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Hydro-mechanical behaviour of *Aucoumea klaineana* under drying process

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Before the Cop21 forum, we know that environmental issues oblige wood and wood products to take an important place in our life due to their ecological impact in Europe and in equatorial regions such as Gabon, which concentrates various and unknown tropical species. Okoume (*Aucoumea klaineana*), one of the well know tropical specie, is used extensively in building, veneer, finished or semi-finished products and in the design of the paper. In timber structure, Okoume is often used after drying but also immediately after cutting. However, his mechanical behavior during drying plays a decisive role in the development of defects (Moutou Pitti et al 2013). This fact induces the necessity to study this important specie submitted to natural drying process.

Material methods and results

The experimental device is composed of: a testing table, a scale, a thermo-hydrometer, a marker and a digital camera. A green wood slice (okoume) with a thickness $e = 30 \text{ mm} (\pm 2 \text{ mm})$ and diameter $d = 200 \text{ mm} (\pm 5 \text{ mm})$ is considered, Figure 1 (a). Before test, the slice is conditioned in water in order to guarantee its saturation. The marks are put on the slice to measure displacements during the drying process with a camera. In this case 6 radius ($R1 \dots R6$) and 4 Crowns ($C1 \dots C4$) around the center have been drawn, Figure 1 (b). The slice is finally positioned on the balance in order to measure the mass loss. Figure 1 (b) presents the cracked slice at the end of test after 7 days with final internal moisture content of 10%. The environment conditions of the experimental chamber are $HR = 33\%$ and $T = 22\%$. The mass loss, displacements and crack evolution are simultaneously recorded over time until the moisture content balance is achieved.

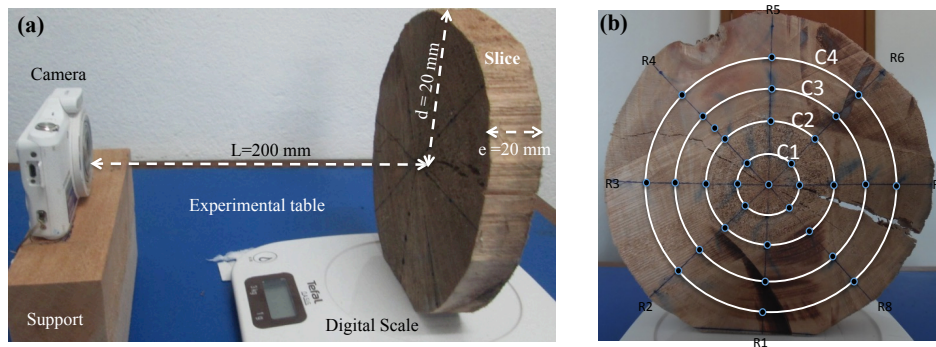


Fig. 1 (a): Experimental device. (b): Cracked slice with radius R and crowns C at the end of drying (10%)

Two tests have been performed in order to compute the radial strain E_R , tangential strain E_T and shear strain G_{RT} according to the expression proposed by Guitard (1987) and Palka (1973)

$$E_R = 1810 * \left(\frac{\rho}{0.65}\right)^{1.30}, E_T = 1030 * \left(\frac{\rho}{0.65}\right)^{1.74}, G_{RT} = 366 * \left(\frac{\rho}{0.65}\right)^{1.74} \quad \text{Equation 1}$$

ρ is the volume mass. In this work, the obtained elastic moduli are compared with the values given by Guitard only for Test 2, Table 1. We observe important differences in the case of E_{RT} and G_{RT} .

Tab. 1 : Comparison of obtained elastic moduli with Guitard data

	H(%)	Mv (g/cm3)	Er (MPa)	Et (MPa)	Grt (MPa)
Test 2	12,04	0,42	1040	448	174
Guitard	14,30	0,42	1170	736	70

Figure 2 (a) shows the evolutions of radial strains versus internal moisture content. We can deduce that the point saturation fibre of Okoume is around 30%. Figure 2 (b) shows the evolution of tangential strains versus time after 250 h. We observe that strains in the heart of the slice are greater than the periphery; also, the influence of crack that occurs approximately 4 days after the start of the test, is observed. This defect is justified by a sudden decrease of tangential strains.

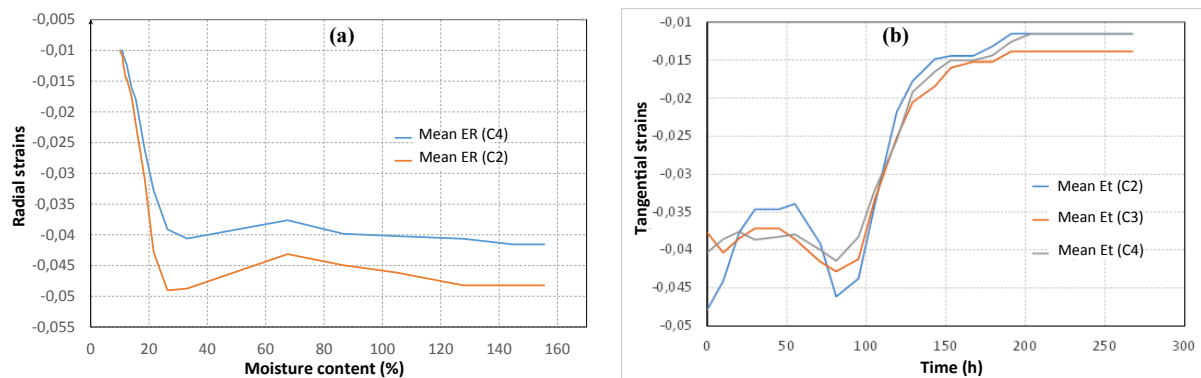


Fig. 2 (a): Evolutions of Radial strains vs. moisture content. (b): Evolutions Tangential strains vs. time

This work is devoted to the knowledge of mechanical behaviour of tropical specie *Aucoumea klaineana* submitted to drying process. The PSF (30%) has been obtained by following the evolutions of radial strain versus internal moisture content. Also, the tangential strains have shown that the deformations are greater at the center than at the periphery and are perturbed by the apparition of crack 4 days after the beginning of test. In the coming works, a numerical finite element model will be developed in order to simulate the crack phenomenon in this tropical specie. The main goal is to know the real impact of environmental effects in timber structures under various loading conditions.

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