) - determines the lightness, axis \( a^* \) - determines the ratio of red to green and axis \( b^* \) - specifies the ratio of yellow to blue (Fig. 1). To assess the difference of two colors is used total color difference \( \Delta E^* \), expressing the distance between two points in the CIELAB:

\[
\Delta E^* = \sqrt{\Delta L^*^2 + \Delta a^*^2 + \Delta b^*^2}
\]

where \( \Delta L^* \), \( \Delta a^* \), \( \Delta b^* \) are differences in individual axes (difference between the value measured after heating the sample and the reference sample).

MATERIAL AND METHODS

Experimental samples of spruce (Picea abies L.) with size: 8 x 10 x 120 mm (thickness x width x length), were obtained by tangential cut from trunk of the tree. Samples were conditioned to 12 % absolute humidity. Heating was carried out in the heating chamber for 90 minutes at temperatures of the 20, 113, 134, 158, 187, 221, 237, 253 and 271 °C. The color changes were measured using a spectrophotometer Minolta CM 2600D. Color values are expressed in CIELAB colorimetric system.

RESULTS AND CONCLUSIONS

The thermal treatment of wood leads to changes in its main components what considerably depends on the applied temperature. The results obtained show that significant color changes occur at temperatures above 160 °C. Now is the gradual degradation of the polysaccharide share - especially hemicelluloses, as shown by chemical analysis. Cellulose and lignin are thermally more resistant. Color differences correlate well with changes in the bending strength and in the modulus of elasticity7, which is consistent with the results of other authors8.

REFERENCES


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