Microwave drying kinetics of *Gmelina arborea* wood

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INTRODUCTION & AIM

- Drying is a crucial step involved in wood processing towards improving its utilization for various end use applications.
- Properly dried wood offers several advantages i.e. such as reduced hygroscopicity, better dimensional stability, improved workability and gluabilty.
- Conventional method of kiln drying is time-consuming along with being labour and energy-intensive.
- Microwave (MW) heating has emerged as an efficient technology for rapid and uniform drying process with minimal defects.
- Present study aimed to assess drying kinetics of MW dried *Gmelina arborea* for improving utilization of this important planation grown wood

METHOD

- Small clear specimens of ***Gmelina arborea*** wood with dimensions 20 mm (T) × 60 mm (W) × 310 mm (L) were prepared for experiments.
- Drying experiments were performed in a 2.45 GHz MW oven with a output power of 900 W and 540 W.
- The drying cycles consists of exposing the wood samples to MW heating for 1 min followed by an idle time of 3 min.
- Drying cycles were carried out until the wood samples achieved the desired moisture content.
- After each drying cycle, the samples were weighed to measure the moisture loss.
- Temperature profile of wood samples during the drying process, was recorded using a Testo 872 infrared camera.
- After completion of the drying process, three 20 mm long strips (along the grain direction) were cut from centre of the dried specimen. The three strips were used for assessing the final moisture content of the whole section, prong test and moisture distribution in cross section respectively as per Indian standard, IS: 1141-1993.

RESULTS & DISCUSSION

Wood specimens were dried from an initial moisture content (MC) of about 130% to final moisture content of 12%. Total time as well as effective MW time incurred in wood drying was nearly half for samples irradiated at 900 W, compared to samples dried at 540 W (Table 1.).

Table 1. Effective microwave and total drying time taken for different treatments

	540 W	900 W
Effective Microwave time (min)	53.34	24.67
Total Drying Time (min)	213.3	98.67

Temperature profile of wood specimens during different stages of MW wood drying is presented in Figure 1.

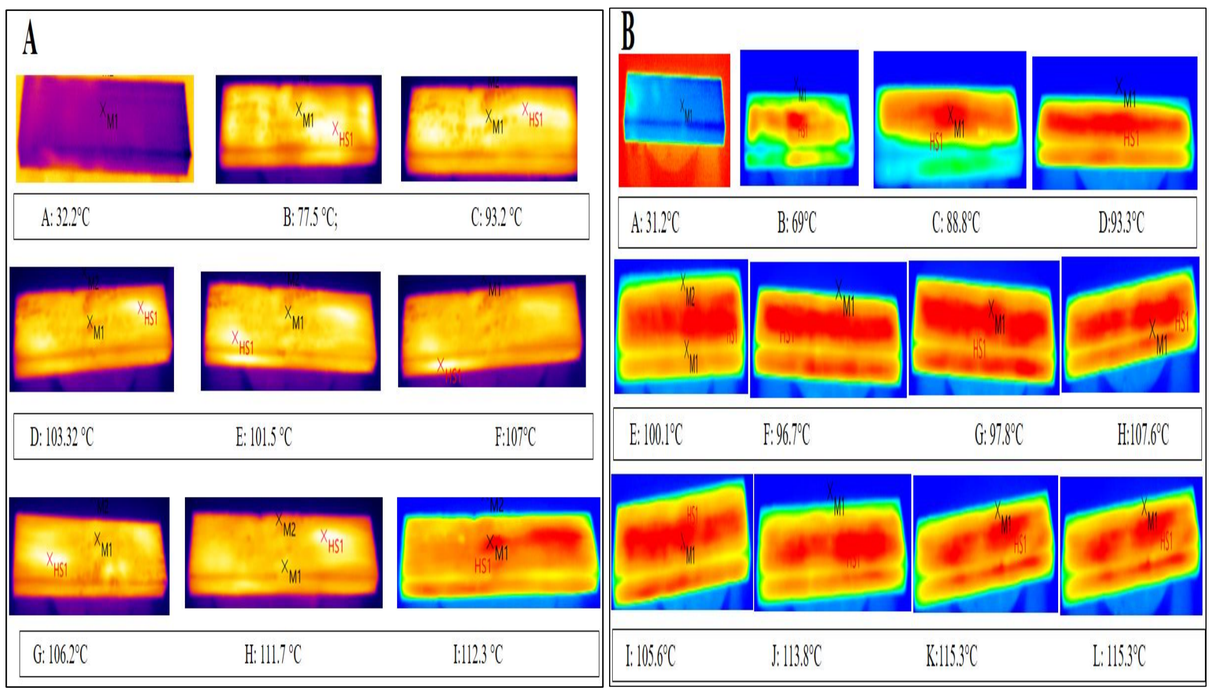

Fig 1. Temperature profile during MW wood drying at different intensities: A- 900 W; B-540 W

The drying rate was observed to be higher at MC above FSP compared to MC below FSP (Table 2.).

Table 2. The drying rate of MW dried wood samples

Moisture Content in wood	Drying rate (gm./minute)	
	540 W	900 W
Above FSP	1.21	2.24
Below FSP	0.98	1.88

Moisture distribution between core and surface was observed to be very uniform. Quality of dried wood was good, with only occurrence of slight internal checks. Severity of internal checks was higher in samples dried at 900 W.

CONCLUSIONS

- Weight loss (g/min.) was observed to be maximum for drying experiments carried out at 900 W followed by 540 W respectively.
- Drying rate was higher in samples dried at 900 W compared to samples dried at 540 W, whereas the drying rate above FSP was found to higher than rate below FSP.
- MW dried wood at all intensities has been found to be free from warping and case hardening but some internal checks were observed in cross section of samples dried at higher intensity (900W).

FUTURE WORK / REFERENCES

Further studies may be carried out to evaluate the effect of MW drying on different wood properties viz. physical, mechanical, anatomical and permeability.