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Characterization of Sorption Behavior and Mass Transfer Properties of Four Central Africa Tropical Woods

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Abstract : This study provides the sorption isotherm, its hysteresis and their mass transfer properties of four Central Africa Tropical woods largely used for building construction: frake, lotofa, sapelle and ayous. Characterization of these three species in particular and Central Africa tropical woods, in general, was necessary to develop conservation and treatment of wood after first transformation using the drying. Isotherms were performed using a dynamic vapor sorption apparatus (Surface Measurement Systems) at 20 and 40°C. The mass diffusivity was determined in steady state using a specific vapometer. Permeability was determined using a specialized device developed to measure over a wide range of permeability values. Permeability and mass transfer properties are determined in the tangential direction with a 'false' quartersawn cutting (sapelle and lotofa) and in the radial direction with a 'false' flatsawn cutting (ayous and frake). The sample of sapelle, ayous and frake are heartwood when lotofa contains as well as heartwood than sapwood. Results obtained showed that the temperature effect on sorption behavior was low than relative humidity effect. We also observed a low difference between the sorption behavior of our woods and hysteresis of sorption decreases when the temperature increases. Hailwood-Horrobin model's predicts the isotherms of adsorption and desorption of ours woods and parameters of this model are proposed. Results on the characterization of mass transfer properties showed that, in the steady state, mass diffusivity decreases exponentially when basal density increases. In the phase of desorption, mass diffusivity is great than in the phase of adsorption. The permeability of ours woods are greater than Australian hardwoods but lower than temperate woods. It is difficult to define a relationship between permeability and mass diffusivity.

Keywords : tropical woods, sorption isotherm, diffusion coefficient, gas permeability, Central Africa
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