CELL WALL STRUCTURAL DIFFERENCES BETWEEN HARDWOOD AND SOFTWOOD STUDIED BY FT-IR, RAMAN AND FLUORESCENCE SPECTROSCOPY

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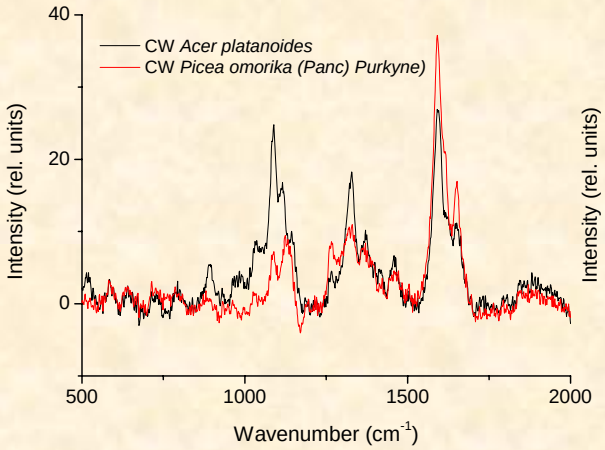
CWs isolated from *Picea omorika* (Panč) *Purkyne* (softwood) and *Acer platanoides* (hardwood)

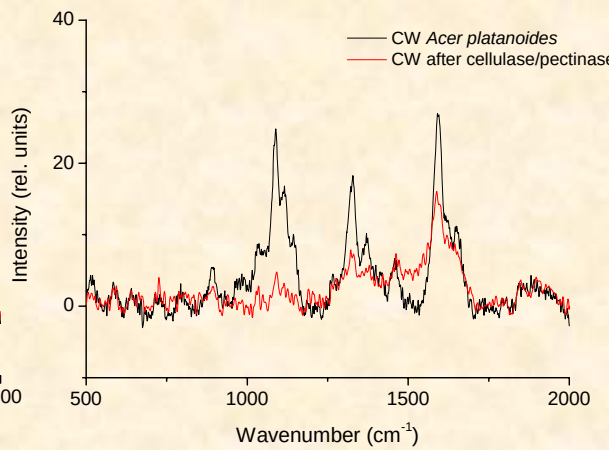
Cell walls (CWs) of wood tissue:
Cellulose
Hemicelluloses
Lignin

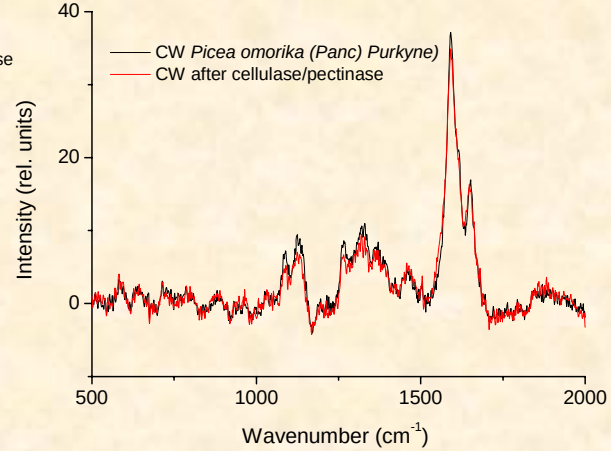
Chemical differences between conifers (softwoods) and deciduous trees (hardwoods) in:
- type of hemicelluloses
-lignin monomeric precursors in the CWs (guaiacyl, syringyl/guaiacyl)

- **Raman, FT-IR – lignin and polysaccharides fingerprint regions;**
- **Fluorescence spectra – deconvolution and modeling as a tool for complex molecules**

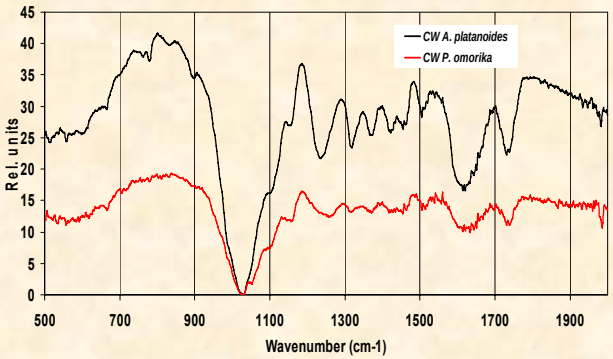
Raman spectra of the cell walls

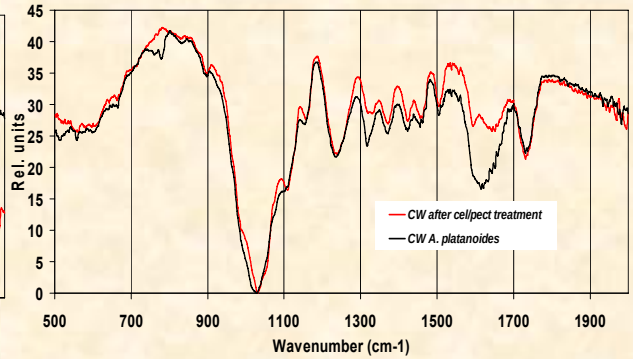


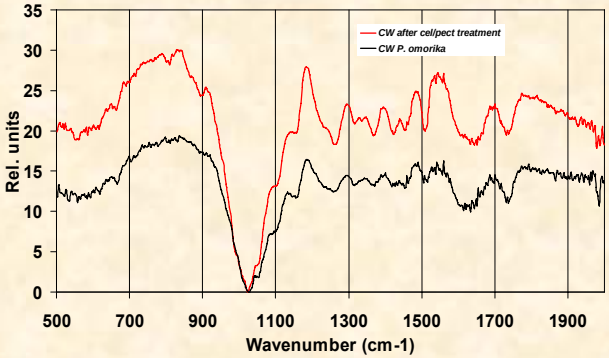




FT-IR spectra of the cell walls

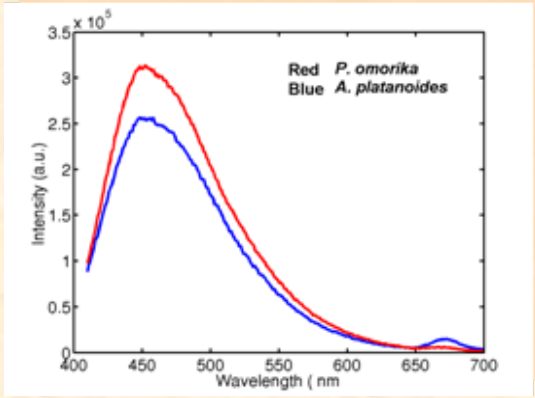


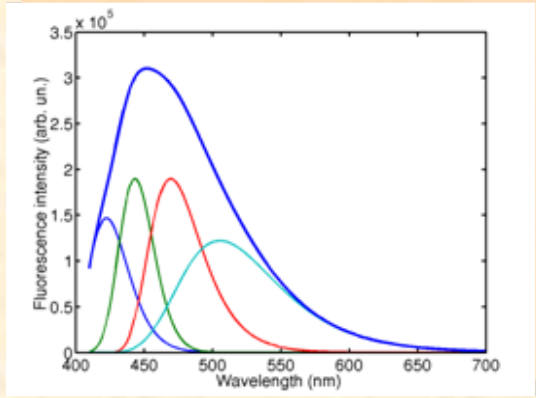




- **The bands in the FT-IR spectra of the *Acer* cell walls are more pronounced in comparison with those of the *P. omorika* cell walls, but there are no substantial differences in the spectral pattern. However, differences are much more pronounced in the Raman spectra of the two CW samples, in the lignin (band region of C=C vibrations being active in Raman) and polysaccharide characteristic regions.**
- **The effect of cellulase/pectinase treatment is more prominent in sycamore CW than in omorika CW, which is much more visible in the Raman spectra (lignin skeletal vibration and region of C=C vibrations, polysaccharide spectral region) than in FT-IR spectra. It means that the treatment has a strong effect on Raman active, i.e. symmetric, vibrations. From the spectral data, such groups are more abundant in sycamore than in omorika CW.**

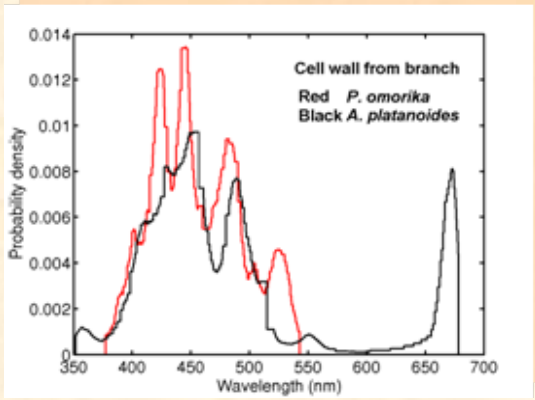
Fluorescence spectra of the cell walls

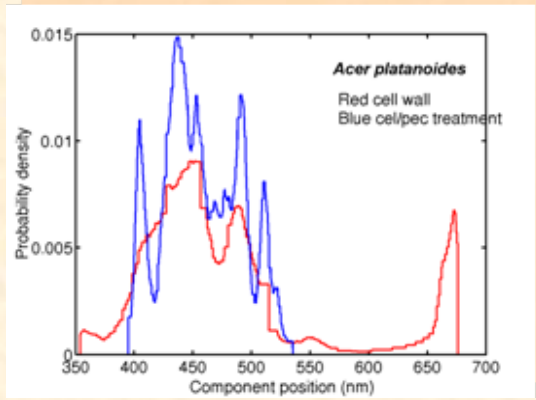


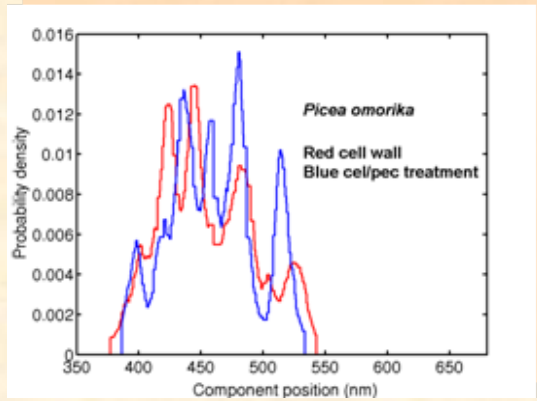


For each of the samples, a series of emission spectra were collected by varying excitation wavelengths with 5 nm steps, in order to trace all fluorophores in the cell walls. The deconvolution of all spectra of a sample, using a logn model, was performed in order to determine the number of fluorophores in the sample.

Emission spectra and an example of deconvolution of one of the spectra, using 4-component logn model. Excitation λ = 390 nm.







Approximate distribution of the probability that a fitted logn component of all emission spectra of each of the samples occupies a position on the wavelength axis.

• APDs of emission spectra indicate higher number of fluorophores in sycamore CW than in omorika CW. The effect of cel/pect on the APDs of two CWs reflects changes in fluorophore organization after the treatment. Red shift of the long-wavelength APD component of sycamore CW (550 nm) in comparison with omorika CW may show higher amount of conjugated C=C bonds in sycamore. The cel/pect removes the longest wavelength APD component (670 nm) of sycamore CW, which is, together with its effect on the Raman spectra, an evidence that the treatment influences arrangement of C=C bonds.

• The results show different organization in lignin and polysaccharide components of the CWs in omorika and sycamore wood (branches). These data may contribute to the understanding of different mechanical strength in the two wood types.