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Experimental characterization of hydrogel swelling under plant cell wall environment

C. Assor\textsuperscript{a}, T. Alméras\textsuperscript{b}, F. Quignard\textsuperscript{c}, O. Arnould\textsuperscript{b}

Context
Characterization of molecular mechanisms responsible of wood maturation growth stress
Biomechanic functions of tension wood: weight increase balance and plant orientation control

Materiel and methods

\[ \text{swelling} = \left( \frac{\Delta m}{m_0} \right) \times 100 \]

\begin{tabular}{|c|c|c|c|}
\hline
Alginate & \( \varepsilon_{\text{max}} \) & \( \sigma_{\text{max}} \) & \( G' \) \\
(\%, dw) & (\%) & (kPa) & (kPa) \\
\hline
1 & 129 & 0.71 & 10 \\
2 & 103 & 1.60 & 41 \\
3 & 51 & 1.75 & 86 \\
\hline
\end{tabular}

Conclusions and perspectives

- The confined swelling stress could more correspond to an osmotic pressure. Additional tests will be established with different alginate structures to characterize the origin of the stress developed.
- The 0.2\% deformation of crystalline cellulose estimated within the G-layer require a lateral compressive stress from the matrix closed to 1 MPa, that could not be reached by the osmotic pressure. From these experimental results, it appears that the confined chamber is too stiff as the matrix needs to be less confined to produce a sufficient swelling stress.
- Nano hydrogels could allow to raise a polymer ratio around 20\% that would be a more realistic G-layer analog and would allow to study cellulose/matrice interactions.