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# Beech wood improvement by in-situ polyesterification using bio-based polycarboxylic acids and polyols

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SIMPPÉ



## Context

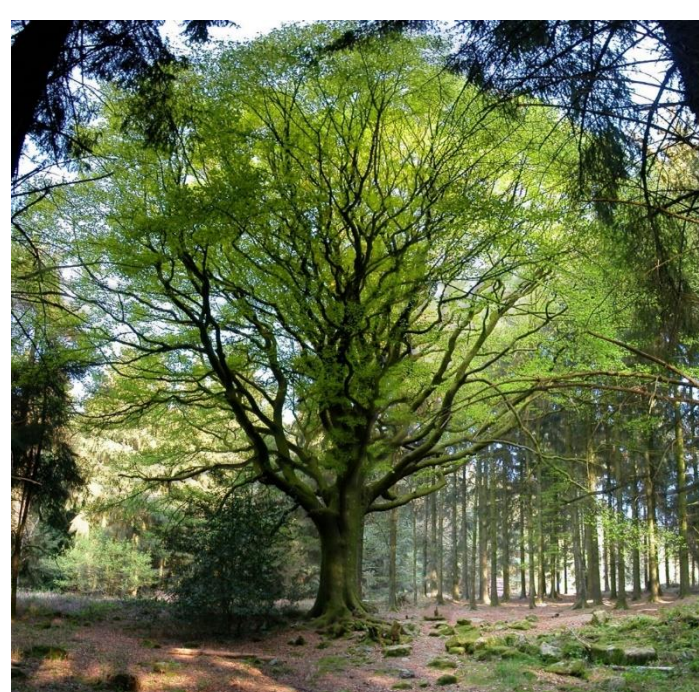
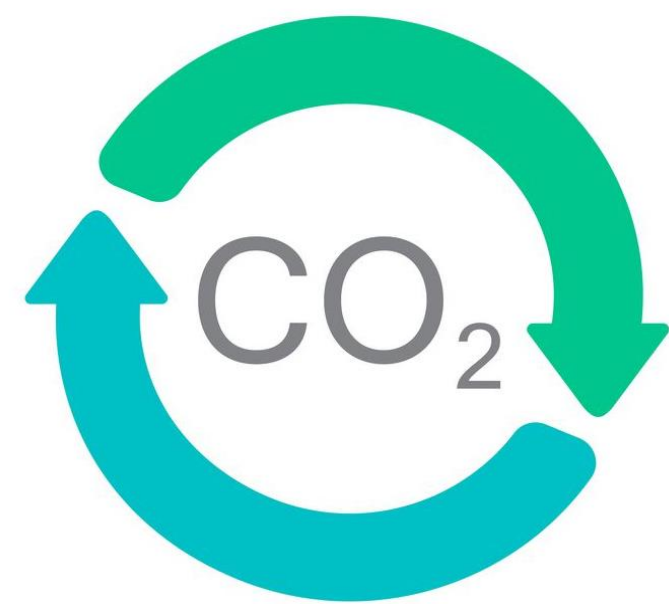
- Important CO<sub>2</sub> stocking properties.
- Mechanical properties, esthetic, diversity, availability

Beech wood is/has:

- Abundant specie in Europe – 10% of the living wood in France
- Low resistance to fungal attacks
- Important dimensional variations accompanying moisture content changes.

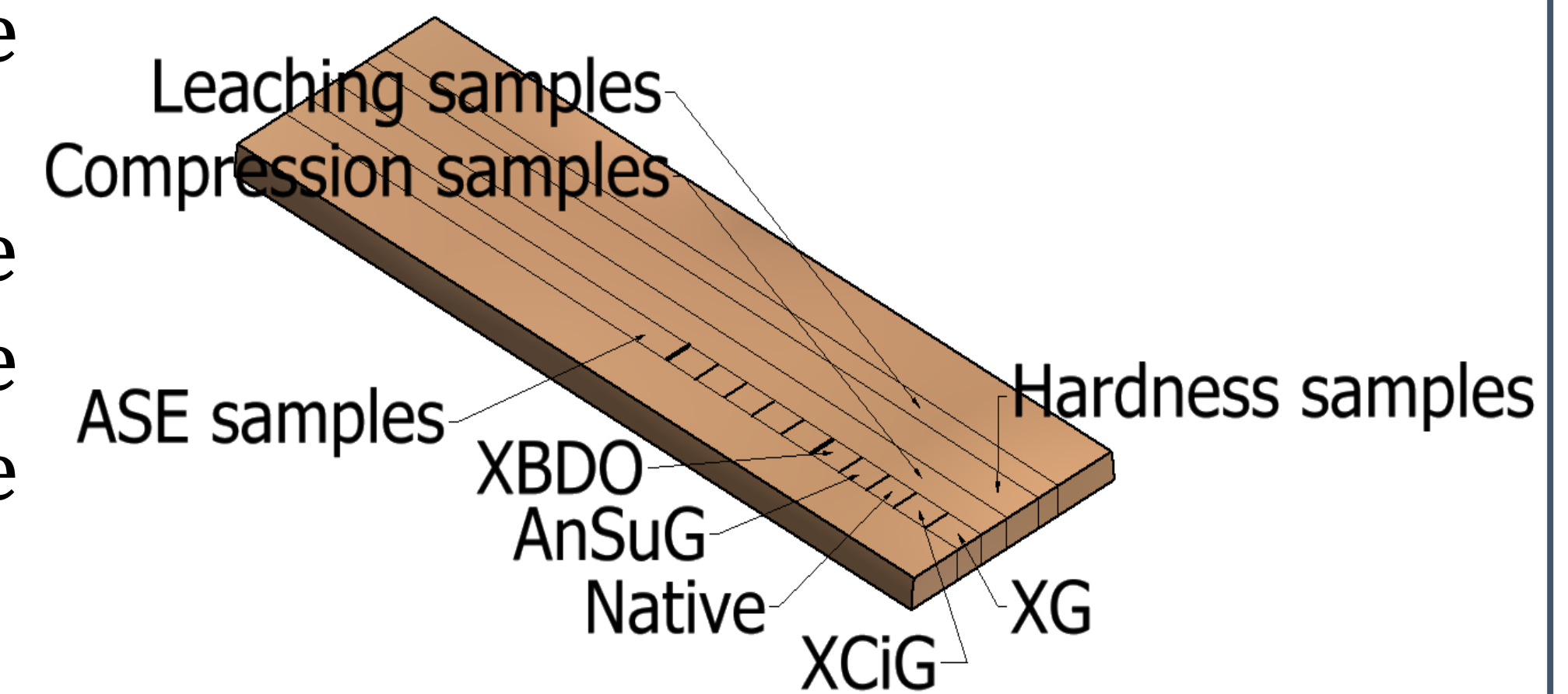
Objectives:

- Study polyesters in-situ treatments using environmentally friendly chemicals in order to improve the dimensional stability.

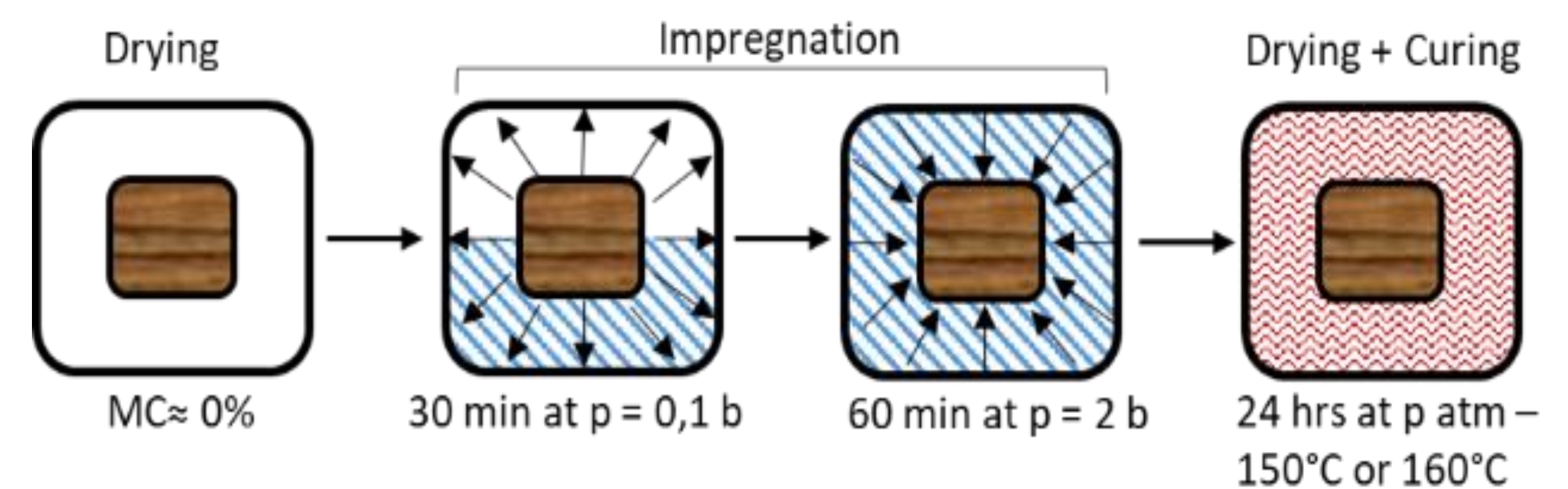


## Sampling Strategy - Impregnation process

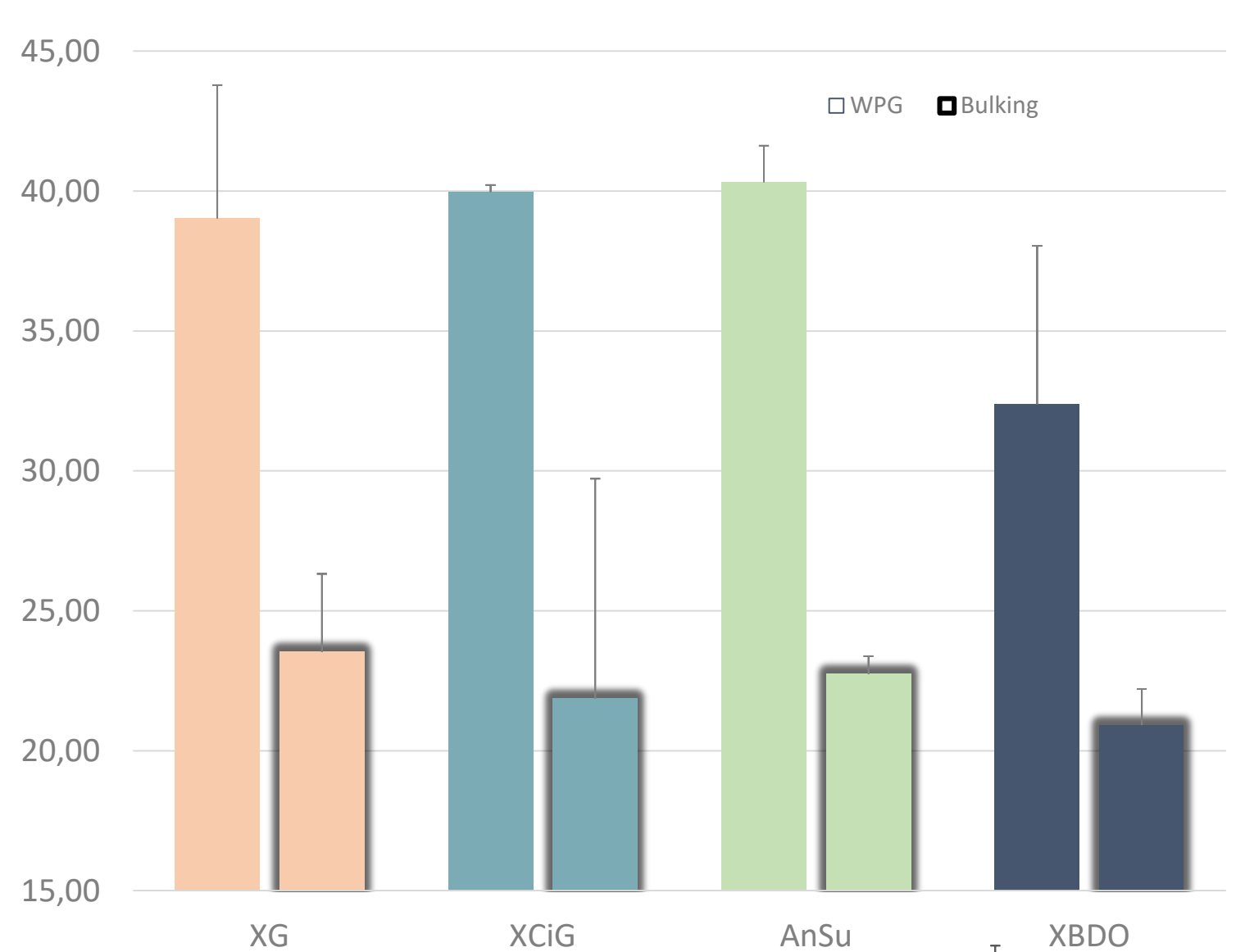
- To observe the treatments' effects while limiting the impacts of the wood heterogeneity



- Impregnation Process

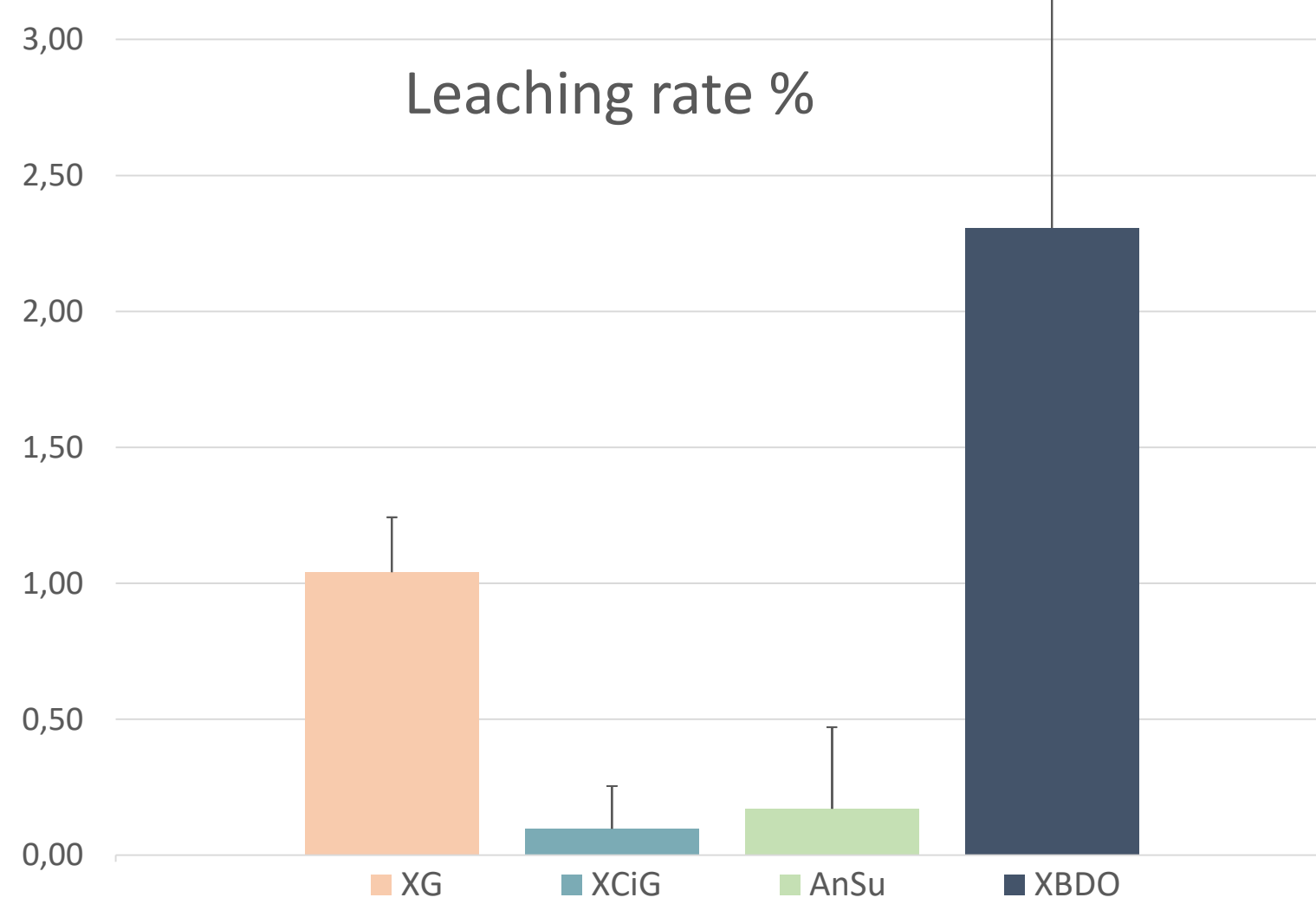


## Results: Impregnation - ASE - LR - Swelling



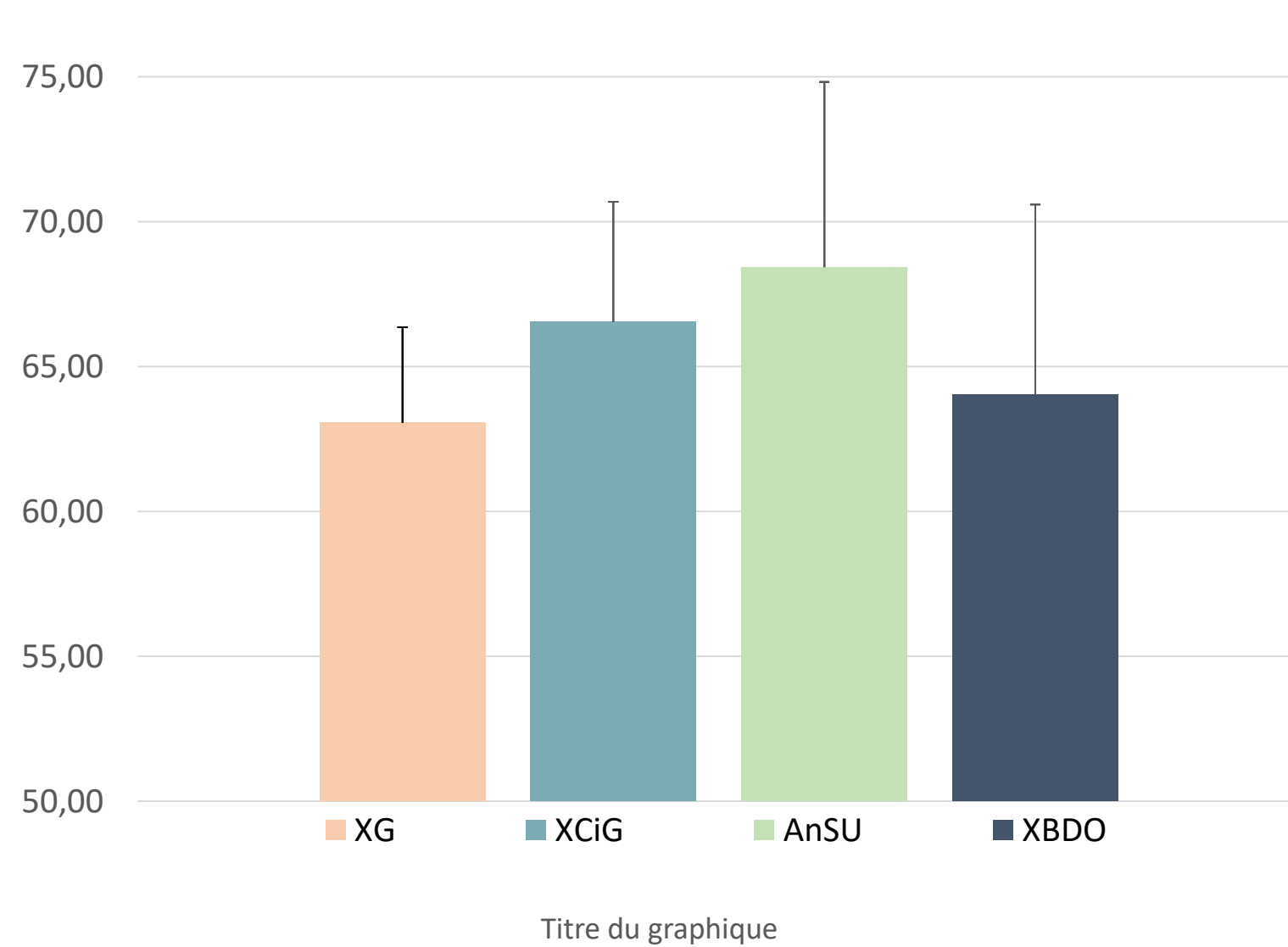
Impregnation:

- WPG around 32% and 40%
- Bulking between 20% and 23%,



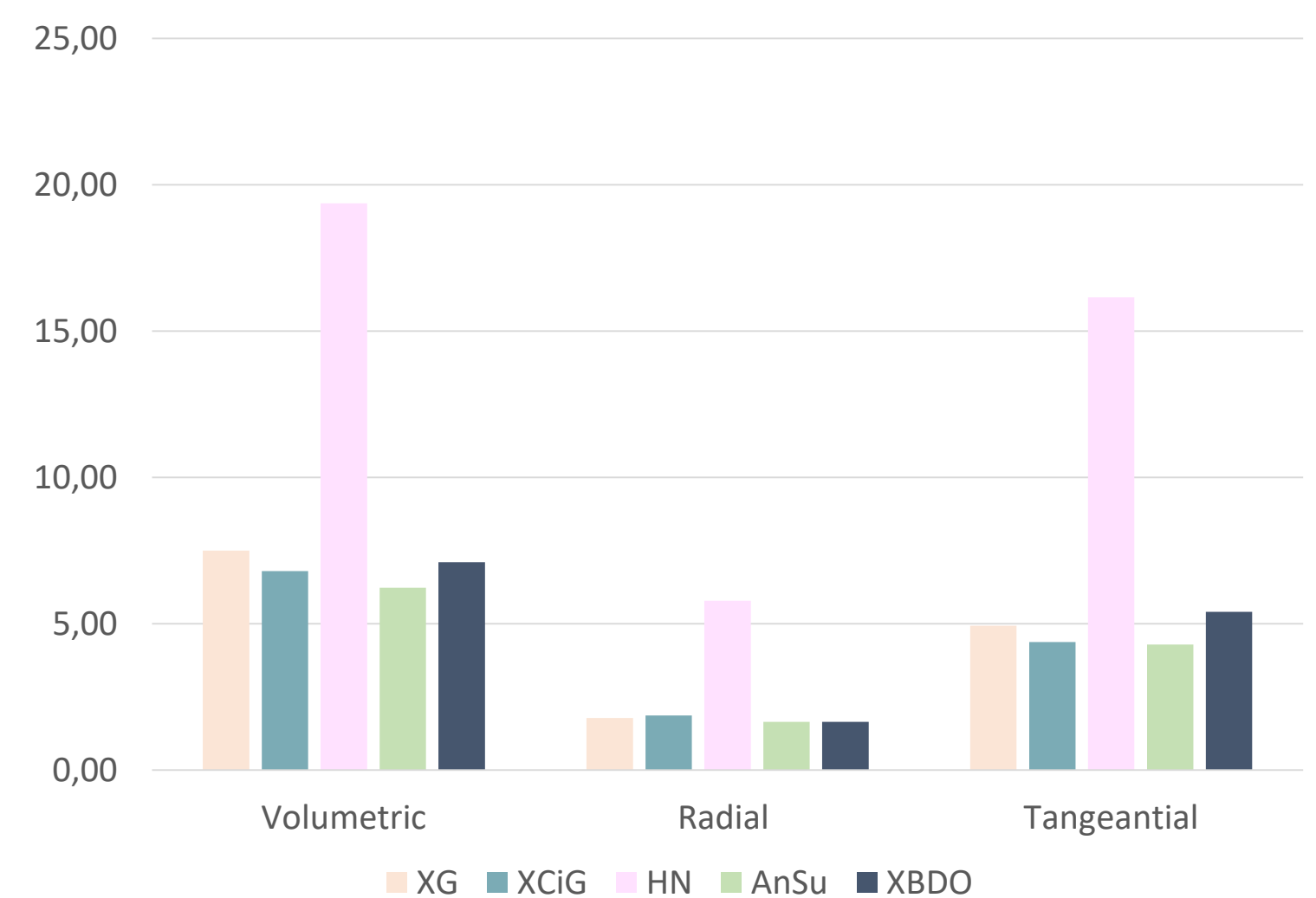
Leaching Rate:

- 31 hours in water
- Values comprised between 0.05% and 4%



Dimensional Stability:

- ASE between 60% and 70%

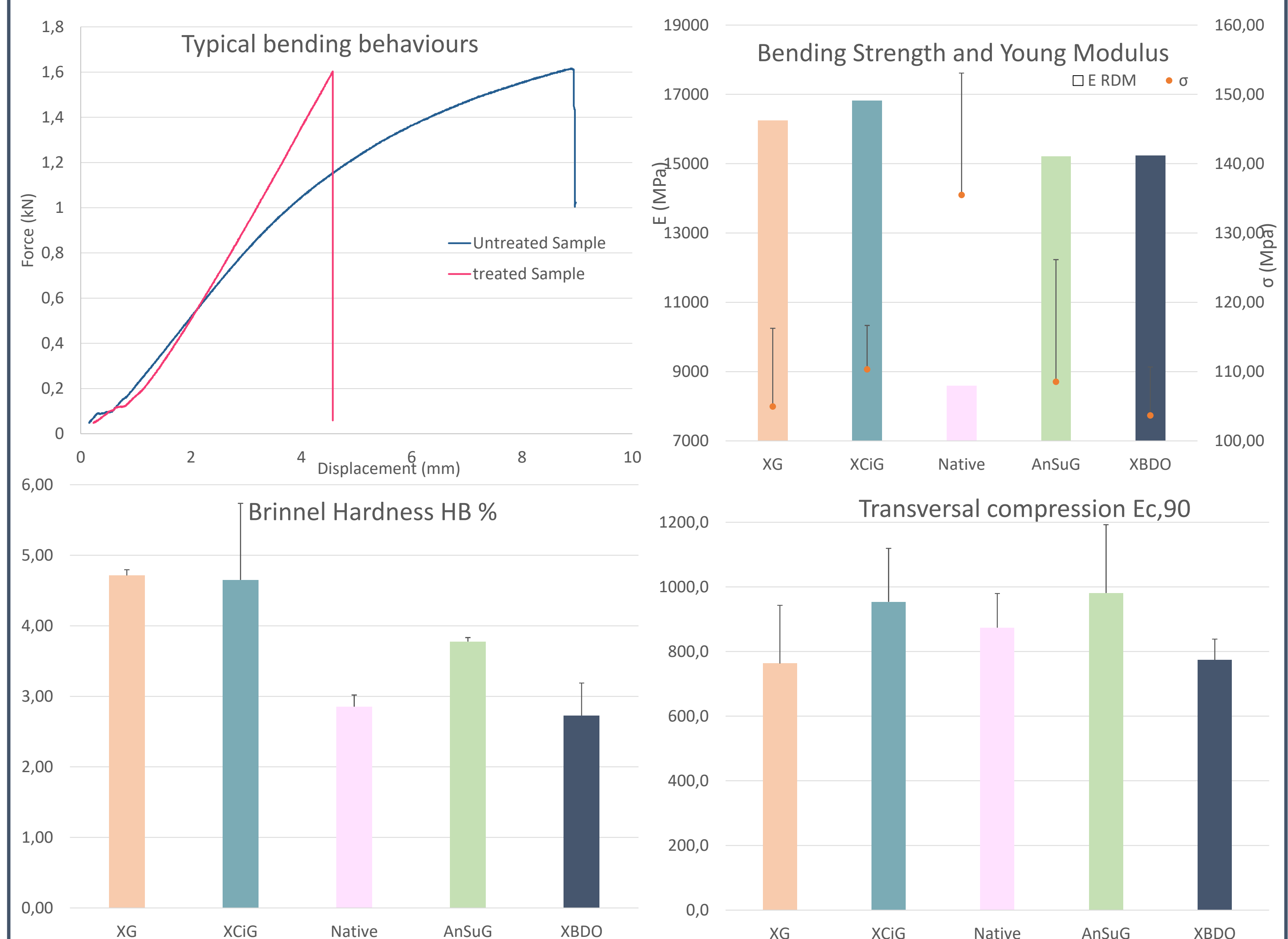


Swelling

- Improved in the linear directions
- Factor two between radial and tangential directions

## Mechanical Tests - Results

- Hardness values improved compared to the value of native as high as 4.71 HB compared to 2.85 HB.
- Bending strength decreased, Young Modulus improved for two of the treatments
- Young Modulus  $E_{c,90}$  increased in transversal compression from 7% to 12%, for XCiG and AnSuG compared to native beech wood.



## Conclusion

- Considering the results obtained in LR and ASE, especially for the XCiG and AnSuG treatments, it can be safely assumed that a polymerization and/or grafting occurs on the sorption sites of the wood affecting then, the wood ability to bond with moisture.
- Thermal treatment is also induced when curing the samples. This explains the losses of mechanical resistance in both bending and compression. However it is compensated by the chemical treatment effect.