

Supplementary data analysis

S1. Linear regression to predict Anti-shrink efficiency (ASE) from tangential swelling

To determine if the percentage tangential swelling from oven dry to water saturation (ΔT) could be used as an alternative metric ASE, simple linear regression was used to test if the tangential dimensional change significantly predicted ASE across all the different wood types. The fitted regression model was: $\Delta T = -13.7 \times ASE + 97.7$. The overall regression was statistically significant ($R^2 = 0.9222$, $F(1, 46) = 557.8$, $p < 0.001$). The tangential swelling is plotted against ASE in Figure S1, and the regression line is shown.

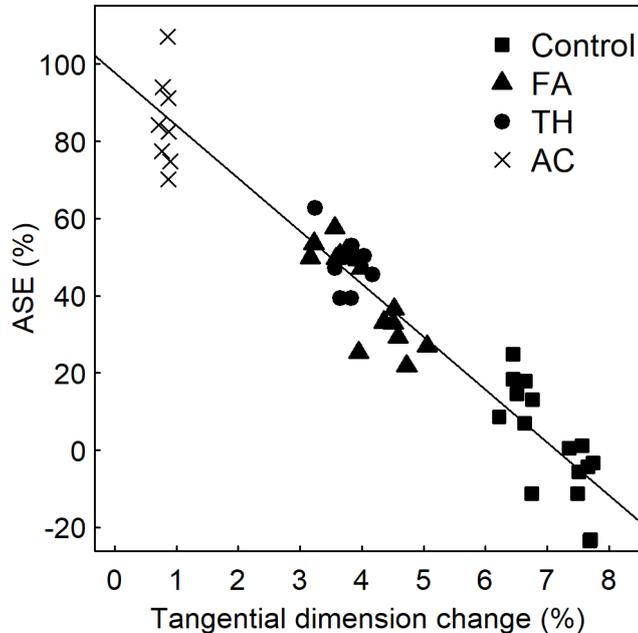


Figure S1. Anti-shrink efficiency as a function of tangential dimensional change from oven dry to water saturation. A fitted regression line is also shown.

S2. Examples of swellometer swelling rates over time

The tangential swelling over the first 12 hours of the swellometer test is shown in Figure S2 for one representative specimen of each wood type. Differences in both the rate, and final extent of the swelling can be clearly seen. The test continued for 72 hours, by which time all the specimens had stopped swelling.

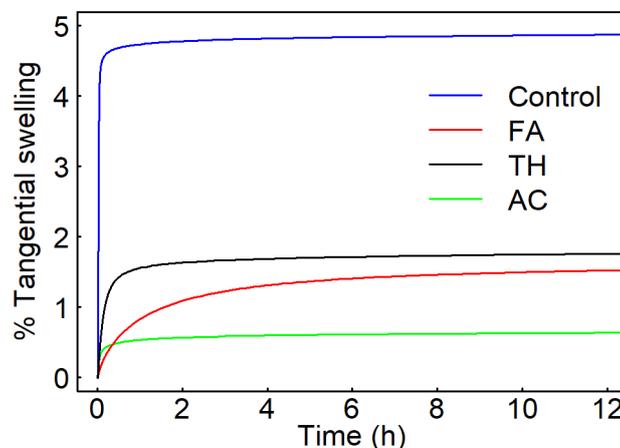


Figure S2. Tangential swelling for the first 12 hours of the swellometer test, illustrated with representative specimens from each wood type.

S3. Comparing maximum tangential swelling from water soak and swellometer tests

Simple linear regression was used to test if the maximum tangential swelling from the swellometer test ($\%SW_{max}$) was significantly correlated with the tangential dimension change during the repeated water soak test. The fitted regression model was: $\Delta T = 1.18 \times \%SW_{max} + 1.38$. The overall regression was statistically significant ($R^2 = 0.8502$, $F(1, 22) = 131.5$, $p < 0.001$). In Figure S3, $\%SW_{max}$ is plotted against the tangential swelling from the repeated water soak test, and the regression line is also shown. The magnitude of $\%SW_{max}$ is much lower than the tangential swelling in the repeated water soak test, but the linear relationship between them means that when comparing the relative performance of different wood types, $\%SW_{max}$ should give equivalent results to tangential swelling from the repeated water soak test.

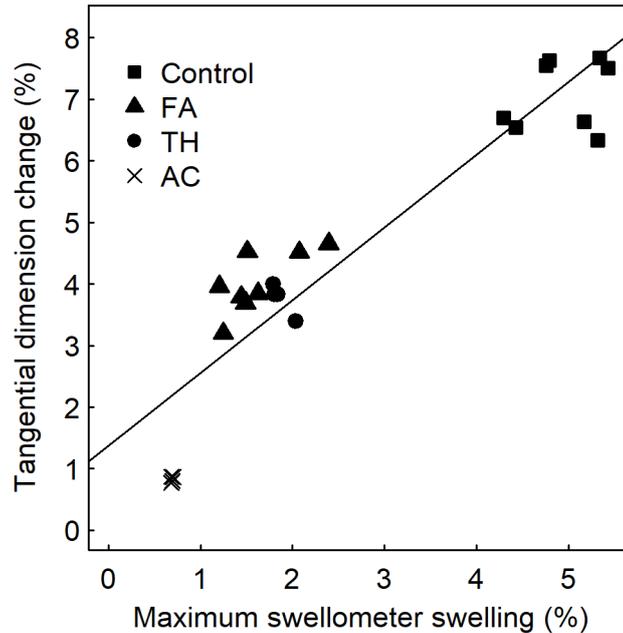


Figure S3. The maximum swelling from the swellometer test plotted as a function of tangential dimension change from the repeated water soak test. A fitted regression line is also shown.

S4. Calculation of swelling coefficients from equilibrium humidity cycling test

For each specimen tested in the equilibrium humidity cycling test, simple linear regression was used to predict both radial and tangential swelling as a function of relative humidity. The slope of these regression lines are the radial and tangential swelling coefficients for that specimen. An example of this using the ThermoWood specimen "TH2-3" is shown in Figure S4.

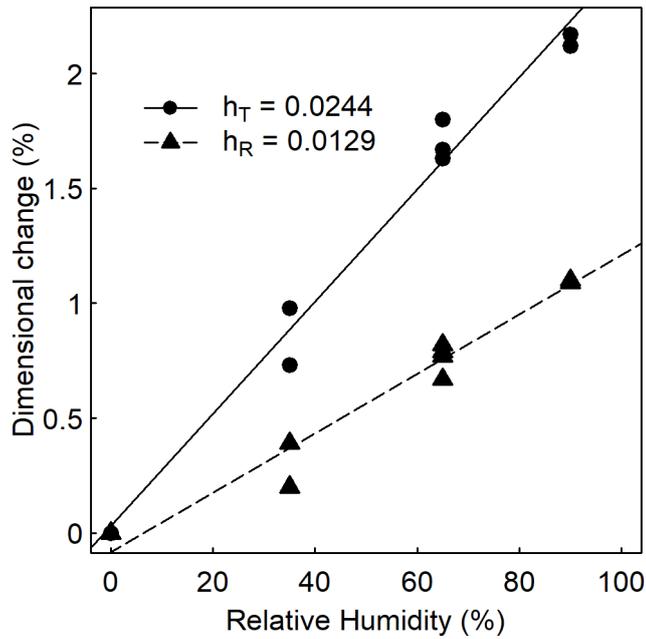


Figure S4. Dimensional changes for specimen “TH2-3” in the equilibrium humidity cycling test as a function of relative humidity. Tangential dimensions are shown as circles and radial dimensions as triangles. Regression lines are also shown (solid line for tangential dimensions, dashed line for radial dimensions). The slope of each regression line is shown in the legend.

S5. Calculation of swelling anisotropy ratios from equilibrium humidity cycling test

Swelling anisotropy ratios were calculated for each individual specimen by linear regression of the tangential dimensional change as a function of radial dimensional change. The slope of this regression line is the swelling anisotropy ratio (T/R) for that specimen. Where the linear regression was not statistically significant (95% confidence level), the specimen was excluded from subsequent analysis. Figures S5 to S7 show examples of the linear regression in a range of different specimens with both large and small dimension changes and giving examples where the linear regression was, and was not, statistically significant.

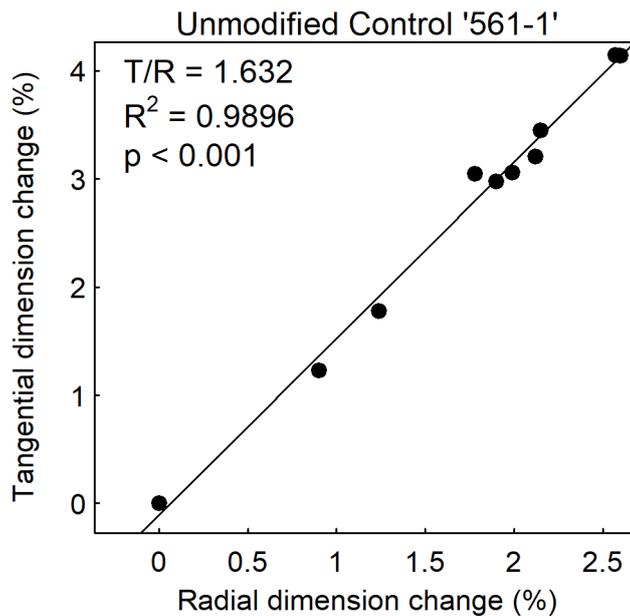


Figure S5. Swelling anisotropy ratio for an unmodified control specimen calculated from tangential and radial dimensional changes during equilibrium humidity cycling test. The dimensional changes are large, and the linear regression is statistically significant (95% confidence level).

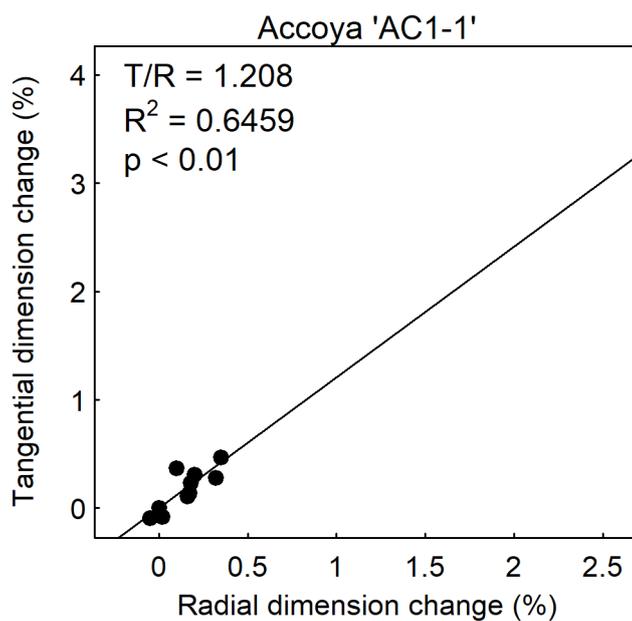


Figure S6. Swelling anisotropy ratio for an Accoya specimen calculated from tangential and radial dimensional changes during equilibrium humidity cycling test. The dimensional changes are small, but the linear regression is statistically significant (95% confidence level).

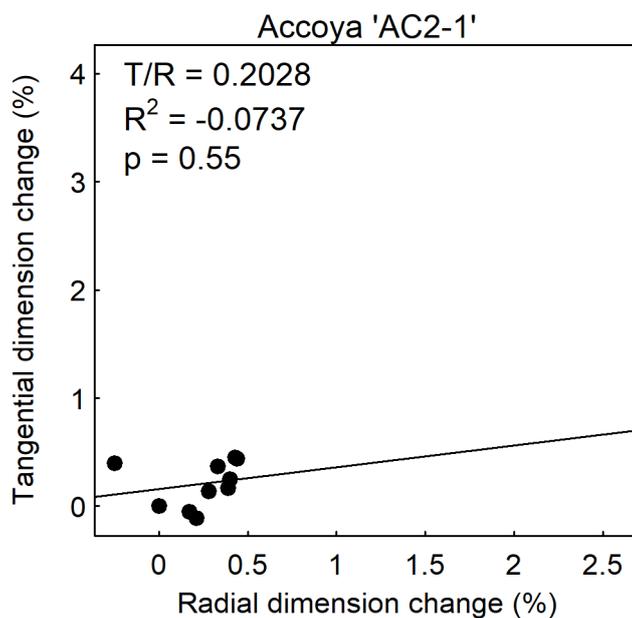


Figure S7. Swelling anisotropy ratio for an Accoya specimen calculated from tangential and radial dimensional changes during equilibrium humidity cycling test. The dimensional changes are small, and the linear regression is not statistically significant (95% confidence level). This specimen was not included in subsequent analyses.