PHYSICAL ANALYSIS OF QUALITY WOOD *Melia azedarach*

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ABSTRACT

Forest species, in general, present a slow growth, which results and profits can manifest themselves in the long run, it becomes necessary the study and discovery of new species that may provide raw materials and return on invested capital more immediate, being that the *Melia azedarach* wood is a potential option. In the absence of information about, the objective of this paper is to determine its physical properties: basic density and shrinkage of the *Melia azedarach* species in the Itapeva-SP region. The data obtained in this study allow to classify wood Melia azedarach as wood of average density and good dimensional stability. Feature that makes it ideal for its use in furniture industry. The low amount of research related to quality of this wood prevents the commercial use of it to achieve its full potential harnessing its effectively, and essential investments in this field.

Keywords: Basic density, shrinkage, wood.

ANÁLISE FÍSICA DA QUALIDADE DA MADEIRA DE *Melia azedarach*

RESUMO

As espécies florestais, de maneira geral, apresentam crescimento lento, cujos resultados e lucros obtidos manifestam-se a longo prazo, torna-se necessário o estudo e descoberta de novas espécies que venham a fornecer matéria prima e retorno do capital investido mais imediato, sendo a madeira de *Melia azedarach* uma opção potencial. Diante da ausência de informações a respeito, objetivou-se com este trabalho determinar as propriedades físicas: densidade básica e retratibilidade da espécie *Melia azedarach* na região de Itapeva-SP. Os dados obtidos neste estudo permitem classificar a madeira *Melia azedarach* como madeira de densidade média e boa estabilidade dimensional. Característica que o torna ideal para a sua utilização na indústria de móveis. A baixa quantidade de pesquisas relacionadas à qualidade dessa madeira impede a utilização comercial dos mesmos para atingir todo o seu potencial aproveitamento seus investimentos de forma eficaz, e essenciais neste domínio.

Palavras-chave: Densidade básica, retratibilidade, Madeira.

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INTRODUCTION

Melia azedarach is a medium-sized specie, belonging to the Meliaceae family, being popularly known as Neem. It is a tree native to Asia (CABEL, 2006), found distributed in India, Pakistan, Sri Lanka, Thailand, Laos, Vietnam, Cambodia and Brazil (BOBADILLA, 2004). It is a deciduous tree with alternate leaves and small and numerous flowers. The drupe types fruits, are yellowish, wrinkled, persisting through the winter, and its seeds are feasible to use for up to two years. It is undemanding as to soil type, however according to Hoppe et al (1991), it has increased productivity in deep and fertile soils. Cabel (2006), studying the various dendrometric species, mention that in adulthood this species can reach up to 40 m high and its diameter at breast height varies from 40 to 60 cm.

The Neem is rapid growth specie. From the same family as cedar and mahogany, shows good yields in the production of thick wood sheets and as solid wood is light, clear and is used for furniture, tool handles, crates, musical instruments, matchsticks, truck body and fuel. Also, it dries easily, and provides excellent finish (REMADE, 2015).

In Brazil, this species is widely used in urban forestry. Being that forest tree species, in general present a slow growth, that its results and profits manifest themselves in the long run, it is necessary to study and discovery new species that will provide raw materials and return on invested capital more immediate , and the *Melia azedarach* wood is a potential option.

The successful introduction of new wood in the furniture sector, including the Neem, depends on the knowledge of their behavioral characteristics and use. However, knowledge of the physical properties of the wood allows the correct destination and its application in various sectors, and the choice of destination of each timber is made possible through knowledge of the physical properties of them. From a structural point of view, the properties are related to the following characteristics: Wood: moisture, density and shrinkage (Gesualdo, 2003).

This study goal was to determine the physical properties: wood specific density and shrinkage of *Melia azedarach* species in Itapeva-SP region.

MATERIAL AND METHODS

This study was developed from the wood of a *Melia azedarach* tree. The material used for the study was collected in a property in the city of Itapeva-SP, from a pure individual, age estimated: 15 years, the Latitude coordinates 23'59 "S and longitude 48'53"W with an altitude of 713 m.

According to IPT (2001), the climate in the region is classified as Cfb in the Koeppen classification, ranging between 18 to 20 °C of average annual temperature being 26 to 28 °C average temperature in January, and 8 to 16 °C the typical temperature in July. Annual rainfall varies between 1200-1400 mm. In the region, according Novais et al. (2009) predominating the Oxisols and Ultisols.

From a circular disk taken from the height of 15 cm from the tree base in the radial direction marrow-exchange, it was obtained 12 test specimens with dimensions 2x3x5 cm, according to the NBR 7190/2010 - Wooden Structures, which were linearly properly identified and measured three times on each plane (tangential, radial and longitudinal), in order to estimate the initial volume. In all measurements, obtained also the weight of each sample, using a hydrostatic balance accurate to 0.01 g, and this weight is used to obtain the initial moisture content, and then the bodies were transferred to a container with water to saturation.

After a full saturation, the linear dimensions of the test specimens was measured again, in order to subsequently find the values of swelling and shrinkage, and the weighing of the pieces also took place. Once these values were measured, the samples were sent to a drying oven (103 ± 2 ° C) until the weight became constant. After drying, the test specimens were measured and weighed again. With this data, it was possible to obtain the values of the initial moisture content, specific density, swelling and linear and volumetric shrinkage and anisotropy coefficient.

The basic density is defined as the ratio of the dry weight and the saturated volume of the specimen, and was calculated using the equation:

$$\rho_{bas} = \frac{m_s}{V_{sat}}$$

m_s: Dry mass of the test specimen, in grams;
V_{sat}: Saturated volume of the test specimens, in cubic meters, in cm³;
ρ_{bas}: Basic density of the test specimen in g/cm³.

To determine the swelling and shrinkage it was used the methodology mentioned by Souza Junior and Barreiros (2012) according to the equations:

	Retraction	Swelling
Axial	$\varepsilon_{r,1}=\left(\frac{L_{1,sat}-L_{1,seca}}{L_{1,sat}}\right)\times 100$	$\varepsilon_{i,1}=\left(\frac{L_{1,sat}-L_{1,seca}}{L_{1,seca}}\right)\times 100$
Radial	$\varepsilon_{r,1}=\left(\frac{L_{2,sat}-L_{2,seca}}{L_{2,sat}}\right)\times 100$	$\varepsilon_{i,1}=\left(\frac{L_{2,sat}-L_{2,seca}}{L_{2,seca}}\right)\times 100$
Tangential	$\varepsilon_{r,1}=\left(\frac{L_{3,sat}-L_{3,seca}}{L_{3,sat}}\right)\times 100$	$\varepsilon_{i,1}=\left(\frac{L_{3,sat}-L_{3,seca}}{L_{3,seca}}\right)\times 100$

$L_{1,sat}, L_{2,sat}, L_{3,sat}$: Length of the sides in the axial direction, radial and tangential, respectively, from the saturated test specimen pieces, in mm;
$L_{1,seca}, L_{2,seca}, L_{3,seca}$: Length of the sides in the axial direction, radial and tangential, respectively, from the dried test specimen pieces, in mm;

With the values of each plane, it has become possible to obtain the volumetric variation in the saturated and dry states:

$$\Delta V=\left(\frac{V_{sat}-V_{seca}}{V_{seca}}\right)\times 100$$

Where:

$$V_{sat} = L_{1,sat} \times L_{2,sat} \times L_{3,sat}$$
$$V_{seca} = L_{1,seca} \times L_{2,seca} \times L_{3,seca}$$

RESULTS AND DISCUSSION

The characteristics from *Melia azedarach* wood, aged 15 years old, are presented in Table 1. Where you can view higher rate of change in the tangential direction and the lowest rate in the longitudinal direction.

Table 1. Physical characteristics of *Melia azedarach.*

	variation
Radial (%)	6,33
Tangential (%)	12,35
Longitudinal (%)	0,27
Volumetric	17,87
Anisotropy coefficient	1,46
BD (g/cm³)	0,446

Nascimento et al. (1997) shows that the basic density is one of the factors that most influence the drying of wood, this factor according to Simpson e Verrill (1997) acts directly on the existence of defects in the final product when it comes to sawmills worked wood or furniture production.

The value obtained from 0.446 g / cm³ of average wood density from *Melia Azedarach* classifies this as soft wood according to Melo et al., 1991, since it has specific density below 0,50g/cm³. Ipt (2015) studying the physical characterization of the species obtained density of 0,510 g/cm³, slightly higher than the value obtained in the present study, Silva et al., (1983), on the other hand classifies wood as moderately dense when on obtains a value between 0,52 and 0,66 g/cm³ from density, different result to those obtained in this characterization, this difference in results compared to literature may be explained, among other factors by the different conditions of the trees studied, highlighting age of the sample, weather and according to Baker et al (2004), especially the difference in soil fertility and availability of soil nutrients in each locality the same author considers that in places with larger spacing and better conditions of nutrients, the trend is of a higher growth, which generates a timber with features that provide a lower density.

Table 2 presents the values obtained in previous studies to determine the physical properties of *Melia azedarach.* Showing relative scarcity of such studies in the literature, yet those found confirmed the values obtained in this study.

Table 2. Values obtained in studies of the physical properties of *Melia azedarach*.

	Results Obtained	Results Literature	
		IPT (2015)	TREVISAN et al., 2006
Radial Variation (%)	6,33	3,1	///
Tangential Variation (%)	12,35	7,2	///
Longitudinal Variation (%)	0,27	///	///
Volumetric Variation	17,87	11,6o	///
DB (g/cm³)	0,446	0,51	0,49

The values show little change from the obtained in this study. Commercially important species from the *Melia azedarach* family obtained values similar to this for basic density. Ipt (2015) in *Cedrella fissilis* physical characterization studies obtained average basic density of 0,44g/cm³, Alves et al. (2011), on the other hand obtained by studying the same species a value of 0,44 g/cm³ basic density. *Swietenia macrophylla* presented values close to 0,520 g/cm³ (IPT, 2015). The similarity values obtained for specific gravity, may indicate the possibility of destination on wood for the same purposes as those species of Meliaceae family without quality loss on the final product.

Other forest species of commercial importance have basic density similar to that obtained for *Melia azedarach,* Sturion et al. (1988) studying the characteristics of *Eucalyptus viminalis*, species commonly used for energy purposes obtained a density value of 0,489 g/cm^3. Suirezs, 2000 on his study in physical characterization of the species *Pinus taeda*, widely used in the furniture industry, obtained 0.430 g / cm³ basic medium density.

Table 3 presents the variation of shrinkage in the exchange-marrow direction from the *Melia azedarach* species that were obtained in this study according to the analyzed samples.

Table 3. Variation towards Exchange-marrow of *Melia azedarach* samples

Sample	*Radial (mm)*	*Tangential (mm)*	*Longitudinal (mm)*
1A	5,120	9,791	0,068
2A	8,881	15,714	1,174
3A	7,417	20,838	0,390
4A	7,021	14,395	0,302
5A	9,810	23,482	0,837
6A	6,153	14,517	1,286
1B	6,503	8,339	0,233
2B	5,931	13,457	0,029
3B	5,919	10,527	0,098
4B	6,593	11,235	0,059
5B	3,665	10,430	0,146
6B	5,951	10,717	0,467
Shrinkage *(%)*	6,33	12,35	0,27

The values obtained for volumetric shrinkage, contraction tangential and radial contraction, respectively 17,87%, 12,35% and 6,33 % were different from those obtained by IPT (2015) to species that descend to 11,6% 7,2% and 3,1% respectively, this difference can be explained by being analyzed trees of different ages and differences in genetic factors. The Longitudinal shrinkage was irrelevant to 0.27%. The anisotropy coefficient of 1.46 was considered to be low, tending to medium-low (KLITZKE, 2011), as a result the timber has good quality for low dimensional variation uses.

It was observed that the tangential contractions were greater than the radial contractions and these, in turn, much larger than the longitudinal contractions, repeating a behavior often observed in the literature, and justified by the microscopic structures of the wood itself.

According to Remade (2015), *Cedrela fissilis*, the *Melia azedarach* family which is widely used for fine furniture and decorative sheets presents thick wood sheets volumetric variation of 11.6, lower than that which was shown in this study, which was 18.87%, indicating a wider range of species, even those who belong to the same family.

CONCLUSION

The data obtained in this study allow to classify wood *Melia azedarach* as wood of average density and good dimensional stability. Feature that makes it ideal for its use in furniture industry. The low amount of research related to quality of this wood prevents the commercial use of it to achieve its full potential harnessing its effectively, and essential investments in this field.

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