vacuum-kiln-for-drying-lumber-slabs-firewood-using-vacuum-bagging

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Vacuum Dry Kiln for Lumber by Infinity Turbine

This webpage QR code

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Company Name: Infinity Turbine LLC
Product: Vacuum Lumber Dry Kiln Plans, Kit, and Systems
Applications: Quickly dry lumber, pallets, firewood, timber, beams, slabs
Construction: Metal and fittings.
Uses: Drying lumber for homes, timber frame, firewood processing, cabinet makers, turning, dimension lumber and slabs, fiberglass and carbvon fiber composite vacuum bagging
Benefits: 90 percent reduced drying time.

PDF Version of the webpage (first pages)

https://infinityturbine.com/vacuum-kiln-for-drying-lumber-slabs-firewood-using-vacuum-bagging.html

Vacuum Kiln for Fast Drying Fresh Cut Lumber in 3 Days

Infinity Turbine with Global Energy are developing DIY plans and kits for kiln vacuum drying lumber. I invented the Global Container Kiln back in 1990 by converting standard shipping containers into dry kilns for the small sawmills. Infinity Turbine has specialized in developing simple pressure vessels and systems with it's renewable waste heat turbine generators back in 2008, and has extensive experience in pressure vessels. It's a natural fit.

Why a vacuum kiln ? Lumber prices are crazy. Homebuilders cannot find quality lumber (supplies are limited), and have turned to buying a port)able sawmill, which produces green lumber. For building, that lumber needs to be dried. This is also true for cabinet makers, and other wood craft business.

Our container kiln was a standard dry kiln and could KD (kiln dry) hardwoods in 30 days. That's too long for most.

Smaller chambers can dry in 3 days or less.

Using a new technique called vacuum bagging for drying lumber may be the answer.

The Impact of Vacuum-Drying on Efficiency of Hardwood Products Manufacturing (Thesis)

It was determined that vacuum drying quality was equal or better than conventional drying with less checking, end splits, drying stress and shrinkage.

Compared to conventional drying, vacuum drying times with air drying and without air drying were 67% less and 70% less, respectively.

Conventional and vacuum with no air drying scenarios were determined to be financially feasible when compared using Net Present Value and Internal Rate of Return analysis.

However, vacuum drying with no air drying had better NPV and IRR values than conventional drying. The scenario of vacuum with air drying was not feasible.

Two case studies, each employing the three drying scenarios (conventional drying, vacuum with air drying, and vacuum without air drying), were used to determine the impact of cycle times and work in process.

It was determined that the cycle times for vacuum drying were 87% and 95% less than conventional drying for the first case study and 51% and 90% less than conventional drying for the second. WIP was 48% and 84% less in the first case study and 43% and 92% less than conventional drying for the second. Cycle time was reduced by 87% and 51% for Plant C and D, respectively.

Finally it was determined that the reduction of WIP represented a cost saving of 73% and 76% for the two case studies. The reduction in costs, faster drying rates, and equal quality, and reduced cycle times make vacuum drying a potential technology available for improvement of the competitiveness for flooring manufacturers.

Evaluation of super-heated steam vacuum drying viability and development of a predictive drying model for four Australian hardwood species

The results of drying trials show that vacuum drying produces material of the same or better quality than is currently being produced by conventional methods within 41 to 66 % of the drying time, depending on the species. Economic analysis indicates positive or negative results depending on the species and the size of drying operation. Definite economic benefits exist by vacuum drying over conventional drying for all operation sizes, in terms of drying quality, time and economic viability, for E. marginata and E. pilularis. The same applies for vacuum drying C. citriodora and E. obliqua in larger drying operations (kiln capacity 50 m3 or above), but not for smaller operations at this stage. Further schedule refinement has the ability to reduce drying times further and may improve the vacuum drying viability of the latter species in smaller operations.

12/3/2024

Introduction

Drying timber to produce material for high quality applications is an expensive and time- consuming operation. It is often referred to as the bottleneck of the production process. The drying process consumes approximately 70% of the energy required to convert green logs into dried, value added products. Additionally, estimates suggest that up to 10% degrade occurs in dried wood due to the drying process because of checking, collapse, distortion, and moisture variation. Over the years the timber industry worldwide, in conjunction with researchers, engineers and manufacturers, have strived to dry quality timber as quickly and cheaply as possible to maximise profitability. Therefore, the timber industry pursues any technologies that can improve the quality and reduce timber drying times and costs.

Back in the Old Days

Author:Telford, C. J. (Clarence John), 1887 Subject:Sawmills Handbooks, manuals, etc. , Woodworking machinery Handbooks, manuals, etc. Format:iii, 121 p.Language: EnglishPublisher:U.S. Dept. of AgricultureYear: 1952 Series: USDA agriculture handbooks

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Characteristics of Timbers Dried Using Kiln Drying and Radio Frequency- Vacuum Drying Systems

Heavy hardwoods are difficult-to-dry timbers as they are prone to checking and internal stresses when dried using a conventional kiln drying system.

These timbers are usually dried naturally to reach 15% to 19% moisture content with an acceptable defects. Besides long drying time, timbers at these moisture contents are not suitable for indoor applications since they will further dry and causing, for example, jointing and lamination failures.

Drying to a lower moisture content could only be achieved in artificial drying kilns such as conventional kiln, dehumidification kiln, solar kiln, radio frequency-vacuum, etc.

The objective of this study was to evaluate the characteristics of 30 mm and 50 mm thick kekatong (Cynometra spp.) timber dried using kiln drying (KD) and radio frequency-vacuum drying (RFV) system. The investigation involved drying time, moisture content (MC) variations between and within boards, drying defects, shrinkage, and drying stress.

Drying defects include checks (surface, end, and internal checks) and warping (bowing, cuping, spring, and twisting). The results showed that RFV drying time was reduced to 50% compared to the KD.

RFV dried boards demonstrated a more uniform MC between and within boards. Shrinkage in width and thickness, as well as tangential/radial and volumetric shrinkages were substantially less in RFV boards. The amount of cupping, bowing and spring were very low and negligible in all drying runs.

There was no twisting observed in all drying methods. The number of stress-free RFV board was higher than KD. With proper procedure, the RFV technology could be used for drying heavy hardwoods which are difficult to dry in conventional kilns due to excessive drying times and degradation.

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Vacuum Kiln Drying Manual

Vacuum drying presentation by Vacutherm.

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State of the Art in Vacuum Drying

Vacuum drying is not a new technology, and its use for drying wood has been sug- gested since the early 1900s. Technologies for vacuum drying of wood can be classified by the heating method used. In this paper, we define vacuum-drying methods in four groups: conductive heating vacuum, cyclic vacuum, superheated steam vacuum, and dielectric vacuum. Advantages of drying wood below atmospheric pressure are the ability to dry at lower temperatures (and thus low- er the probability of developing some drying defects), greatly reduced drying times, color preservation, greater energy efficiency, better control of volatile organic com- pound emissions, and the ability to dry very large cross sections. Some characteristics that differentiate vacuum from conventional drying are that in vacuum the primary driving force is the total pressure difference, the prevail- ing moisture transfer mechanism is water vapor bulk flow, and there is greater water migration in the longitudinal direction. While past research has focused on increasing the understanding of the fundamental mechanisms for vacuum drying and applications to specific industries and species, more recent efforts have concentrated on im- proving existing methods, for example, by improving moisture control and the use of pretreatments to improve drying quality.