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PINE WOOD DIFFUSION COEFICIENT DEFINITION

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Diffusion coefficients, witch characterize water moving intensive inside wood, take a great place in the drying kinetic calculation. These coefficients were estimated for species, witch had grown in northern areas than Ukraine [1, 3, 4]. Just for the same species were worked out drying schedules [2]. Yet achieve quality and economy based drying today is so hard even by using soft schedules. Therefore definition of diffusion coefficients of Ukrainian pine wood is actually.

For this purpose method of conductivity wetting, which include additional experiments for wood hygroscopicity limit definition and main experiments for diffusion coefficients was used.

According to these procedure two types of species were used – first (8 species for each experimental temperatures in 3 x 30 x 50 mm sizes) for additional experiments and another (9 species for each experimental temperatures in 5 x 50 x 70 mm sizes) for main experiments.

Conventional diffusion coefficients for all species were calculated under formula:

$$a'' = \frac{\pi S^2}{16\tau}\left(1-\overline{E}\right)^2, \qquad (1)$$

were S – species thickness, sm; τ – experimental time, hour, $\overline{E}$ – dimensionless moisture:

$$\overline{E} = \frac{W_{м.г.} - W_x}{W_{м.г} - W_{поч.}}, \qquad (2)$$

were W_{hl} – moisture of hygroscopicity limit, %; W_{in} – initial species moisture, %; W_f – final species moisture, %.

Real diffusion coefficient:

$$a' = \frac{(S_2 - S_1) \cdot \overline{a}_2'' \cdot \overline{a}_1''}{S_2 \cdot \overline{a}_1'' - S_1 \cdot \overline{a}_2''}, \qquad (3)$$

were $\overline{a}''_1$ and $\overline{a}''_2$ – average conventional diffusion coefficients for two different species thickness sizes.

As the result of experimental investigations the relationalship of pine wood hygroscopicity limit $W_{h.l.}$ from temperature range $t = 25,40,60,80$ ° C was obtained: $W_{hl} = 89,2t^{-0,19}$ .Wood pine diffusion coefficients in tangential a_t' and radial a_r' directions and its relationalship from the same temperature were defined: $a_t' = 0,082t^{1,076}$. Correlation between diffusion coefficients in tangential a_t' and radial a_r' directions is $a_p' / a_m' = 1,25$.

With the help of obtained diffusion coefficients were calculated drying kinetics curves of pine saw timber 50 mm thickness. Comparison with experimental drying kinetics curves of the same saw timber was shown the large distinction. The calculated drying period was lesser more than 35 % than experimental. It connects with the simpler description of drying process with the help of diffusion equation.

Results of our investigations were used in elaboration of pine saw timber schedules and engineering calculated drying duration method for low temperatures chambers.