Drying Kinetic Of Chilean Coigüe: Study Of The Global Drying Coefficient

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ABSTRACT

A one-dimension phenomenological wood drying model has been used to describe Chilean coigüe ***Nothofagus dombeyi*** conventional drying kinetic. This model is based on a global mass transfer coefficient K_x, and consists on four first class coupled differential equations, which are solved as an initial value problem. With the purpose of having K_x determined, four drying cycles were performed, thus varying wood thickness and drying air velocity. The model suitably predicted the moisture transient behavior during the coigüe wood drying. K_x varied with wood thickness, but did not regarding air velocity. This coefficient value ranged from $1.87 \bullet 10^{-5}$ and $3.37 \bullet 10^{-5}$ ($kg.m^{-2}. s^{-1}$). A preliminary running of a 100 m^3 filling up rate industrial dryer showed that the model accurately represented the average moisture content during drying. In such a case, the optimized K_x coefficient turned out to be $5.55 \bullet 10^{-6}$ $kg.m^{-2}. s^{-1}$.

Keywords: Drying rate, global mass transfer coefficient, *Nothofagus dombeyi*, Chile.

INTRODUCTION

The Chilean coigüe features a high commercial and industrial interest; however, this type of lumber drying has been limited by defects and collapse trends (Kauman and Mittak, 1964; 1966). The wood drying modeling led to the optimization of the industrial process. A simple drying modeling that applies to the wood industry would make the drying cycle time reduction possible and the achievement of better quality in dry wood possible.

Related literature shows many drying models which are based on transport phenomena, as well as on diffusion and phenomenological laws. Transport models include a greater amount of physical information about the drying phenomenon through mass and heat transfer equations than other models (Perré and Degiovanni, 1990; Turner, 1996; Perré and Turner, 1999). These drying models provide a clear description of what actually happens to wood piece, while helping to the understanding of wood drying behavior. Drying modeling of the whole stack by using phenomenological models best describes the industrial drying process (Ananías *et. al.*, 2001 a).

A simple phenomenological wood drying model may be featured by a global mass transfer coefficient (Karabagli *et. al.*, 1997). Such global mass transfer coefficient K_x includes internal moisture movement through the wood, as well as the mass transfer from wood surface to drying air flow. Consequently, it depends both on wood characteristics and drying parameters (Chrusciel *et. al.*, 1999).

This current research work shows drying kinetics represented by the differential equations system that have been introduced by Karabagli *et. al.* (1997). It requires the experimental setting up of K_x global mass transfer coefficient, for which sample data are collected. The purpose of this work is to state the Chilean coigüe drying kinetics by means of a phenomenological model.

MATHEMATICAL MODEL

The model states that drying rate turns out to be a linear function of the drying potential (MC-EMC) and a factor of proportionality characterized by the global mass transfer coefficient, which has been considered as a constant during drying. This hypothesis was also verified by Ananías *et. al.* (2001 b).

The model assumes that mass transfer and enthalpy take place in one direction, while the initial moisture content is homogenous and air distribution inside the