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Drying Characteristics of Ghora-neem [*Melia sempervirens* (L.) All.] Wood of Different Thickness Using Solar kiln

M. Rowson Ali, M. Jahangir Alam, U. K. Rokeya and S. P. Paul
Seasoning and Timber Physics Division, Bangladesh Forest Research Institute, Chittagong, Bangladesh.

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M. Rowson Ali, M. Jahangir Alam, U. K. Rokeya and S. P. Paul
Seasoning and Timber Physics Division, Bangladesh Forest Research Institute, Chittagong, Bangladesh.
E-mail: rowson_ali@yahoo.com

Abstract

A seasoning schedule was developed for different thicknesses of ghora-neem [*Melia sempervirens* (L.) All.] wood. The seasoning time of 2.5 cm thickness of sawn wood required 9-10 days to attain 16% moisture content in solar kiln and 22-23 days in air dry conditions, respectively. On the other hand, for thickness 4.0 cm and 5.0 cm sawn wood required 12-13 days and 16-17 days in solar kiln and 27-28 days and 31-32 days in air dry conditions, respectively. Moisture content decreased with increase in time duration.

সারসংক্ষেপ

বিভিন্ন পুরুত্বের ঘোরানিম কাঠের একটি সিজনিং সিডিউল তৈরি করা হয়েছে। ২.৫ সে. মি. পুরুত্বের চেরাই কাঠকে ১৬% আর্দ্রতায় আনতে সৌর চুলী ও এয়ার ড্রাই পদ্ধতিতে সময় দরকার হয় যথাক্রমে ৯-১০ দিন এবং ২২-২৩ দিন। অপরপক্ষে ৪.০ সে. মি. এবং ৫.০ সে. মি. পুরুত্বের জন্য সৌর চুলী ও এয়ার ড্রাই পদ্ধতিতে সময় দরকার হয় যথাক্রমে ১২-১৩ দিন, ১৬-১৭ দিন এবং ২৭-২৮, ৩১-৩২ দিন। সময় বৃদ্ধির সাথে কাঠের আর্দ্রতা ধীরে ধীরে হ্রাস পায়।

Keywords: Solar kiln; *Melia sempervirens*; Moisture content; Thickness; Kiln schedule

Introduction

Ghora-neem [*Melia sempervirens* (L.) All.] is one of the handsome timber species in Bangladesh. It is largely planted in the road side avenue along highways, railway tracks and other places due to its well adaptation and fast growing nature (Das *et al*. 2001). It is a light, weak and moderately stable timber and generally used in making packing cases, pencil slat and artificial limbs (Sattar *et al.* 1999). Open sun drying or air drying of wood materials is most common in Bangladesh which often gives low quality wood having defects with discolorizations, bending, cracking, twisting and internal deformation. Low graded wood products are often unstable and create heavy loss in economy as well as pressure on forest resources.

Solar energy is emerging as a renewable source of energy and solar drying is one of its important applications (Paswan & Mohit 2010). The primary reason for drying of wood is to bring down its moisture content to a level as will later be used in service condition to minimize the dimensional changes in the final product. Moisture content of wood is a variable factor for different tree species. The nature of sawing particularly, the size of the sawn wood is one of the important variables for its moisture content. On the other hand, drying of wood is required to improve mechanical properties, dimensional stability and also enhances service life of wood against biodegradation. Solar kiln seasoning helps attaining wood moisture content at the level of 12-14% which is optimal for Bangladesh atmospheric conditions (Sattar 1987). Use of solar energy for seasoning of wood through solar kiln developed by the Bangladesh Forest Research Institute is focused with better end use of wood. It also contributes to the number of benefits like competitive rates, higher quality products,

products of dimensionally more stable, faster than air drying, minimal degrade compared to air drying, as well as environment friendly (Anon 2009). The present study was undertaken to evaluate the seasoning schedule of ghora-neem sawn wood with different thicknesses through solar kiln.

Materials and Method

Three number of ghora-neem (*Melia sempervirens*) trees with 15-18 years old having 8-10 m height and 0.9-1.1 m diameter at 2.1 m height was collected from Satmile road side, Jessore, a Southern district of Bangladesh. The growing area of the trees generally represents subtropical monsoon climate mostly supported by alluvial soils. From each of the trees three bolts of 2.50 m size above the stump height were selected. Thus the total numbers of bolts from the three trees were nine (3×3). All the bolts were fairly straight and free from natural defects. Five sample planks from each of nine bolts were prepared for experiment representing heart wood. For determination of seasoning properties, 10 sample planks with 122 cm x 30 cm x 2.5 cm; 10 sample planks with 122 cm x 30 cm x 4.0 cm and sample planks with 122 cm x 30 cm x 5.0 cm sizes were taken for both solar kiln seasoning and air drying. The planks were arranged by 2.5 cm space in the stackyard both for air drying and inside the solar kiln for seasoning purpose. The initial and the final moisture content were determined using a hammer type wood moisture meter at every 2-3 days. The total drying time from green condition to 12-14% moisture content (MC) of the wood materials was recorded.

Results and Discussion

The daily temperature range for solar kiln and air-drying shed were determined. This study started 16th of February, 2012 and terminated on the 17th of March, 2012. The temperature range in the solar kiln varies from 35°C to 55°C while the temperature in the air drying shed varies from 25°C to 32°C during the drying period. The relative humidity was observed during the drying period and it was found that solar kiln attained a higher temperature and lower relative humidity than those of the air-drying.

The ghora-neem is light dense wood. It is common that the free water contained in the wood materials releases faster than that of bound water depending on the surrounding environment. Bound water needs consistently higher temperature for drying of wood below fiber saturation point. In determining the seasoning schedule of ghora-neem wood of different thickness there emerges variable scenarios. It is evident that the seasoning time of 2.5 cm thickness of ghora-neem sawn wood need 9-10 days to attain 16% wood moisture content in solar kiln and 22-23 days in air dry conditions, respectively (Figure1). On the other hand, 4.0 cm and 5.0 cm thickness sawn wood of ghora-neem required 12-13 days and 16-17 days in solar kiln and 27-28 days and 31-32 days in air dry condition respectively (Figure 2 & 3).

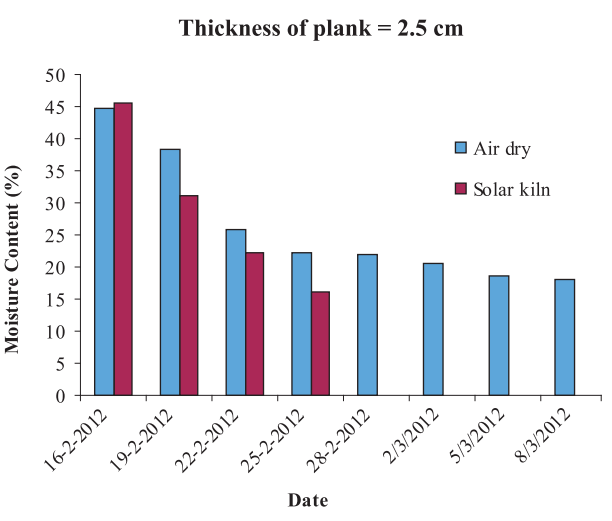

Figure 1. MC of ghora-neem wood with time

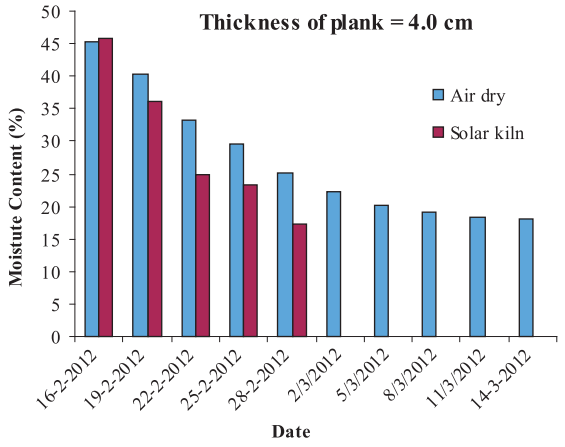

Figure 2. MC of ghora-neem wood with time

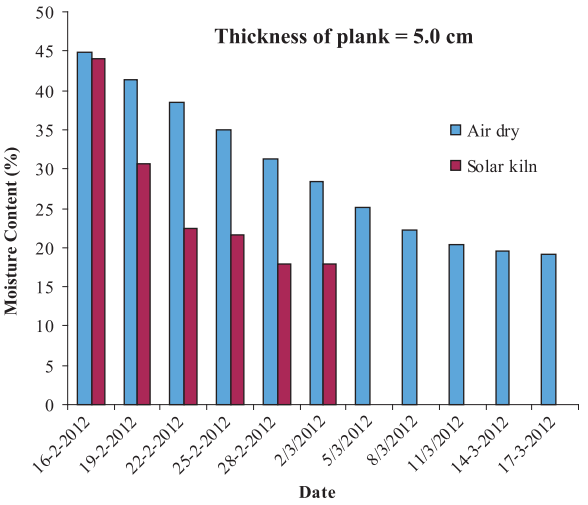

Figure 3. MC of ghora-neem wood with time

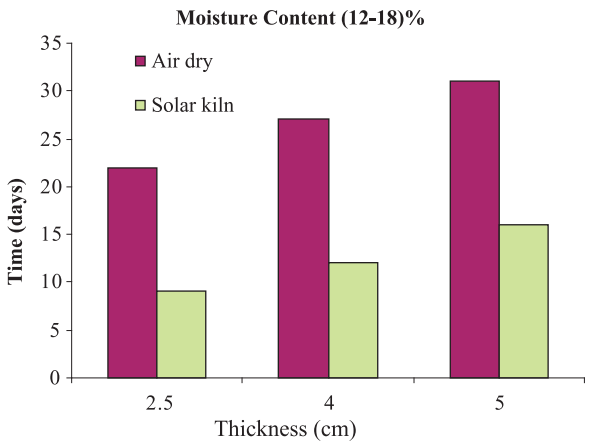

Figure 4. Seasoning time with thickness of ghora-neem wood

Figure 4 shows that moisture content was decreased due to increase in time duration. Higher thicknesses samples showed that the moisture content decreased slowly compared to lower thickness wood in both drying conditions.

Despite variability of wood thickness, the seasoning of ghora-neem wood in the solar kiln occurs 2-3 times faster due to its in-built generation of increased and consistent temperature as compared to air dry conditions. The sawn wood in air dry conditions was infected by fungus which leads to discoloration. The seasoned wood of ghora-neem with different thickness through solar kiln was found to have less check, bend, split, warp, collapse and case hardening than those of air dried timbers.

The colour of the ghora-neem wood in the solar kiln was comparatively brighter and fungus attack to the wood is prevalent in the air dry condition. Use of solar kiln yielded better quality seasoned wood in short duration than air drying technique in agreement with other studies (Chen 1981; Das 1985; Sattar 1987; Sharma *et al.* 1981; Stangerlin *et al.* 2009; Yang 1980).

Conclusion

Seasoning characteristics of sawn wood of ghora-neem were determined using solar kiln and air dry method. Comparative performance of solar kiln showed its superiority in consideration to prevent biodegradation and time durations. Data indicate that the seasoning time for ghora-neem sawn wood of 2.5 cm thickness showed better performance than 4.0 cm and 5.0 cm thickness both in solar kiln and air drying conditions. To attain lower moisture content within a very short period, solar kiln can be used as proved by the results obtained. Wood quality after solar drying is much better than that obtained by the air drying method.

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