TECHNICAL NOTE

The Chinese Treated Wood Market: Current Status and Future Perspectives

Xiaozhi (Jeff) Cao
Jeffrey J. Morrell
Eric N. Hansen

Abstract

The Chinese market represents good opportunities for those interested in exporting building materials, including wood products. One growing building material sector is preservative-treated wood. Fewer than 70 treatment facilities operated in China in 2002 compared with more than 600 currently operating. Sizable quantities of treated product are also imported. China's status as a net wood importer creates sizable opportunities for importers seeking to expand into this market. This article reviews the current status of the treating industry in China, identifies issues related to quality control and the implementation of standards, and outlines critical needs for the continued growth and success of the industry.

Since the economic reform and open-door policies launched in the early 1980s, China's gross domestic product (GDP) has grown between 5 and 15 percent annually. China's nominal GDP reached US$5.9 trillion in 2010. In terms of purchasing power parity, the GDP was estimated to be $11.2 trillion, making China the world's second-largest economy after the United States (World Bank 2010). Coupled with GDP growth has been an ever-increasing demand for materials, including a variety of wood products. Imports of logs, lumber, plywood, and veneer increased from 5.5 to 49.3 million m^3 between 1995 and 2010, making China the world's second-largest wood importer ($6.1 billion) after the United States ($6.8 billion) and the largest wood exporter ($5.5 billion), followed by Canada ($5.0 billion; Global Trade Atlas [GTA] 2012). This trade deficit also represents China's first trade shortfall in wood products since 1995 when Chinese wood products exports took off (GTA 2012).

China uses large quantities of wood in both decorative and structural applications including increasing volumes of preservative-treated wood. China has a long history of using treated wood for industrial applications. A tie treating plant was first established in 1911 (Chen 2010). Recently, however, there has been a shift in the use of treated wood from industrial applications, such as railway ties, pilings, and timbers, to more residential uses, such as landscaping, park bridges, and decking. This has markedly altered the characteristics of the industry, but it has also stimulated rapid growth. There were an estimated 70 wood preserving plants in operation in 2002, compared with more than 340 in 2008 (Chen 2010). Recent estimates suggest that more than 600 companies treat wood, although many are small operations (<20,000 m^3/y). More than 110 of these plants are located on Hainan Island in South China and treat rubber wood, while most of the remainder are located in major cities in the more well-developed coastal regions (Chen 2010). The Chinese Wood Protection Industry Association, officially established in October 2011, is expected to assume many mediating responsibilities, such as developing and enforcing quality standards and enhancing communications among companies, to help the industry grow more sustainably (W. Dang, personal communication, October 16, 2011).

The rapid growth of the Chinese treated wood industry has created tremendous demands for imported white wood (untreated), treated wood, and chemicals (Preston and Jin 2008). At the same time, the growth has created a certain amount of chaos in the marketplace that has the potential to hamper future demand for imports. Understanding the

The authors are, respectively, Research Associate, Asian Inst. for Energy, Environment and Sustainability (AIEES), Seoul National Univ., Seoul, South Korea (caoxz@snu.ac.kr [corresponding author]); and Professor (jeff.morrell@oregonstate.edu) and Professor of Forest Products Marketing (eric.hansen2@oregonstate.edu), Dept. of Wood Sci. and Engineering, Oregon State Univ., Corvallis. This paper was received for publication in October 2011. Article no. 11-00120.

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market as well as the forces that affect it will be essential for those seeking to enter the market. In this review, we use the results from interviews with designers of wood structures, treaters, agencies attempting to develop specifications, and academics involved in the evaluation of treated wood to analyze the potential for creating new opportunities for preservative-treated wood in China.

Identifying these opportunities, however, is difficult. At present, there is no single body that collects statistics for production of treated wood, nor are there uniform national standards. In order to help generate information on market opportunities in China for wood producers, we undertook the following study based on four separate export promotion-oriented trips to China and on-the-ground insights and experiences. Interviews were undertaken from 2006 to 2011 concentrating on Beijing, Shanghai, and Nanjing. In some cases, interviewees were sent a short questionnaire in advance, and this document served as a template for the interview. In other cases, an interview protocol was developed and followed without providing it to interviewees beforehand. In all cases, additional questions were asked on the basis of the answers provided. Additional data were gleaned from trade statistics, visits to trade shows, and home improvement centers in China.

Species Used

The market for treated wood in China is dominated by scots pine (*Pinus sylvestris*) and southern yellow pine that grows in the southern United States, which includes mainly four species: longleaf (*Pinus palustris*), shortleaf (*Pinus echinata*), loblolly (*Pinus taeda*), and slash (*Pinus elliottii*) pines. Initially, however, the market for treated wood for residential/landscape uses in China was heavily influenced by the Europeans (R. Chen, personal interview, April 18, 2011). High-grade, chromated copper arsenate (CCA)–treated scots pine (also known as Russian pine in the marketplace) was originally imported by Finnforest and could be found in many do-it-yourself retailers. Although it did not appear to develop a sizable market, it did convince potential users of the value of treated wood. At the same time, Taiwanese businessmen began to import CCA-treated southern pine lumber from the United States. This material developed an excellent reputation for quality and is relatively easily treated, and most treaters interviewed expressed an interest in obtaining more untreated lumber. According to US Department of Agriculture statistics (Foreign Agriculture Service 2012), between 2005 and 2011, China's total imports of US southern yellow pine logs grew from 2,546 m^3 (ca. 1 million board feet [MMBF]) to 111,070 m^3 (ca. 47 MMBF), while untreated southern yellow pine lumber grew from 6,938 m^3 (<3 MMBF) to 89,033 m^3 (ca. 38 MMBF). Total imports of treated softwood lumber (primarily southern yellow pine) increased from 2,265 m^3 (0.96 MMBF) in 2007 to 4,009 m^3 (1.7 MMBF) in 2011. Recent declines in US timber prices, plus an appreciating Chinese yuan (CNY) against the US dollar (USD; over 30% change from roughly 1 USD = 8.3 CNY in July 2005 to 6.3 CNY in December 2011), have helped Chinese buyers source more of the material from the United States.

A major problem with the use of untreated southern yellow pine in China (as well as nearly all lumber manufactured in the United States), however, is lumber size. Nearly all southern yellow pine is cut to American dimensions. Since Chinese designers draft building plans in metric units, they must convert US dimensions to incorporate the products into their designs. This increases the complexity of work and the time required to prepare the drawing. Schedules in China's booming construction market are tight, and developers are reluctant to modify their construction schedule to incorporate the lead times required for the product to arrive from the United States. Instead of importing untreated southern yellow pine lumber, many Chinese treaters with sawmill facilities prefer to import cants or logs and cut their own lumber as a way to reduce costs, improve overhead, shorten lead time, and produce custom sizes to meet customer specifications.

Price appears to be the major drawback of US treated southern yellow pine imports in the highly price-sensitive Chinese market. According to industry expert estimates, US treated southern yellow pine costs approximately US$125 per m^3 more than Chinese treated southern yellow pine. Southern yellow pine treated in China sells for US$625 to US$750 per m^3 (RMB 5,000 to 6,000 per m^3), whereas US treated products are priced at US$750 to US$875 per m^3 (RMB 6,000 to 7,000 per m^3).

By comparison, scots pine is readily available and inexpensive; however, the majority of Chinese treating plant operators viewed scots pine as an inferior species. The species contains a high percentage of heartwood that makes it much more difficult to treat. This increases the time required to achieve adequate penetration of preservative, reducing treating plant competitiveness. Relatively little scots pine is currently kiln dried, and most treating plants lack the space required to air season lumber sufficiently to allow for treatment. As a result, most scots pine observed by the authors was treated while nearly green, producing inadequately penetrated material that is likely to perform poorly. Many treaters do extensive posttreatment fabrication that removes large percentages of the shallow treatment. This reduces the value of treatment and leads to poor performance. Much of the scots pine resource also arrives at the treating plant with existing stain and mold because of the time it remains wet between felling and treating. These issues have given scots pine a poor reputation in the marketplace, although it remains the most commonly treated wood species in China because of its low cost.

An ancillary issue with scots pine has been the Russian government policy regarding log export taxes. Increases in Russian log export taxes since 2008 have led many Chinese wood companies to set up sawmills just across the border in Russia (Tian 2008). As a result, Russia's lumber supplies to China surged from less than 2 million m^3 in 2008 to over 6 million m^3 in 2011 (GTA 2012). Russia became a member of the World Trade Organization in December 2011, and industry analysts expect that the Russian government will lower log export tariffs but at the same time will impose a log export quota, so the general trend of increasing lumber and declining logs from Russia into China will unlikely be changed (Ekstrom 2012).

While southern yellow pine and scots pine currently dominate treated wood markets in China, there is interest in other species such as spruce–pine–fir (SPF) from Canada and hem–fir from the United States. SPF refers to a group of softwood species that grow in Canada, including white spruce (*Picea glauca*), Engelmann spruce (*Picea engelmannii*), lodgepole pine (*Pinus contorta*), alpine fir (*Abies lasiocarpa*), and other species. However, compared with southern yellow

pine, SPF is difficult to treat. Similarly, hem–fir is a species combination that consists of western hemlock (*Tsuga heterophylla*) and a variety of firs, such as noble fir (*Abies procera*), California red fir (*Abies magnifica*), and white fir (*Abies concolor*). While hem–fir is less difficult to treat than SPF, it still requires more treatment time than southern pine. The tendency for extensive posttreatment fabrication also mitigates against the use of SPF or hem–fir unless the treaters choose to prefabricate and then kiln dry after treatment to control warping and checking. At present, there is little incentive to perform these steps because the consumer is either unaware of what constitutes quality treatment or unwilling to pay for it.

Chemicals Used

Interviews revealed that the vast majority of wood was treated using CCA with some treaters using alkaline copper quaternary compounds (ACQ). CCA was preferred by most treaters because of its lower cost, while ACQ was often used in government projects where price was less critical. Most treaters claimed to use standards of the American Wood Protection Association (AWPA) for these systems; however, we saw no evidence that plants had access to X-ray fluorescence analyzers that would allow them to perform regular solution analysis. Some plants said that they periodically sent solutions to outside laboratories for analysis. At least one treater was working on metal-free preservatives containing triazole compounds. In addition, many treaters offered so-called heat-treated wood. In some instances, this wood was prepared by burning the wood surface and then brushing or sandblasting off the char. Since the char tended to affect the early wood more deeply than the latewood, this added some topography to the surface that made it more attractive to consumers. There was no evidence that this material was any more durable than untreated wood, and one treater stated that it would last for 3 to 5 years in nonsoil contact. Douglas-fir was one of the preferred species for this application, and this moderately durable heartwood would likely provide that service life without treatment in most locations in China (Scheffer and Morrell 1998). This treatment should not be confused with the thermal treatments currently used in Europe in which wood is heated at various temperatures to alter the color and moisture behavior of the finished product. We visited at least one plant that did claim to produce thermally modified wood; however, it was using primarily a naturally durable heartwood (merbau, *Intsia bijuga*), and it was unclear how the results translated into improved durability. The other treatment mentioned in interviews was acetylated wood. Acetylation has been extensively studied in Europe and is not a new technology (Rowell et al. 2008). It is generally more costly than traditional treated wood; however, it may be attractive with consumers who do not want to use pesticides. A large acetylation facility is being built in Nanjing and is expected to start operating at full capacity in early 2013. Currently, acetylated wood from Europe is sold to higher-end projects in China, Japan, and other Asian states. This local facility may reduce the cost for this material; however, given the price sensitivity of most Chinese specifiers, it will be difficult for acetylated wood to achieve a sizable market share in China.

There is also a strong desire to develop new preservatives for the Chinese market, and the government has been actively supporting research toward this goal. Preservative development is typically a long-term effort, and it is unclear whether this support will translate into actual products.

Standards

Chinese standards for wood treatment for residential applications were virtually nonexistent before 2005, and most treaters interviewed at local building products shows claimed to use the standards of the AWPA. However, there was little evidence that this was actually the case beyond the specification for preservative solution. In the intervening 5 years, cooperative efforts between several Chinese universities and the government along with collaboration with Canadian researchers have led to the development of a number of treating standards. At present, 32 standards cover various aspects of wood treatment; 14 are national standards, 19 are commercial standards, 5 are forest industry standards, 2 are product standards, and 1 is specifically for railroad ties. Standards are clearly evolving from mirroring other national standards to ones that are more appropriate for Chinese applications (M. Jiang, personal interview, April 22, 2011). For example, some Chinese companies are using International Organization for Standardization ISO/FDIS 21887:2007 (ISO 2007) to set hazard classes that differ from those used by the AWPA standards (M. Jiang, personal interview, April 22, 2011). This is likely to create confusion in the marketplace, as consumers determine which standards to use. In addition, at least one agency has tried to position itself as the overseer of these standards. The China Wood Conservation Development Center, for example, has developed a national industry standards system framework that consists of five categories of standards, including basic and universal standards that cover terminology and use classification issues; management standards that regulate business practices, production, safety, and laboratory operations; product standards that specify production procedures for chemical preservatives, treated products, and equipment; methodology standards that concern testing and sampling approaches; and standards for treated wood in construction applications (Ma and Zhang 2010).

At present, however, there is little evidence of enforcement of standards, although most treaters expressed a need for quality standards. The interviews showed near unanimity concerning the need for higher quality to avoid treated wood developing a poor reputation that would hinder further market acceptance. This is clearly illustrated by the perception that treated southern pine from the United States produced under clear quality standards constituted a superior product. The lack of clear authority concerning who oversees the use of treated wood in China currently makes it difficult to enforce standards that would improve the image of Chinese treated wood. Ultimately, however, the market will demand a uniform set of standards that are appropriate for the Chinese market.

Quality Control

Because of a lack of strict enforcement of standards that are essential for developing a stable market for products of known quality, Chinese treaters are left largely to regulate themselves. This has created a race to the bottom in terms of quality control as treaters try to undercut their competitors' prices. Not only has the desire to produce treated lumber at the lowest possible cost eroded product quality, but the

environmental standards and treating procedures at a number of local treating plants are dismal as well. According to industry reports (e.g., Su and Liu 2006), many treating plants are poorly designed with little or no quality control and environmental protection procedures. Treating cylinders, measuring tanks, and tracks were often in direct contact with the ground—a setup that is prone to causing chemical spills and leaching into the adjacent soil and groundwater. Many treaters use concrete treating tanks, which are vulnerable to cracking and polluting the adjacent soil. The authors also reported inadequate-sized drain tanks being used, which allowed treating chemicals to spill out of the treating cylinder or measuring tank. Undersized tanks also lead to inaccurate measurements of absorption and waste volumes.

At no point during our visits to treating plants did we see any evidence that treated wood was sampled to assess quality on a regular basis, nor did any plant we visited have the ability to determine retention on-site. By example, treating plants in the United States treating under AWPA standards regularly sample the quality of the treated product using a three-tiered system in which the plants routinely remove increment cores from treated lumber to assess both penetration and retention of chemical. The plants typically sample every charge until they pass 10 in a row; then they can fall to less frequent sampling unless they have a failure that triggers continued sampling of every charge until the 10 successful assays are achieved. This provides an incentive to the treater to produce a quality product. At the same time, a third-party quality assurance agency periodically visits each treating plant and takes additional samples for inspection. Finally, the American Lumber Standards Committee sends inspectors who can check treated wood quality anywhere in the market chain. This process, in principal, should produce a quality treated wood product. While there is no reason for China to institute the exact same system, the absence of regular, in-plant quality control programs in Chinese treating facilities provides little incentive to meet any standard. Continued development of the treated wood market will depend on instituting an enforceable quality control system to improve product reputation.

User's Awareness of Treatment

Since treated softwood lumber products are still new to many Chinese, end users have little basis for distinguishing between high-quality and low-quality treated lumber. Interviews with a number of specifiers and users of treated wood highlighted the fact that most inherently recognized that treated wood was superior to untreated wood; however, they had little direct knowledge about what made a treatment good or bad. User knowledge was generally limited to color as a measure of treatment quality, and many complained about specifying wood species and treatments and then having contractors substitute less expensive, inferior materials. Users expected only a limited warranty of 3 to 5 years. Even an inferior treatment is likely to perform for this time period in most of China, allowing poorly treated materials to enter the market place.

Users also did not understand the premise of treatments acting as envelopes of protection. They frequently performed extensive cutting and drilling after treatment, thereby negating the value of treatment. They did not distinguish between biological and physical degradation. Most of those interviewed commented about warping, checking and twisting, especially of Russian pine and, to a lesser extent, southern pine. They did not understand that a typical preservative treatment would have little or no effect on either property. Some treaters talked about using water repellent additives to help reduce these problems, but none used them because of the added cost and high price competition in the marketplace.

Finally, we found an interesting perception among some specifiers that wood was less green than concrete or steel because it required cutting trees. Some noted that they would use concrete made to look like wood over actual wood because it was greener. Specifiers did not refer to impacts of mining, smelting, or fabrication with steel or concrete. This is likely a reflection of China's emphasis on conservation and reforestation and suggests that there is a need for specifier education on the impacts of producing all types of materials, including wood, using life cycle assessment and other tools. There is also a growing market for wood–plastic composite (WPC) material, which has been marketed as decay resistant and more environmentally friendly. These materials been used in big government projects for the Beijing Olympics and Shanghai Expo. As these materials tend to be more expensive and have not lived up to all of their durability claims, the Chinese markets for WPCs may grow more slowly than predicted.

Future Perspectives

The future outlook for the industry remains somewhat mixed. China's economy has started to show signs of cooling because of the lagging effects of tightening credit by the central government in the face of a housing bubble, high inflation, and overheated investment in capacity expansion. Globally, the economic recession and uncertainties continue to loom and have caused significant and consecutive drops in Chinese exports between 2007 and 2010 (Cao 2011). These factors lead us to believe that China's future demand for treated wood products, which has been traditionally driven by housing construction and urban development, may slow. This is particularly true in Chinese frontline cities, such as Beijing and Shanghai, where market competition is already intensive and housing prices have started to fall.

Still, on the positive side, continued urbanization in second- and third-tier cities, combined with central government stimulus efforts to increase domestic consumption, will provide strong incentives for China's economy to grow, and this should also help the treated wood industry. Chinese second- and third-tier cities and the vast western region are playing leading roles in the processes of urbanization and absorbing rural population (McKinsey Global Institute 2009). The need to develop infrastructure and housing in these smaller cities and towns should help sustain demand for treated wood products, as will reconstruction projects in earthquake zones, such as northern Sichuan Province and Yushu of Qinghai Province. Furthermore, government efforts to encourage tourism by building more tourist destinations will likely incorporate large quantities of wood as Chinese seek to reconnect with this historic building material. For example, the central government has announced plans to develop Hainan, China's southernmost island province, to become an international tourism destination by 2020 (Anonymous 2010). These government projects should create further demand for treated wood products for use in resorts, villas, parks, walkways, and even high-rise apartment buildings,

where treated wood is regarded as the best material for balcony floors (Anonymous 2011). Given the size of the country and its lack of domestic timber supplies, it can be expected that a significant volume of treated and untreated wood will be imported into China over the next decade before domestic Chinese plantations and natural forests are up to full production (Flynn et al. 2011).

In addition to China's continuing urban development needs, the fact that wealthy Chinese consumers covet the latest brands and high-quality, safe, and healthy products can offer further competitive advantages for US treated wood suppliers with a well-targeted brand strategy. Wealthy Chinese consumers traditionally favor dark-colored wood products, such as rosewood furniture, as symbolic of a high-end lifestyle and social status (Kaplinsky et al. 2010). Recent food scandals, toxics released from toys and furniture, industrial accidents, and high levels of water and air pollution have made affluent Chinese consumers increasingly interested in green products. However, the definition of ''green products'' to Chinese consumers may refer more to ''trustworthy,'' ''fashion,'' ''high quality,'' ''safe,'' and ''healthy'' and less to low pollution or nature conservation, which is different from consumers in Western countries (Mol 2012).

At present, there appears to be little standards enforcement, and this provides little incentive for local treaters to treat properly. The lack of incentive and the abundance of poorly treated materials entering the market have the potential for reduced marketplace confidence, and this will ultimately threaten markets for all treated products. In this sense, the US industry may further benefit from China's growing domestic market by helping local industry associations develop standards and train more designers and technicians. Essential in these efforts will be increased involvement by Chinese industrial authorities to build a comprehensive system for regulating, controlling, and monitoring the performance of treaters. The combination of educating consumers and creating systems for ensuring quality should lead to a more stable market with a greater emphasis on brand, quality, and services rather than price.

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