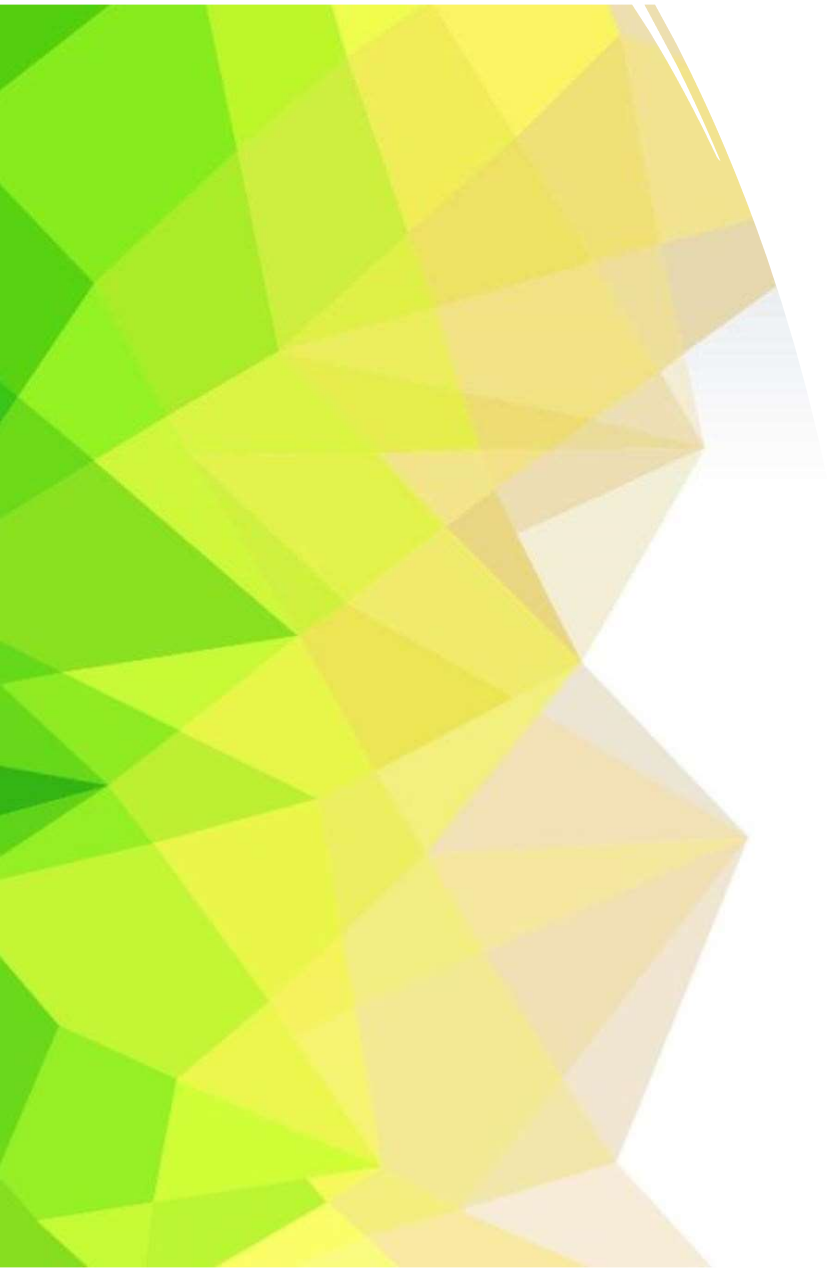

UNIVERSITÀ DEGLI STUDI DELLA TUSCIA
DIPARTIMENTO DI SCIENZE AGRARIE E FORESTALI

Water absorption behaviour and dimensional stability of a thermally modified tropical hardwood (*Triplochiton scleroxylon* K. Schum).

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Ayous wood and heat-treatment

The ayous wood is obtained from the tree species *Triplochiton scleroxylon* K. Schum, coming from central-western Africa. This species often reaches 50 m of height, without branches for the first 30 m, and 2 m of dbh. Given its size, it often provides interesting commercial assortments.

One of the main problems of ayous wood is its low natural durability, therefore treatments are usually needed in outdoor use.

Heat-treatment is one of the possible choices. Generally, is carried out at a temperature between 180 and 260 °C for some hours and the main effects on wood are the reduction of weight and hygroscopicity, of the mechanical properties, and the colour darkening.

Materials and methods

The samples were collected from untreated and heat-treated ayous planks coming from FSC certified Cameroonian forests. The heat treatment cycle was carried out at a temperature of 215 °C for three hours and then the planks were left cooling down slowly and equilibrated to normal environment condition (20 °C, 60% RH).

The following ISO reference standards were applied:

- ISO 3129 (sampling methods)
- ISO 13061-1 (moisture content determination)
- ISO 13061-2 (determination of wood density)
- ISO 13061-15 (determination of wood linear swelling)
- ISO 13061-16 (determination of wood volumetric swelling)

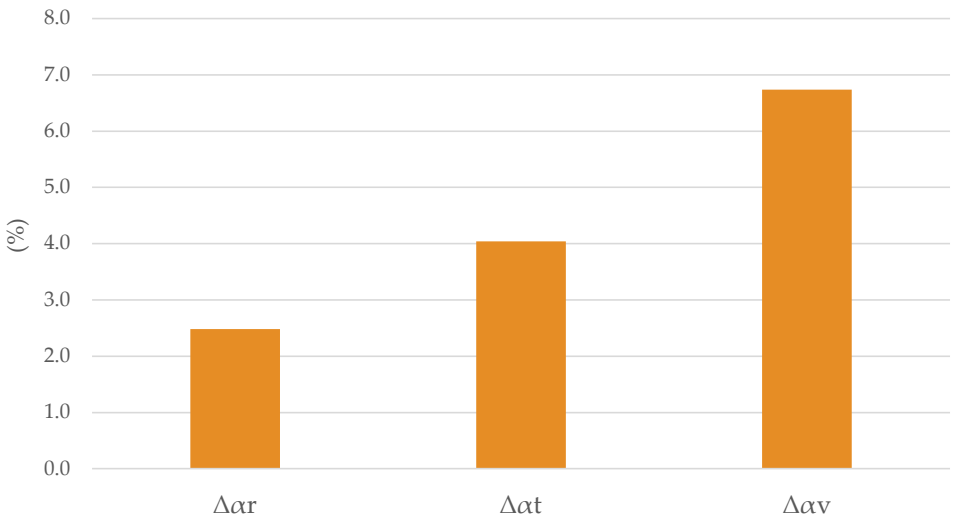

Results

Dimensional stability

	Untreated		Heat-treated	
	Mean	St. Dev.	Mean	St. Dev.
α_r (%)	4.2	1.3	1.7	0.5
α_t (%)	5.8	0.9	1.8	0.9
α_v (%)	10.2	1.7	3.5	1.1

Difference (Δ) between the swelling values before and after the treatment are showed in the chart for linear and volumetric swelling.

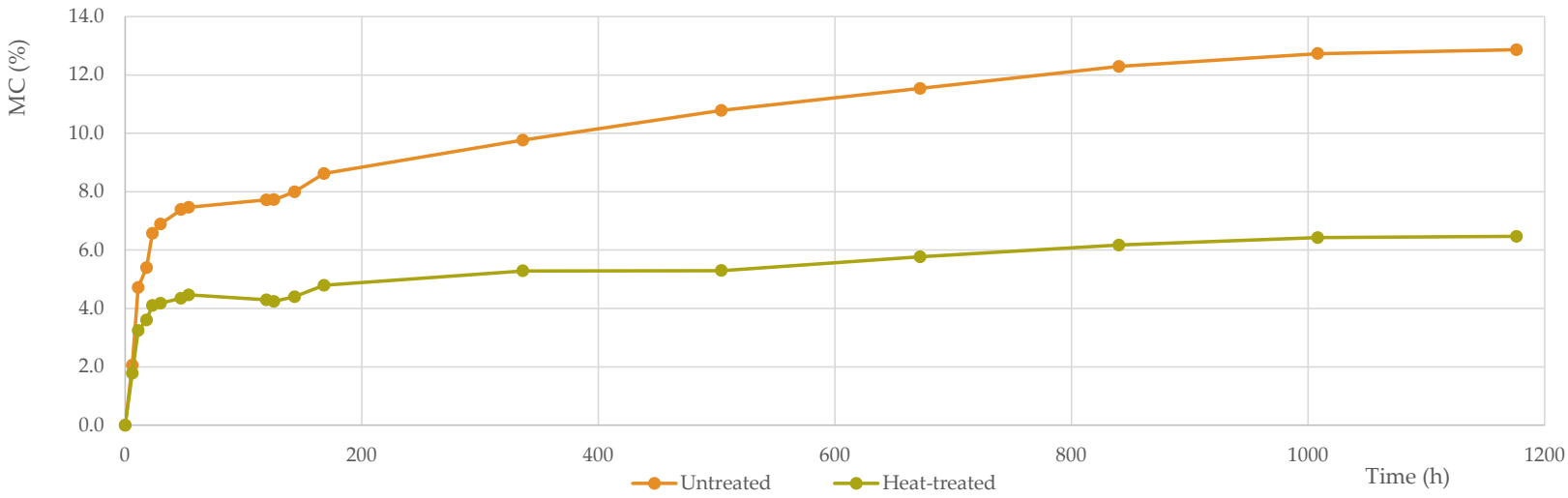
Results of the linear and volumetric swelling of untreated and heat-treated ayous wood are showed in the table.



Water absorption behavior

Time (h)	Δ (%)	Reduction percentage (%)
0	0.0	0
6	0.3	13
11	1.5	31
18	1.8	33
23	2.5	38
30	2.7	39
47	3.0	41
54	3.0	40
119	3.4	44
126	3.5	45
143	3.6	45
168	3.8	44
336	4.5	46
504	5.5	51
672	5.8	50
840	6.1	50
1008	6.3	49
1176	6.4	50

The chart shows the temporal increase in moisture content of untreated and heat-treated ayous wood.
The table shows the difference in wood moisture content between untreated and heat-treated over time and related reduction percentage.



Wood density

	Untreated		Heat-treated	
	Mean	St. Dev.	Mean	St. Dev.
Dry density (g/cm^3)	0.37	0.03	0.32	0.01
Density 12% MC (g/cm^3)	0.41	0.04	0.34	0.01

The table shows the difference between untreated and heat-treated ayous wood, both in the anhydrous state and at 12% of moisture content.

Discussion

- The linear swelling was reduced from 4.2±1.3% and 5.8±0.9%, respectively for radial and tangential direction of the untreated wood, to 1.7±0.5% and 1.8±0.9%. The percentage reduction is 60% for radial swelling and 69% for tangential swelling. The volumetric swelling was reduced from 10.2±1.7% to 3.5±1.1%; which results in a percentage reduction of 66%.
- The equilibrium moisture content of the wood exposed to environmental condition with a temperature of 20 °C and 70% of RH was 12.9% and 6.5% respectively for untreated and heat-treated ayous wood. Which results in a percentage reduction of 50%.
- The dry density was reduced from 0.37±0.03 g/cm^3 to 0.32±0.01 g/cm^3. The reduction percentage of the dry density is 16%. Whereas density at 12% of moisture content was reduced from 0.41±0.04 g/cm^3 to 0.34±0.01 g/cm^3, which results in a percentage reduction of 15%.

Conclusion

These results emphasize the validity of the thermal modification as alternative to chemicals to improve some physical properties of wood, particularly for the improvement of the dimensional stability and the reduction of the hydrophilicity.

This work can be helpful to provide a general overview of the heat treatment effects on this tropical hardwood, which it is little studied and is enjoying a growing interest in the market.

Acknowledgements

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