Middle-East Journal of Scientific Research 11 (10): 1472-1474, 2012
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2012.11.10.1621

Variation of Basic Density in *Eucalyptus camaldulensis dehnh* Wood Grown in Iran

Abassali Nouri Sadegh

Zabol Branch, Islamic Azad University (IAU), Zabol, Iran

Abstract: Eucalyptus wood is one of important hardwood for pulp and paper production in the world. Present study carried to the influence on stem height and radial direction on wood basic density of *Eucalyptus camaldulensis Dehnh* were studied in five 43 years-old trees in southeast part (Sistan site) of Iran. Three sections were taken from each tree at 25%, 50% and 75% of stem height and five radial positions (10%, 30%, 50%, 70% and 90% of radius). Results indicated that there is a significant difference between samples of stem height and radial position in wood basic density, while the interaction effects between both variables weren't significant. The values of wood basic density increased along the axial direction from the bottom to the up and decreased along radial direction. The values of wood basic density were 567 kg m^{3} for eucalyptus wood grown in the southeast of Iran. The eucalyptus wood is suitable for papermaking due to good basic density.

Key words: *Eucalyptus camaldulensis Dehnh* % Wood basic density

INTRODUCTION

Wood density represents the weight of wood mass related to its unit volume. This is an essential feature of timber, as it significantly influences other wood properties [1]. In particular, it closely correlates with the strength characteristics of wood [2]. The density is therefore widely used to estimate the strength characteristics of wood [3]. The wood density value is greatly influenced by moisture content. For this reason, the oven-dry density of wood, with its uniqueness of determination, is used to compare results. In trade, where people work with fresh material, the basic wood density is used. This value describes the amount of wood mass in a volume of wood with certain moisture. The volume of maximally swollen wood is normally used [4].

Due to exposure to both external and internal factors, the density is subjected to considerable variability. Apart from the kind of tree species [5], the value of the density is affected in particular by annual ring width, by the proportion of latewood within the annual rings and the position within a stem [6, 7, 8]. The presence of juvenile wood has a significant influence on density fluctuations within the stem in the radial direction, from the pith to the bark [9].

Eucalyptus camaldulensis Dehnh was one of the hardwood species planted in many parts of Iran and it has shown good adaptation to environmental condition. Therefore, the objective of this study was to investigate the basic density of eucalyptus wood, as well as their vertical and horizontal variability within a stem.

MATERIALS AND METHODS

In this research, 5 normal *Eucalyptus camaldulensis* Dehnh trees were randomly selected from a plantation at the Sistan site, which is located in the southeast of Iran. It was grown at the elevation of 477 meter above sea level with geographical direction 31° 05´ 12½ N and 61° 25´ 57½ E. The mean annual precipitation and temperature of this area is usually about 41 mm and 22°C. Figure 1 shows the characteristics of trees samples. Stem sectional discs were taken from each tree at different levels of total height (25%, 50% and 75%). The radial variation was studied by sampling in each wood disc at 5 positions of radius from pith to the bark (10%, 30%, 50%, 70% and 90%). The samples testing were randomly prepared from these discs to evaluation wood basic density according to the ISO-3131 standard. Oven-dry measurements were taken after the specimens were dried to constant weight in an

Corresponding Author: Abassali Nouri Sadegh, Zabol Branch, Islamic Azad University (IAU), Zabol, Iran.

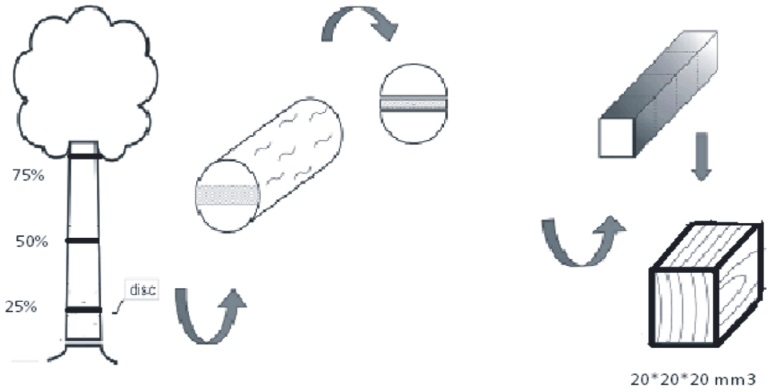

Fig. 1: Testing samples to examine wood density

oven at 103±2°C. The dimensions were measured in both green and dry conditions by a slide caliper and mass measured on an electric balance to an accuracy of 0.01 g. Basic density was determined from green volume (using the water displacement method) and oven-dry mass. If the specimen developed collapse during oven drying, it was replaced with a new sample. Finally, analysis of variance was used to determine statistically significant differences at a 0.05 significance level for the different variables (wood basic density) within the tree between radial positions and between height levels.

RESULTS AND DISCUSSION

The variations of wood basic density along radial and longitudinal directions of eucalyptus are shown in Figures 2 and 3. Analysis of variance (ANOVA) analysis showed that the effects of stem height and radial direction on the basic density were significant, but the interaction of stem height levels and radial position on wood basic density weren't significant. The wood basic density values increased along longitudinal direction from the bottom to the up of tree. The wood density varied between stem heights levels from 559 to 572 kg/m^3. The radial variation of the wood basic density showed a decreasing trend from the pith to the periphery. The basic density varied from pith to the periphery (10% and 90% of the radius) 571 to 546 kg/m^3 at breast height (25%), from 571 to 560 kg/m^3 at the 50% height level and from 573 t0 565 kg/m^3 at the 75% height level. Overall, the wood density variations along radial position from the pith to the bark (in total of three stem height levels) varied 572 to 554 kg/m^3.

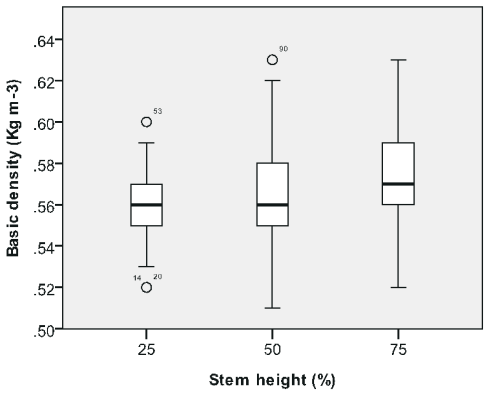

Fig. 2: Variation of basic density along stem height in eucalyptus wood

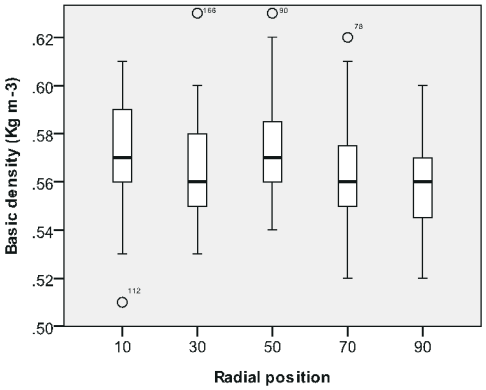

Fig. 3: Variation of basic density along radial position from the pith to the bark

The decreasing of wood density along radial direction can be related to differences chemical composition and existing of heartwood. Heart wood has a high extractive material in the pith and near to the pith compared to sapwood [1].

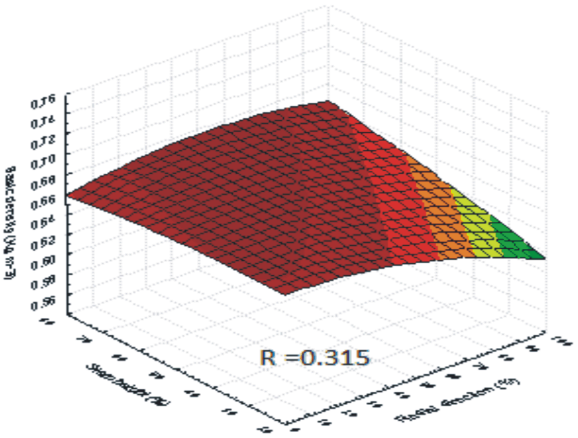

Fig. 4: Regression models for predicting the Basic density depending on the position within the stem

Nonlinear regression models were used to fit the acquired data and predict variability of basic density depending on the position in the stem (Fig. 4). The models indicate an increase in density towards the crown and decrease in the direction from the pith to the bark to the pith for basic density. Although the presented models are statistically significant, the coefficients of determination are quite low (R=0.315).

CONCLUSION

In this research, the wood basic density of *Eucalyptus camaldulensis Dehnh* in longitudinal and radial axes was determined. This study indicates that there is significant difference between radial samples and stem height specimens in wood basic density. The wood density of *Eucalyptus camaldulensis* increased along the longitudinal direction from the bottom to the up and decreased along radial position from the pith to the bark.

REFERENCES

1. Zobel, B.J. and J.P. Van Buijtenen, 1989. Wood variation: Its causes and control. Springer- Verlag, Berlin, Heidelberg, pp: 363.
2. Sonderegger, W., D. Mandallaz and P. Niemz, 2008. An investigation of the influence of selected factors on theproperties of spruce wood. Wood Science and Technology, 42: 281-298.
3. Niemz, P., 1993. Physik des Holzes und der Holzwerkstoffe. einbrenner, DRW-Verlag, pp: 243.
4. Podrázský, V. and J. Remeš, 2009. Soil-forming effect of Grand fir (*Abies grandis* [Dougl. ex D. Don] Lindl.). Journal of Forest Science, 55: 533-539.
5. Simpson, W. and A. Ten Wolde, 1999. Physical Properties and Moisture Relations of Wood, Wood Handbook - Wood as an Engineering Material. Madison, US Department of Agriculture, Forest Service, pp: 463.
6. Kollmann, F., 1951. Technologie des Holzes und Holzverkstoffe Berlin, Springer-Verlag, pp: 1050.
7. Bosshard, H.H., 1974. Holzkunde. Band 2. Basel, Stuttgart, Birkhäuser Verlag, pp: 312.
8. Panshin, A.J. and C. De Zeeuw, 1980. Textbook of Wood Technology. New York, McGraw-Hill, pp: 722.
9. Gryc, V., H. Vavrèík and S. Gomola, 2008b. Selected properties of European beech (*Fagus sylvatica* L.). Journal of Forest Science, 54: 418-425.