Continuously Varying Schedule (CVS) – A New Technique in Wood Drying

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Summary. The high potential of marketing dry wood encourages the study of the possibility to kiln dry green hardwood. Description of the technical details of three drying processes and their differences are discussed. One of the processes is recently developed, and is called “Continuously Varying Schedule”. Three drying tests were carried out using each process to dry green 100×50 mm quarter and back sawn *Eucalyptus laevoinea* and *E. agglomerata*. The Continuously Varying Schedule and the Continuously Rising Temperature processes reduced the drying time to one third that of the Conventional process. Recovery in volumetric shrinkage for samples dried by the Continuously Varying Schedule was not significantly different from those dried by the Conventional Schedule, but different at the 5% confidence level from those dried by the Continuously Rising Temperature.

Introduction

Recently the Australian market shows an increasing preference toward dried timber. A general recognition of the manner and care used in the drying process, improves the value of the dried timber. The technical progress in kiln drying made it possible to dry softwood species from the green condition. Drying of green hardwoods is still associated with some problems – especially the dense species – this initiated a research investigation to achieve economical kiln drying for green hardwood.

Bibliographic work led us to the “Continuously Rising Temperature” (CRT) process, developed by Dallas S. Dedrick (U.S. Patent) in the late sixties. This process provides very successful results in drying softwoods in the U.S.A. A description of the basic principles of this process together with the conventional one and the new process, the “Continuously Varying Schedule” (CVS) follows.

Methods

**CRT Process**

Continuously Rising Temperature is an accelerated drying process, starting with the dry-bulb temperature (DBT) inside the kiln as near as practical to the ambient

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temperature. As the drying proceeds the DBT is constantly increased to maintain a substantial temperature gradient between the air in the kiln and the wood surface. In other words, if the temperature of the air entering the wood stack is increased at a constant rate, the rate of air-wood temperature gradient will correspondingly be affected. A DBT rise ranging from \( \frac{1}{2} \) to \( 5\% \) °C per hour is recommended (1 to 3 °C per hour for drying boards above 50 mm thick). It should be remembered that these “rise” ranges were used for drying U.S.A. softwood species. D. S. Dedrick (U.S. Patent) emphasised that laminar flow of air through the stack as the most important factor in the CRT process. That laminar flow is distinguished by a layer of fluid (the air and water vapour mixture inside the kiln) at the wood surfaces, which is substantially stationary. Immediately adjacent to this layer is a second layer which moves at a slow rate. As a result of a slow rate of movement in layer after layer, the main stream of the fluid will move slowly without substantial intermixing between adjacent layers. This will ensure that all of the moisture which is removed from the wood passes into the air layer adjacent to the wood surfaces, and then from there diffuses into the main stream. It follows that the stationary layer of fluid at the wood surface, becomes the region through which all of the moisture escaping from the wood must pass. This layer therefore tends to become more saturated than the main stream of fluid, making it possible to use air having a low relative humidity [i.e. having a high wet-bulb depression (WBD)], while maintaining relatively high humidity conditions at the wood surfaces. When using the CRT process in conjunction with laminar flow there is no need for close humidity control in the sense that moisture is added to the air. However, there is a need for a control device which can open the vents to discharge moisture, if the humidity in the kiln builds up. Therefore there is no necessity for close humidity control when drying softwood species.

Dedrick also emphasised the use of very low air velocities through the wood stack, in the range of \( \frac{1}{2} \) to 1 m/s, with Reynolds number ranging from 1500 to 2000. There is no need to reverse the air direction inside the kiln as this tends to disturb the property of the laminar flow. The rate at which the temperature of the air fluid inside the kiln must be increased is subject to wood species, its quantity and the position of the stack inside the kiln.

**Conventional Kiln Drying Process**

Generally the Australian practice of drying hardwood species is a combination of air and kiln drying or preliminary drying in a predrier followed by kiln drying (Campbell, Hartley 1978). Some of the medium dense hardwoods are kiln dried conventionally from the green condition. Conventional kiln drying was chosen for sake of comparison. This process utilizes close control over the DBT and Wet Bulb Temperature (WBT) of the fluid inside the kiln. Relative humidity is maintained initially high enough to prevent surface checking. Conventional schedules start with DBTs ranging from 45 to 80°C and Wet Bulb Depression (WBD) of 3 to 20°C. The DBT and WBT of the fluid in the kiln are changed according to a set of changes in the mean moisture content (m.c.) of the wood. The first change is when the mean m.c. drops to 60%, then changes are made at m.c.s of