

Properties of Iron Wood Branches

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Abstract: In the present study, the oven-dry density, basic density and volumetric shrinkage in three parts of Ironwood branches includes normal (Part A), Mistletoe (Part B) and jointed (Part C), branches were studied. In each of branch parts, a disc was selected in the north of Iran. Testing samples were randomly prepared from disc cross-section. Results indicated that there are significant differences between three branches in the oven-dry density, basic density and volumetric shrinkage. The highest of wood density and volumetric shrinkage values were found in the part C. A positive relationship was found between wood density and volumetric shrinkage in three parts of branches. This relationship between both mentioned items in the normal branch (part A) is stronger than the other branch parts (parts of A and B). Mistletoe plant species hadn't negative impact on the wood quality.

Key words: *Parrotia persica* • Branch wood • Density • Volumetric shrinkage • Fiber

INTRODUCTION

Wood quality can be measured directly by submitting timber to a large number of technical tests. However, many of wood traits such as strength and elasticity properties are related to density. This parameter is suitable index for predicting wood quality [1]. From a specific species, the wood density among trees is very variable due to genetic and environmental differences [2]. The relation between density and site index depends on difference in growth rate that is very complex discussion [3]. Wood density varied along longitudinal and radial directions from bottom to the up and the pith to the bark [4]. Variations of wood density may be directly related to variation in cell wall percentages and changes in cell wall thickness, cell diameter and tissue proportions [2].

The aim of the present study is: a) to determine the wood density and volumetric shrinkage, b) to examine to the relationship between wood density and volumetric shrinkage.

MATERIALS AND METHODS

Three iron trees (*Parrotia persica*) were selected in north of Iran (Chaloos Province). Disks were taken in normal branch (Part A), Mistletoe branch (Part B) and

jointed branch (Part C). Testing samples were randomly cut in surface of disk base to ASTM -D143. After preparing the samples, the relevant experimentation including weighing and measuring the dimensions were conducted. In the first stage, the samples volumes and weights (after cutting the sample) were measured. Then, the samples were placed in water for 48 hours so that all samples would go under the water or become saturated with water. After that, the samples weight and saturated volume were determined using a digital scale and caliper. The third stage included putting the samples in an oven for 48 hours at $103 \pm 2^\circ\text{C}$ to completely dry the samples and afterward the sample volume and weight were measured in dry state.

The oven-dry density (D_0) was calculated as follows:

$$D_0 = M_0 / V_0$$

where M_0 and V_0 are the oven-dry weight (g) of the specimen and volume (cm^3) of specimen, respectively.

The basic density (D_b) was determined by the gravimetric method;

$$D_b = M_0 / V_g \text{ (g cm}^{-3}\text{)}$$

where, V_g is the green volume of the specimen (cm^3) and M_0 is the oven-dry weight of the specimen (g).

Volumetric shrinkage (β_v) was determined as follows:

$$\beta_v = (V_s - V_0) / V_s (\%)$$

where V_s is saturated volume and V_0 is oven-dry volume. Finally, the effect of branch samples on the wood density and volumetric shrinkage has been investigated that it was used by analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Branch Density: The average of oven-dry density and basic density of Iron branch are shown in Fig. 1. The analysis of variance (ANOVA) indicated that there are significant differences between the types of branch and wood density (Table 1). The Duncan's mean separation test shows that there is a significant ($P < 0.05$) difference in the wood density between part A and C and between part B and C. The highest of wood density was found in the part C. wood density branch in part A is similar to wood branch density in part B.

Volumetric Shrinkage: The average of volumetric shrinkage of Iron wood is shown in Fig. 2. The analysis of variance (ANOVA) indicated that there are significant ($P < 0.05$) differences between types of branch and volumetric shrinkage (Table 2). The Duncan's mean separation test shows that there is a significant difference in the volumetric shrinkage between part A and C and between part B and C. The highest and lowest of volumetric shrinkage was found in the part C and part A, respectively.

The relationship between wood density and volumetric shrinkage were analyzed by linear regression in three parts of branches samples (Fig. 3). It was found that there is a positive relationship between wood density-volumetric shrinkage in all parts of branch samples. The relationship between two items in part A ($R^2 = 0.498$) is stronger than part B ($R^2 = 0.255$) and part C ($R^2 = 0.371$). These results were previously reported by several researchers [5, 6, 7].

Table 1: Analysis of variance between branch part and wood density in ironwood

	Properties	Sum of Squares	df	F
Oven-dry density	Between Groups	0.015	2	4.909*
	Within Groups	0.087	56	
	Total	0.103	58	
Basic density	Between Groups	0.006	2	4.030*
	Within Groups	0.039	56	
	Total	0.045	58	

* Significant at 0.05 level.

Table 2: Analysis of variance between branch parts and volumetric shrinkage in Ironwood

Volumetric shrinkage	Sum of Squares	df	F
Between Groups	24.250	2	2.026*
Within Groups	335.139	56	
Total	359.389	58	

* Significant at 0.05 level.

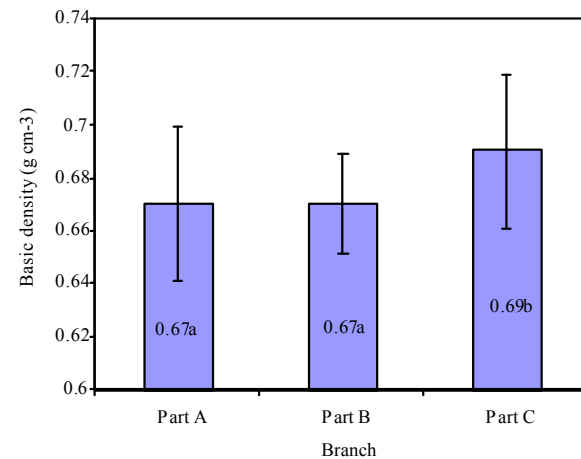
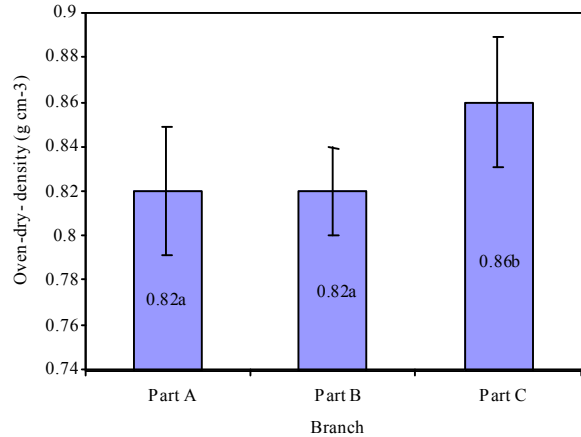


Fig. 1: The average of wood density in three branch samples

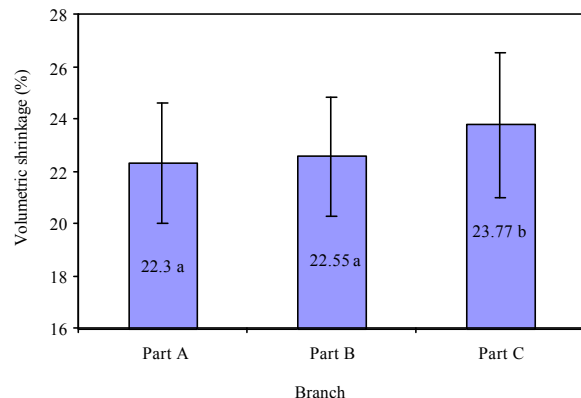


Fig. 2: The average of volumetric shrinkage in three branch samples

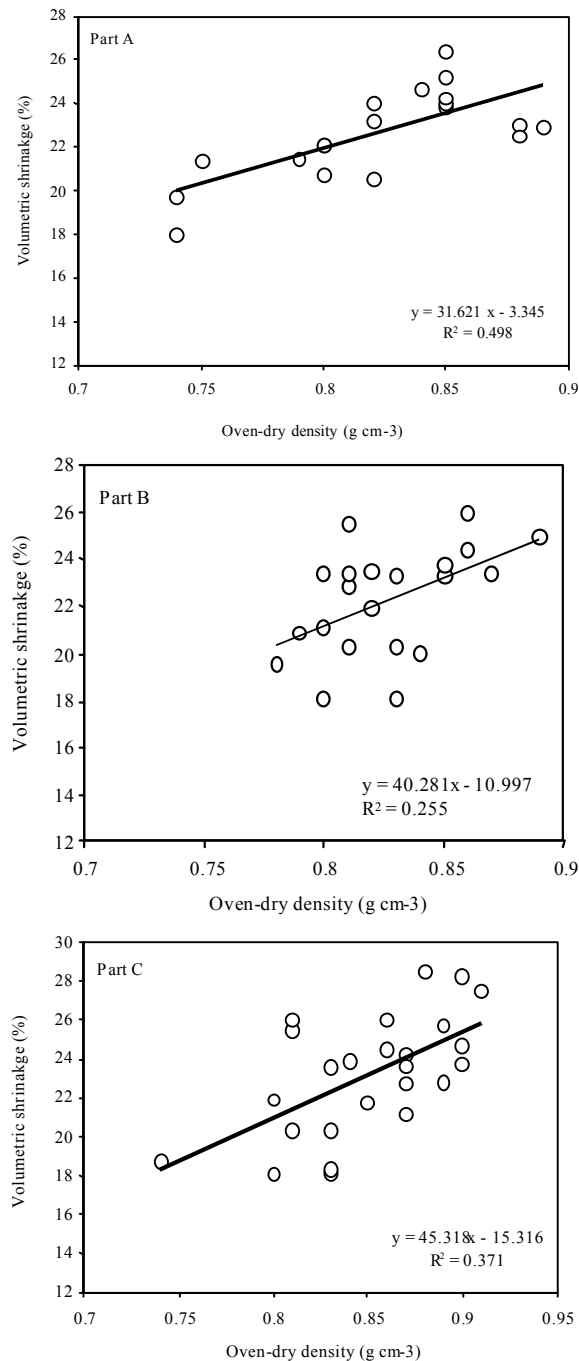


Fig. 3: The relationship between wood density and volumetric shrinkage in part A, B, C.

CONCLUSIONS

The present research indicated that the wood samples part of branches hadn't influence on the wood density and shrinkage in ironwood. Overall, Mistletoe plant species hadn't significant ($P < 0.05$) impact on the wood quality in mentioned wood.

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