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SOME TECHNOLOGICAL PROPERTIES OF SAWN BOARD *Eucalyptus camaldulensis* Denh. GROWN IN ASKIKALAK

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ABSTRACT

This study deals with wood density and static bending boards property of *Eucalyptus camaldulensis* Den. It was conducted using standardized, defect-free test specimens. Boards of air drying showed lowest value (749.117 kg/cm²) of static bending when compared with kiln (812.267kg/cm²) and solar (815.267kg/cm²) drying respectively, whereas, the quarter sawing boards recorded the lowest rates (586.633kg/cm²) when compared with flat sawn boards (1008.467kg/cm²), Also 2cm thickness level achieved the lowest rate (747.367kg/cm²) when compared with other two levels 4cm (812.650 kg/cm²) and 6cm (837.633kg/cm²) of thickness. But, there were no any significant effects of wood density on the studied factors. *E. camaldulensis* in Kurdistan Region of Iraq has potential for traditional uses and by itself it can be harvested by applying suitable techniques at plantation areas, in saw mills and drying for utilization.

KEYWORDS: Wood Density, Static bending, *E. camaldulensis*, Sawn Board

Introduction

Kurdistan Region of Iraq is located in Northern Iraq. According to its fertile soil and appropriate environmental conditions have made this region known for its natural forests. Most prominently, the flowing of a number of big rivers through this region such as Tigris and some others lead to the prospect of establish artificial stands depending on river for irrigation.

About 30-40 species of the genus were introduced to Iraq during the last century Shahbaz, (2010).

Literature mentioned that the two main of them being *E.camaldulensis* and *E. microtiheca*, were considerably succeeded in middle and southern of country Rooitzsch and Reader, (1969). *E. camaldulensis* Den. has been used for pulp, chipboard, fire wood, shelter belts and others. Appropriate temperature and humidity rates as well as precipitation in Kurdistan provided well situations for Eucalypt throughout the year. The shortage of manufacturing wood products in Iraq, so including in Kurdistan Region makes it difficult to have a clear overview of the prospects of eucalypt exploitation (Taha, 2013).

Eucalypts species are recognized simultaneously of the fastest wood producing trees. It has the capability to produce approximately100m³/capita. Some investigations in their studies (Myburg, *et al.*, 2006,Acosta,*et al.*,2008 and Iglesias, *et al.*, 2008) reported that there are about 18 Million hectares of Eucalypt in the world, and they expected the total areas of *Eucalyptus* will increase to reach up to 20 Million hectares in 2010 cited by (Taha,2013). It is distinguished that environmental circumstances might have their important belongings on the wood properties, and for the reason of the lack of researches on eucalypts wood in Iraq principally those associated to its drying, this study was designed to investigate the wood density and static bending (MOE) properties of dried sawn board of trees grown in Kurdistan Region.

Materials and Methods

Ten trees of *Eucalyptus camaldulensis* with DBH 35-45cm were selected, felled, and logged in a stand at Khabat district (Askikalak) in Erbil Governorate, Kurdistan Region of Iraq where it lies at N 36° 15'; E 43° 38' and located at 252m, It is37km far from Erbil city. All logs were bucked (2m length) then they were sawed by sawing table with band saw (SIPA 100 Saw) preliminarily; the logs then were converted to planks. After that, the resulted planks were sawed into two types of board; quarter sawn board and flat sawn board at three different thickness 2,4, and 6cm. Logs were used for producing lumber for air drying, kiln drying, and solar drying methods respectively.

Method of randomizing

The following two characteristics were examined:

Wood density and static bending, before applying the test, make sure that the samples be free from defects and splits. The tests concerned load the experiment specimens at Mid-length at prepared sawed boards.

With the aim of collect material to be used for present study determined by using ASTM D-143-94 and ASTM D-2395-93 procedures(Anonymous 1996) get 10 store dried (Air, Solar, and kiln) boards of (*Eucalyptus camaldulesis*) for each properties randomly. To evaluate wood properties of sawed boards, in situation (temperature 20-25°C, 35-40% relative humidity and wood moisture content 12%) defect free specimens (5×2×2cm) for wood density (kg/ cm²). And (30×2×2cm) for static bending (MOE) were tested by using the universal Strength Testing Machine .

The collected data so collected were analyzed statistically using experiment; it was included of three factors:

Factor A: Drying method; with 3 levels: (AD; Air Drying, KD; Kiln Drying and SD: Solar Drying)

Factor B: Thickness of board; with 3 levels: (Th1; 2cm, Th2; 4cm, and Th3; 6cm)

Factor C: Board kind; with 2 levels: (FS; Flat Sawn board and QS; Quarter Sawn board).

Numbers of treatment combinations were 18. Ten boards were chosen randomly to represents replication of each treatment combination. The experiment was statistically analyzed as factorial RCBD by using SAS program version 0.9 SAS, (2002). Statistical differences between treatment combination means were tested by Duncan Multiple Range test at 5% level Duncan, (1955).

Results and Discussion

The influence of interaction between drying methods, board thickness, and sawing methods on the studied parameters:

Effect of drying method, board thickness, and sawing method on wood density and static bending of dried board as shown in Table (1)

Table (1): Analysis of variance of wood density and static bending as affected by drying method (DM), board thickness (Th), and board kind (BK).

Variables	d.f	Wood Density F Value	Wood Density Pr > F	Static Bending F Value	Static Bending Pr > F
Drying Methods (DM)	2	2.09	0.1276	4.45	0.0123
Thickness (Th)	2	2.21	0.1135	13.72	0.0001
Board Kind (BK)	1	3.08	0.0815	750.65	0.0001
DM×Th	4	1.06	0.3780	3.83	0.0054
DM× BK	2	0.73	0.4814	3.77	0.0252
Th× BK	2	0.96	0.3846	2.66	0.0731
DM×Th× BK	4	1.06	0.3778	3.77	0.0060

Table (1) refers that drying method (DM), thickness (TH), and board kind(BK) and their interaction could not affect significantly on wood density. Mean values of (Tab. 2) indicate that moderate values of wood density have been obtained in almost all treatments.

Accordingly, differences should be so small that they would not be enough to give statistical significances. The results, also agreed with what has been found by Lima *et al.,* (2008) who mentioned that density varies from a minimum of 0.319 g/cm³ to a maximum of 0.731 g/cm³. In general, wood structures formed in early stages of tree growing that have low density.

Table (2): Mean values of wood density as affected by drying method, board thickness, and board kind.

Drying Methods (DM)	Board Thickness (TH) cm	Board Kind (BK) Flat	Quarter	MD□TH	Mean of (DM)
Air Drying(A)	2	0.570	0.609	0.590	
	4	0.601	0.680	0.641	0.643
	6	0.608	0.789	0.699	(a)
Kiln Drying(K))	2	0.570	0.609	0.609	
	4	0.601	0.680	0.685	0.670
	6	0.608	0.789	0.715	(a)
Solar Drying(S)	2	0.570	0.609	0.606	
	4	0.601	0.680	1.065	0.824
	6	0.608	0.789	0.800	(a)
	Mean of (BK)	0.644 (a)	0.780 (a)		0.712
TH ✕BK	T1	0.578	0.616		0.601(a)
	T2	0.655	0.939		0.797(a)
	T3	0.689	0.786		0.738(a)
DM✕BK	A	0.593	0.693		
	K	0.648	0.692		
	S	0.690	0.957		

However, the diminishing of wood density alongside tangential direction (flat sawn board) can be associated to differentiations between chemical compositions in wood structures and existing of heartwood near to the pith compare to sapwood Akhtari, *et al.,* (2012).The results were achieved from the study confirmed that the density of dried boards is located within the middy category (0.56 -0.75 g/cm³) according to the classification of the IAWA, (1989).

The studied factors were affected differently on static bending (MOE) (Tab.1). While board thickness showed moderate significant effects, drying method affected at lower level, and board kind(BK) high levels of confidence ($p<0.05$). Drying method showed high statistical influences on static bending. Boards dried by (AD) possessed the lowest values (Tab.3) because the density values were obtained in this study show the difficulty of different drying situations clearly.

Table (3): Mean values of MOE as affected by drying method, board thickness, and board kinds.

Drying Methods (DM)	Board Thickness (TH) cm	Board Kind (BK) Flat	Quarter	MD×TH	Mean of (DM)
Air Drying(A)	2	746.000	553.400	649.700	
	4	1036.200	584.500	810.350	749.117
	6	1056.200	614.400	835.300	(b)
Kiln Drying(K))	2	1018.000	556.400	787.200	
	4	1038.200	586.400	812.300	812.267
	6	1058.200	616.400	837.300	(a)
Solar Drying(S)	2	1021. 000	559.400	790.200	
	4	1041.200	589.400	815.300	815.267
	6	1061.200	619.400	840.300	(a)
Mean of (BK)		1008.467	586.633	797.550	
		(a)	(b)		
TH ×BK	T1	928.333	556.400	742.367(b)	
	T2	1038.533	586.767	812.650(a)	
	T3	1058.533	616.733	837.633(a)	
DM×BK	A	946.133	584.100		
	K	1038.133	586.400		
	S	1041.133	589.400		

*Means of each factor and their interactions followed by the same letters are not significantly different from each other according to Duncan's multiple ranges test at 5% level.

The air dried boards (765.117 kg/cm²), when compared with kiln and solar drying respectively. While board thickness increased, static bending values increased too. Thin boards (2 cm thick.) bended only by (742.367 kg/cm²), while thickest ones (6cm thick.) deflected from straight line by (837.633 kg/cm²)as a mean may be caused by existence of different drying situation. The scholarships Bolza and Kloot (1963), Bryce (1967) and Louppe *et al.*, (2008) were attributed by reason of low age and fast growth level.

Ogunsanwo, (2000), Oluwafemi and Adegbenga, (2007) through their studies on *Eucalyptus camaldulensis* were clarified that the values of density and mechanical properties achieved, They could be of use its wood in various aspects as building, construction, flooring, cabinetry, and furniture.

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هندەك سالوخێن تەكنولوژی ین دەپێن .Eucalyptus camaldulensis Denh داهێنانكری ین ئەوین ل خەبات شوین بوی ل هەرێما كوردستانێ عیراق

پوخته:

ئەڤ ڤەكولینە سەرەدەرییێ دگەل كار پێكەرێ ڤەچەمینێ(Static bending) و(Wood density) مشتاتیا دارا *Eucalyptus camaldulensis* بو سالوخین دەپێن داهینانكری هاتبوكرن. ئەڤ چەندە دگەل نمونەین ڤالە ژ خرابیا و ستاندارد هاتبوكرن. دەپێن برێكا هەوایی هشكببون كێمترین چەنداتی (٧٤٩.١١٧kg/cm^2)ژ كار پێكەرێ ڤەچەمینێ تومار كربون دەمێ بەراورد دگەل رێكێن تەنورێ (٨١٢.٢٦٧kg/cm^2) وهەتاڤێ(٨١٥.٢٦٧kg/cm^2) هاتیەكرن ئێك لدویڤ ئێك. هەروەسا دەپێن شیوازێ Quarterهاتبونە داهێنانكرن كێمترین ئاست تومار كر دەمێ بەراورد كرنێ دگەل شێوازێ راست(١٠٠٨.٤٦٧kg/cm^2). دیسان دەپێن خودان ستویراتیا٢ سم كێمترین چەنداتی (٥٨٦.٦٣٣kg/cm^2) تومار كرن بەراورد دگەل (٧٤٧.٣٦٧ kg/cm^2)تومار كر دەمێ بەراورد دگەل ئاستێن دیتر ٤سم(٨١٢.٦٥٠ kg/cm^2) و٦سم هاتیەكرن (٨٣٧.٦٣٣kg/cm^2) . بەلێ چو جوداهیێن پێشچاڤ ین كارتێكرنا مشتاتیا داری لسەر فاكتەرین تاقیكری نەهاتنە دیتن. ل هەرێما كوردستانا عیراقێ شیانێن بكارئینانا ناڤخووی یا هەی و *Eucalyptus camaldulensis* دكارین ب كارئینانا تەكنیكین باش ل جهێن چاندی، كارگەهێن داهێنانێ، و هشككرنێ.

دراسة بعض الصفات التكنولوجية لالواح النشرلاشجارالیوكالبتوس النامية فى منطقة خبات –اقليم كوردستان العراق

الخلاصة

تم دراسة تاءثيركثافة و معامل الانحناء لخصائص الالواح اليوكاليتوس. تم استعمال النماذج المناسبة وخالية من العيوب.الالواح المجففة هوائيا(٧٤٩.١١٧kg/cm^2) سجلوا اقل قيمة لمعامل الانحناء مقارنة مع المجففة بالفرن(٨١٢.٢٦٧kg/cm^2) والشمسى (٨١٥.٢٦٧kg/cm^2)على التوالي.مع ذلك، الالواح المنشورة بطريقة الشعاعي سجلوا اقل مستوى(٥٨٦.٦٣٣kg/cm^2) عند المقارنة مع الطريقة المماسى (١٠٠٨.٤٦٧kg/cm^2) ، بالاضافة الى الالواح ذو سمك ٢سم حصلوا على اقل نسبة (٧٤٧.٣٦٧kg/cm^2) عند المقارنة مع مستويات الاخرى ٤سم (٨١٢.٦٥٠kg/cm^2)و ٦سم(٨٣٧.٦٣٣ kg/cm^2). بينما، لم تشاهد اية الاختلافات المعنوية لتاءثير كثافة الخشب على العوامل الدراسة.تمتلك اليوكالبتوس في اقليم كردستان العراق امكانية استعمالها في مجالات التقليدية و لذلك يمكن استثمارها باتباع تقنيات المناسبة فى مناطق المزروعة، معامل النشر، و التجفيف لاستغلالها