Biological Forum – An International Journal **14(1): 1416-1423(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Study the Drying Behavior of Green Wood Turning on *Ecalyptus* spp

Ezhumalai R. and Shikhar Shukla
Forest Products Division, Forest Research Institute, Dehradun, India.

(Corresponding author: Ezhumalai R.)*
(Received 18 November 2021, Accepted 08 February, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: Wood seasoning is a well established technology to dry timber in a controlled atmosphere. The biggest challenge that it faces is the drying time, which paves ways to explore more towards reducing seasoning time. Some of the faster drying processes include radio frequency (RF) drying and vacuum drying but economically they are bit expensive. So innovative method of seasoning that involves least energy, less skill on the part of the laborers involved, quicker drying, comprehensibility, and easy workability is the need of the hour. Considering all above factors, this research work is on the method of converting the green wood into the turned products directly and then drying them. The output of adopting this methodology was that the turned samples of Eucalyptus wood were dried to 12-14% moisture content within 14 days in electric heated kiln which otherwise took more than 18 days to achieve this moisture content in unturned condition. More over working with green wood is easier and faster than that of dried wood. The drying rate of green turned samples was achieved to be 1.7 times more than that of green unturned samples. No variation was noticed in drying rate upto 48% moisture content, but there was a remarkable change in them beyond that moisture content upto 10% moisture content. The primarily converted planks from the green logs shows more defects like cracks, warps etc. and it takes more than three weeks to dry whereas the woods used in Turning and pre-surfaced take only two weeks to dry. Due to this, the wastage percentage in case of planks is around 65 % while in the rest it about 20 percentage. So in wood turning it is advised that first turning should be done in green condition followed by drying of the turned product.

Keywords: Green wood Turning, Drying Rate, pre-surfaced wood, *Ecalyptus* spp.

INTRODUCTION

The craze for wooden furniture has always been increasing and it has never shown decreasing trend because of the unique characters of wood *viz*, Grains, Color, Luster etc. These properties are conspicuously absent in steel and plastic which are used as substitutes for wood, though not completely. Wood industries could not cope with the ever-increasing demand of wood and this is attributed to over exploitation of forests, improper usage of timber, obsolete methods of wood processing which involve large amount of wood going as wastage and ever-increasing population. This increase in population has increased the demand for wood and these projections implied an industrial roundwood consumption of around 2.7 billion m^3 by 2010. More recent projections suggest, global consumption of roundwood will be markedly lower, reaching only 2.4 billion m^3 by 2030 (Bruinsma, 2003).

This problem is more acute in case of developing countries like India. In India the problem is well pronounced because of recent Government policies, which aims at imposing complete ban on felling from the natural forests.

This forced us to resort the growing plantations of desirable species. Growing plantation is not without problems. Plantations grown wood are fast growing and short rotation tree spp so more of juvenile wood and it creates lot of problem during seasoning as well as it reduces mechanical properties of wood (Kretschmann, 1993).

Plantation Tree species, which can be grown mostly in India are Eucalyptus, Poplars, *Acacia mangium*, *Meliadubia* etc., among these we selected eucalyptus for our study because of its refractive character and short rotation (more of juvenile wood).

Methods of wood processing which are now being followed throughout the world are suitable only for those woods, which are grown in natural forests (Indian Standard-1141, 1993). These methods can ever be used for those woods grown in plantation because they are highly 'refractive in nature, which makes them difficult to be seasoned. Growth stress will be more in those woods which will increase the seasoning degrade. Presence of juvenile wood complicates the process of

seasoning. These fast-growing species develop spiral grain which makes the sawing difficult. Generally, woods are classified into three categories based on their seasoning behavior *viz,* Refractive, Medium refractive and non-refractive. Each category of woods has different drying schedules and their drying is based on that schedule (IS 1141-1993). In spite of this, drying degrade occurs in all categories because the differences in macro structure of each species within a category behaves differently to the seasoning and even among the same species different sizes of wood need different drying schedules. This makes it difficult to prescribe a particular drying schedule for any category or any particular species.

In India drying schedules have been developed for woods of 1" thickness alone (IS 1141). At present for woods of dimension more than 1" thickness, the schedule is slightly modified and applied but for turning bigger size log or lumber there is no proper seasoning schedule. It was more difficult and also this leads to increased seasoning degrade. So, this requires some innovative method of seasoning which should be fast and less with seasoning degrades. Turning in India is done by use of seasoned wood/poles or partially seasoned wood (air dried) but the problem in seasoned wood is that, it takes more time for turning and not easy to turn and consume more energy. However, green wood can readily be found and is often cheap. Even exotic woods are much cheaper when bought in the log. Working directly from the log gives you an opportunity to fit sizes and grain pattern according to your own requirement, rather than accepting material that has been milled to a predetermined size. The easiest method is to turn the wood when it's green. Once the wood is in a bowl or turned article dries much faster and with fewer defects than a solid chunk.

Earlier days turning on bowl took place on green wood only. In case of walnut log block cross-sections are sawn from green logs, debarked and rounded on a lathe, and was stabilized at high temperature with polyethylene glycol-1000 (PEG) to prevent splitting and checking, and then kiln-dried to 6 percent moisture content. The material was free of seasoning degrade, and stayed that way (Mitchell, 1974). Present days there is the technique like use of water jet and abrasive water jet can effectively solve the problem of the melting of the polymer matrix and its subsequent sticking to the functional parts of a cutting tool resulting from conventional turning specially for WPC material (Hutyrova *et al.,* 2016). In this paper we have come out with a method of seasoning which will address all the above said problems and it is called as "Green wood working/turning and drying through end grain and surfaces". This new method involves making of wood products from green wood followed by seasoning of those finished products which is contrary to the conventional method of making the wood products from the seasoned wood. Major advantages of this method;

A. Quicker drying: In the conventional methods the wood is seasoned before making various products and during drying the wood is coated at the ends. This prevents loss of moisture through the ends and only surface drying is permitted to happen. In the new method the finished products, wherein the end grains are exposed throughout its length, are dried which leads to end grain drying. This is 1.5 times faster than surface drying.

B. Lesser seasoning degrades: Surface drying, that occurs in the conventional seasoning methods leads to uneven shrinkage of wood and as a result warping occurs. End grain drying involves drying of wood in all directions and so even shrinkage results. This leads to minimized defects in the end product. In presurfacing green beech squares or drying the stock as rounds for reducing surface checking was investigated (Rietz & Jenson 1966).

C. Easier workability: Since the wood products are made directly from the green wood it is easier to work and this consume lesser energy than the conventional methods. Also increased kiln-holding capacity because oversize lumber is eliminated (Rietz & Jenson 1966).

If we turn the wood either green or seasoned, it becomes tougher and more difficult to work as it dries. Before the machine age, when all woods were worked by hand, as much work as possible was done while the wood use to be green and at its easiest to work (Jhon Kelsey, 2013). When you turn green wood, you can expect it to change shape as it dries, so you will have to make allowance for the movement (Richard Raffan, 2008).

In order to make the end grains exposed, it is necessary to provide curvature in the product and it is shown in the figure below. There is no sufficient literature available on this topic because Green wood turning was the practice of olden days.

MATERIALS AND METHODS

To conduct the study Eucalyptus wood species was used. Being highly refractory wood species, the result obtained can be generalized for all the timbers. Due to the non-availability of timber resources in the market, Eucalyptus is also being used for the furniture making. The green logs of Eucalyptus were collected from the Forest Range office, FRI, Timber yard and the logs were stored in heaps of sawdust in order to prevent loss of moisture. The logs were then cut into pieces of 3×'1.5' small lumber by plane sawing. This is because the Eucalyptus species has got growth stress and when it is sawn the planks will split.

24 wood samples of size 1'×2"×2" were cut from the sawn timber for turning. Wood samples are first soaked in water for one day and then they are turned into a particular shape (Fig. 1). Turning is done individually on each sample and after turning they are immersed in water to get uniform moisture content and maintain the green condition.

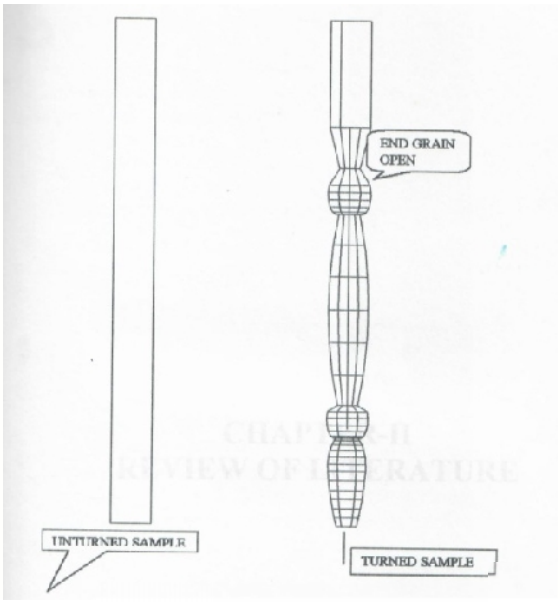

Fig. 1. Turned and unturned sample.

After all the samples are turned, they are all collectively kept in water for another 48 hours to get uniform initial moisture content. The samples are then dried in the electric heated kiln and the moisture content, defects during drying were observed on the turned and unturned sample.

For Control, 15 unturned wood samples of size 1'×2"×2" were prepared and 6 piece of plank having different size but thickness of the 2" inch was placed in the kiln to see only the defects on plank during seasoning. Similar observations were made from these control samples as that of the products and similar inferences were made. Turned and unturned samples were dried in electric heated kiln at FRI, based on the drying schedule prescribed in the IS 1141: 1993.

A. Formula used

To calculating the representative moisture content of the sample, Oven dry weight of the sample for turned and unturned, set of two samples (AI, A2-a1, a2) of each were taken.

$$Moisture\ content\ of\ A1(MA1) = \frac{Intial\ weight\ of\ A1 - Oven\ dry\ weight\ of\ A1}{Oven\ dry\ weight\ of\ A1} \times 100$$

$$Moisture\ content\ of\ A2(MA2) = \frac{Intial\ weight\ of\ A2 - Oven\ dry\ weight\ of\ A2}{oven\ Dry\ weight\ of\ A2} \times 100$$

$$Average\ Mositure\ Content(mca) = \frac{MA1 + MA2}{2}$$

$$Calculated\ oven\ Dried\ weight(Dc) = (w1 \times 100)/(100 + mca)$$

$$\text{Periodic Mositure content} = (W2 - Dc)/Dc \times 100$$

Where WI is initial weight of the samples, W2 is the periodic weight of the samples.

RESULT AND DISCUSSION

The observations made of the turned and unturned samples were recorded and the data so obtained were analyzed in order to get a proper conclusion which will be vital for suggesting one of the best methods of drying that will suit different furniture works. The methods so prescribed will help in easy working of wood for different works, minimize wastage of wood, minimize seasoning defects and reduce cost of processing of wood. The data records of the different wood products are compared with those data of the respective pre surface sized samples and these readings are plotted against each other in a graph in order to get the conclusion.

A. Effect of drying rate and defects in turned and unturned sample (pre-surfaced)

Samples of green turned and green unturned were immersed in water tank for two days to get the uniform moisture content (62.2%) and then dried in the kiln for a period of two weeks and their moisture content were observed in frequent intervals. Table 1 and 2 are evident of the fact that drying of turned wood samples is took place at faster rate in comparison to that of the unturned wood samples provided with the same drying condition. The mean moisture content of turned wood samples after one week drying reached to 35.96%. contrary to that it reached to 41% for unturned samples. In order to ascertain the significant difference between the drying rate of both condition, one way ANOVA for moisture content achieved after one week and two weeks of drying by the turned and unturned wood samples were made. The ANOVA represented in Table 3 and 4 clearly suggest that there is a significant difference in the moisture content achieved after one week and two weeks of drying respectively by turned and unturned wood samples. Since ($P<0.005$) in both the ANOVA, it gives the clear indication that drying rate of turned and unturned wood samples is significantly different. These readings were then plotted in a graph against time taken for drying. This gives the drying rate of both the type of samples. The result shows that the drying rate is 1.7 times more in case of green turned sample than the green unturned samples. Also, there is no variation in drying rate upto 48% moisture content beyond that there is remarkable change in drying rate between turned and unturned samples, it's about approximately 10%. It was found that the drying degrade was minimum in both the cases and it is around 20% (Table 5). Faster drying rate and the minimal drying degrade are due to small size of the samples and exposure of the end grains in unturned pre-

surfaced samples. Natural sap circulation in a living tree happens through the pores and the removal of moisture through these pores is quicker and easier. End grain drying (Fig. 5) also removes moisture through the pores and so the drying rate is faster than the conventional methods of drying where moisture is removed through the pits and is called as surface drying (Fig. 4)(Milota, 2003).

Table 1: Turned sample drying rate.

Days / Sr. No.	1	3	5	7	9	11	13	15	17
1.	62.2	41.7	34.2	30.5	22.2	24.8	13.9	11.6	7.5
2.	62.2	47.1	41.2	36.7	34.3	31.2	16.8	14.5	11.4
3.	62.2	52.6	45.3	41.2	38.2	30.9	13.6	10.8	7.9
4.	62.2	49.6	41.7	38.2	36	31	18.7	16.1	12.7
5.	62.2	48.1	40.6	35.4	33	28.4	13.9	11.8	7.6
6.	62.2	44.7	38.9	34.4	31.4	21.3	13.5	11.5	8.5
7.	62.2	49.9	40.1	35.3	32.3	24.6	8.7	6.4	3
8.	62.2	49.6	41.4	35.2	34.1	27.6	15.2	13.2	12.6
9.	62.2	49.5	41	35.4	32.3	24.7	13.1	10.8	7.7
10.	62.2	51.1	42.1	36.2	24	26.4	9.15	7	3.1
11.	62.2	45.4	39.9	36.2	19.8	27.7	17.7	15.7	11.6
12.	62.2	47.4	40.5	37.6	35.4	28.4	18.8	16.2	12.3
13.	62.2	52.1	44.4	40.3	37.6	31.5	16.5	16.1	10.4
14.	62.2	50.4	40.2	34.6	31.9	24.8	12.3	10.5	7.4
15.	62.2	43.5	34.9	31.3	23.9	24	15.7	13.6	6.9
16.	62.2	58.4	50.3	44.9	41.6	34	16.4	14	9.6
17.	62.2	45.6	40.4	36.2	33.5	27.8	16.3	13.9	9.9
18.	62.2	42.6	40.1	35.3	33.1	27.1	11.7	9.2	5.3
19.	62.2	50.2	35.8	32.8	16.4	25.4	15.2	13.4	9.3
20.	62.2	46.3	43.4	38.4	35.7	27.9	15.5	12.9	9.4
21.	62.2	46.3	41.3	35.9	35.2	26.4	17.1	14.1	10.1
22.	62.2	42.3	36.7	33.7	31.4	26.1	16.2	14.1	9.8
23.	62.2	44.6	39.6	34.9	32.3	25.2	10.9	8.5	4.6
24.	62.2	45.3	36.3	32.6	30.4	24.4	16.1	13.6	10
Average	**62.2**	**47.81**	**40.43**	**35.96**	**31.5**	**27.15**	**14.7**	**12.47**	**8.65**

Table 2: Un turned sample drying rate.

Days / Sr. No.	1	3	5	7	9	11	13	15	17
1.	62.2	50.1	46.3	43.7	42.4	38.9	25.8	22.8	18.5
2.	62.2	51.2	45.6	42.8	40.8	35.5	22.7	21	16
3.	62.2	50.6	45.3	42	40.1	37.9	23.1	19.9	16.5
4.	62.2	43.2	38.8	36.2	33.9	29.4	15.9	12.9	9.1
5.	62.2	50.8	44.6	41.4	39.9	35.9	21.3	18.1	13.4
6.	62.2	48.4	44.5	41.1	39.4	35.2	20.6	17.5	12.9
7.	62.2	50.7	46.1	43.7	42	39.9	25.8	22.8	19.3
8.	62.2	49.8	43.9	41.7	39.4	33.4	19.4	16.7	12.1
9.	62.2	47.6	44.1	41.1	38.9	33.6	20.4	17.5	13.7
10.	62.2	48.2	44.5	41.8	40	34.1	18.1	14.9	11.1
11.	62.2	49.6	41.9	38.3	38.2	30.5	17	14	10.1
12.	62.2	45.9	41.3	37.3	35.5	29.8	18.9	16.6	13.1
13.	62.2	48.8	43.7	41	39.4	34.8	22.1	19.3	14.8
14.	62.2	47.6	43.5	40.2	38.2	31.9	18.2	15.4	10.6
15.	62.2	50.7	46.4	42.8	40.9	34.3	22.4	19.8	15.7
Average	**62.2**	**48.88**	**44.03**	**41**	**39.26**	**34.34**	**20.78**	**17.94**	**13.7**

Table 3: 7th day moisture content ANOVA.

ANOVA						
MCT		Sum of Squares	df	Mean Square	F	Sig.
	Between Groups	234.476	1	234.476	29.507	.000
	Within Groups	294.023	37	7.947		
	Total	528.499	38			

Table 4: 13th day moisture content ANOVA.

ANOVA						
MCT		Sum of Squares	df	Mean Square	F	Sig.
	Between Groups	340.527	1	340.527	43.271	.000
	Within Groups	291.176	37	7.870		
	Total	631.703	38			

Table 5: Rejection and acceptance of turned, unturned and plank samples after seasoning.

Specimen	Processed samples	Accepted sample based on defects (After seasoned)	Yield percentage
Turned	24	20	83%
Unturned	15	12	80%
plank	6	2	33%

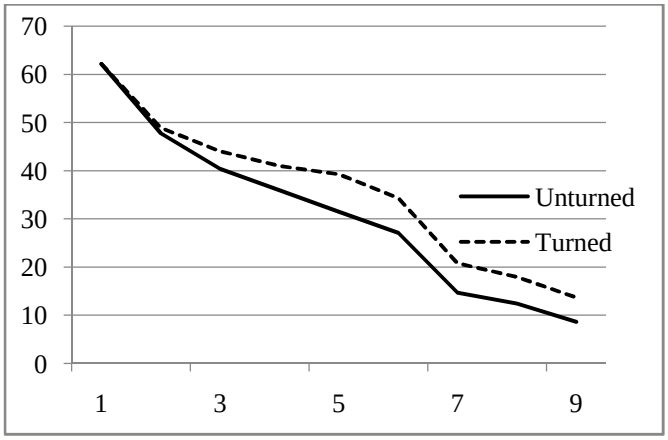

Fig. 2. Drying rate of Turned and Unturned eucalyptus wood sample.

Drying degrade is minimum in case of end grain drying because end grains are exposed in all the axis and the moisture is lost through all the axis. This uniform loss of moisture leads to uniform shrinkage of wood as shown in Fig. 3. Whereas in surface drying the ends are coated and the drying takes place through only one axis (upper and lower surface) which results in uneven shrinkage. Uneven shrinkage causes crack in thicker pieces and warping in case of thinner pieces.

The crack developed at one end of the green turned sample does not extend to the other end because the grains are interrupted by way of turning and they are not continuous.

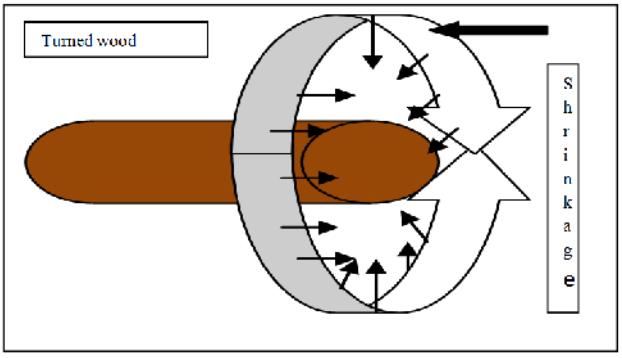

Fig. 3. Uniform shrinkage in turned sample during drying.

Since the grains extend to both the ends in case of uniform sized large sample used in surface drying, the crack continues to both the ends. The area exposed to drying in case of end grain drying is either more or less, in case of surface drying. This is also one of the reasons for the faster drying rate in the former. There is no difference in drying rate upto 48% MC beyond that there is remarkable change in drying rate between turned and unturned it's about approximately 10%. The stacking of the turned samples (Fig. 5) provide alternate crests (B) and troughs (A).

The wind velocity will be more in the crests and less in the troughs as shown in Fig. 6. The same investigated the characteristics of wind pressures on spherical and cylindrical domes through wind tunnel experiments shows similar result (Ogawa *et al.*, 1991). This helps in quicker drying because the end grains are least exposed in crests, which needs high wind velocity and troughs with maximum exposure of end grains need low wind velocity for drying.

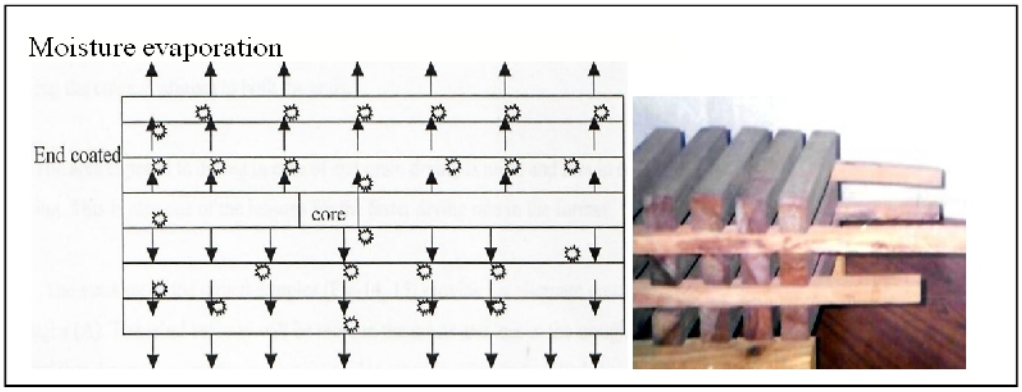

Fig. 4. Surface drying.

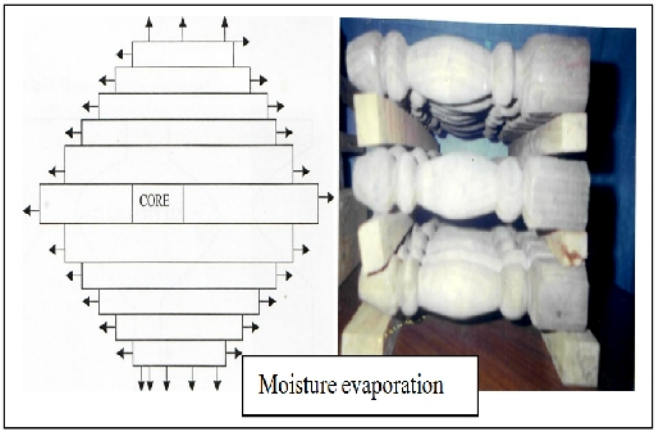

Fig. 5. End Grain drying.

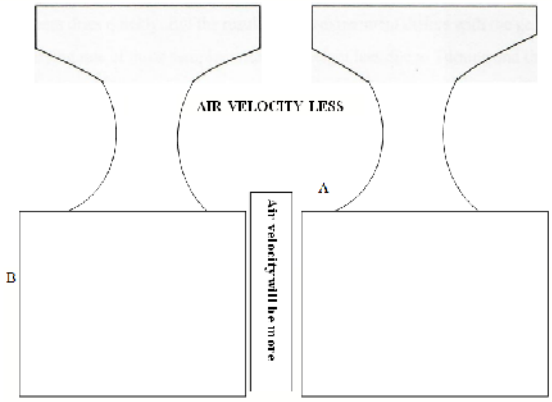

Fig. 6. The Air velocity- inside the stack of Turned Sample.

Table 6: Time consumption per piece during turning.

Sr. no.	Time consumption (minutes)		Sr. no.	Time consumption (minutes)	
	Green Turning	Dry turning		Green turning	Dry Turning
1	20	30	12	11	26
2	20	25	13	20	28
3	16	26	14	20	32
4	17	22	15	8	28
5	15	24	16	13	
6	16	28	17	15	
7	18	27	18	11	
8	23	25	19	21	
9	19	32	20	15	
10	20	31	21	15	
11	17	29	Total		
			Avge	**17 Mints**	**27.8**

Table 7: Shrinkage level in turned piece at different points.

Sr. No.	Point A	Point B	point C	Average
1	0.24	0.19	0.16	0.196
2	0.27	0.22	0.25	0.25
3	0.21	0.2	0.25	0.22
4	0.18	0.17	0.12	0.16
5	0.19	0.13	0.25	0.19
6	0.21	0.15	0.23	0.196
7	0.24	0.22	0.17	0.21
8	0.18	0.26	0.21	0.22
9	0.13	0.16	0.22	0.17
10	0.23	0.16	0.32	0.23
11	0.18	0.16	0.14	0.16
12	0.19	0.14	0.13	0.15
13	0.17	0.22	0.17	0.186
14	0.19	0.13	0.05	0.12
Average	**0.2015**	**0.184**	**0.2**	**0.195**

Table 8: Shrinkage level of unturned sample at different points.

Sr. No.	Point A	point B	point C	Average
1	0.16	0.18	0.18	0.166
2	0.17	0.15	0.15	0.166
3	0.14	0.16	0.16	0.156
4	0.25	0.29	0.29	0.266
5	0.19	0.11	0.11	0.16
6	0.22	0.11	0.11	0.19
7	0.12	0.1	0.1	0.07
Average	**0.17**	**0.15**	**0.166**	**0.167**

Table 9: Visual observation of defects level in turned, unturned and plank.

Sr. No.	Defects	Turned	Pre surfaced (unturned)	Plank-6 nos
1.	Cupping	Nil	Present	nil
2.	Crack	Present but appreciable limit(not extended)	Present and extending	Present in 4 planks, extended towards both ends (Fig. 7)
3.	End checks	Present but negligible	Nil	Present
4.	Workability in green condition	Very good consume less energy	Good	Difficult work consume more energy

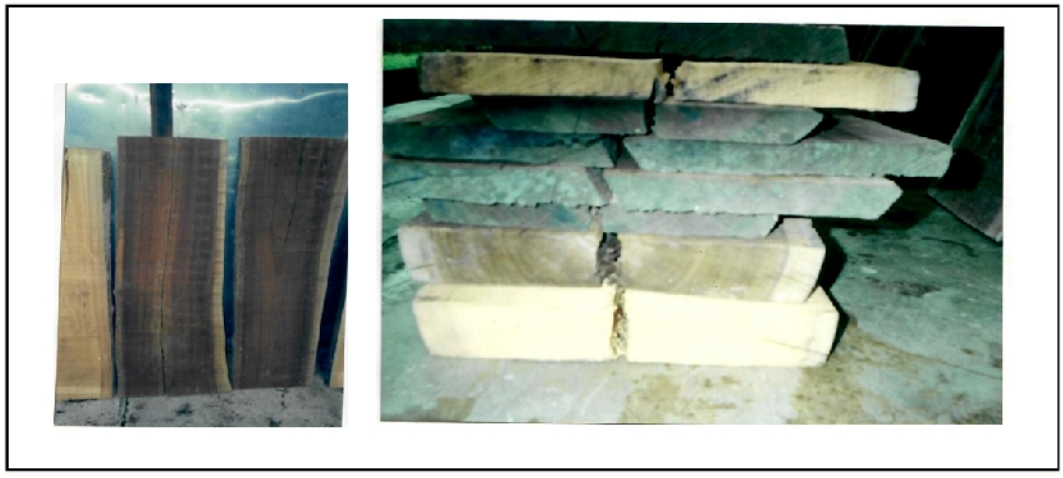

Fig. 7. Extend crack in plank.

CONCLUSION

As it is already mentioned in the introduction, the wood industries throughout the country are finding it increasingly difficult to meet the needs of the people for various wood products. The absence of proper technology of wood seasoning to produce seasoned wood within the time period is another disadvantage to the wood Industry. On the other hand, we have faster drying process by use of RF and vacuum drying but it is costly. So, the new method of seasoning that involves

least energy, less skill on the part of the laborers involved, quicker drying, comprehensibility, and workability is the need of the hour. Considering these, we have focused our research work on the method of converting the green wood into the turned products directly and then drying them.

The result shows that the drying rate is 1.7 times more in case of green turned sample than the green unturned samples. There is no difference in drying rate upto 48% MC (Fig. 2) beyond that there is remarkable change in drying rate between turned and unturned it's about approximately 10%.

One-way annova was performed between turned and un turned sample with 95% confidence interval of different days, drying rate was analysed, result shows that there is no significant difference up to 3 days (Fig. 3) of drying rate after that it shows remarkably significant difference which was found on 7^{th} and 13^{th} day (Table 3 and Table 4).

The results of the turning work shows that within 14 days it reached 12-14% moisture content in electric heated kiln but in case of unturned sample it takes 18 days and more over working in the green wood is easier and faster than dried wood. In case of green turning with sample size of 1'×2"×2" take 17 minutes but in case dried sample it takes 25 to 30 minutes (Table 6). But the problems in green wood drying is actual size will reduce due to the shrinkage but it can be manipulated by calculating the shrinkage level (Table 7, 8) which is about 1.7mm for unturned sample and 2.0mm for turned sample. In turned sample, it shows shrinkage more than unturned sample (Fig. 9) but it is more or less same only (1.7mm & 2.0 mm). So, we have to give tolerance level up to 2mm from the original size of the product in turned and pre-surfaced sample.

Though the pre-surfaced sized sample develop seasoning defects, the defects are far less when compared to that of seasoning defects in the planks. Thus, it is clear that the green dimensional aspect is not only applicable for turned woods but also for any pre-surfaced sized sample, which is used, in large numbers in furniture making. The primarily converted planks from the green logs shows more defects like cracks, warps etc. and it takes more than three weeks to dry whereas the woods used in Turning and pre-surfaced take only two weeks to dry. Due to this, the wastage percentage in case of planks is around 65 % (Table 5, 9 Fig. 7) while in the rest it about 20 percentage.

'Green wood working/turning and drying through end grain and surface method' is highly suitable for turning; wood bowl making and even small to medium sized wood parts (pre-surfaced wood) which can be used in furniture making.

REFERENCE

Mitchell, H. L. (1974). Beat the High Cost of Walnut Turning Blocks. *Review Process: Non-Refereed (Other)*.

Hutyrová, Z., Ščučka, J., Hloch, S., Hlaváček, P., & Zeleňák, M. (2016). Turning of wood plastic composites by water jet and abrasive water jet. *The International Journal of Advanced Manufacturing Technology*, *84*(5), 1615-1623.

Indian Standard-1141 (1993). Seasoning of timber-code of practice, Bureau of Indian Standards, New Delhi.

Bruinsma, J. (2003). World agriculture: towards 2015/2030: an FAO perspective. Earthscan. *Food and Agriculture Organization, London/Rome*.

Jhon Kelsey (2013). Elements of Woodturning: Turning Bowls and Platters, American Association of Wood turners. Saint Paul, Minnesota.

Kretschmann, D. E. (1993). *Effect of various proportions of juvenile wood on laminated veneer lumber* (Vol. 521). US Department of Agriculture, Forest Service, Forest Products Laboratory.

Milota, M. R. (2004). Solid Wood Processing Drying In: Jeffery Burley (Ed.), Encyclopedia of Forest, Elsevier Sciences, Amsterdam,1293-1302.

Rietz, R. C., & Jenson, J. A. (1966). Presurfacing green oak lumber to reduce surface checking. *US For. Serv. Res. Note FPL-0146. For. Prod. Lab., Madison, Wis.*

Richard Raffan (2008). Turning Wood with Richard Raffan. Taunton Press, landon ISBN 978-1-56158-956-2.

Ogawa, T., Nakayama, M., Murayama, S., & Sasaki, Y. (1991). Characteristics of wind pressures on basic structures with curved surfaces and their response in turbulent flow. *Journal of Wind Engineering and Industrial Aerodynamics*, *38*(2-3), 427-438.

How to cite this article: Ezhumalai R. and Shikhar Shukla (2022). Study the Drying Behavior of green wood turning on *Ecalyptus* spp. *Biological Forum – An International Journal*, *14*(1): 1416-1423.