



Structural characterization of different hardwoods using infrared spectroscopy

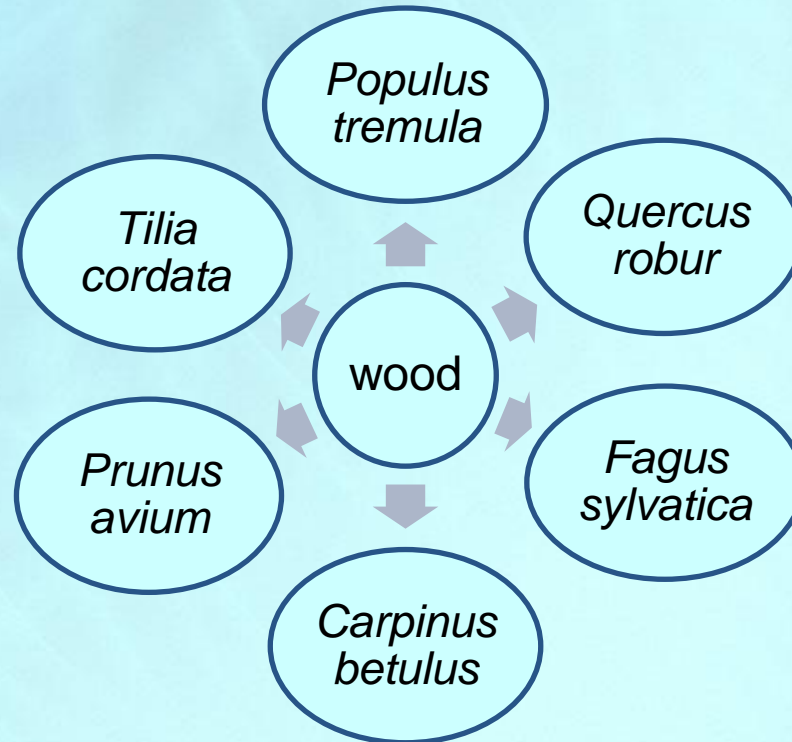
**Carmen-Mihaela Popescu, Maria-Cristina
Popescu**

*“Petru Poni” Institute of Macromolecular Chemistry of
Romanian Academy , Iasi, Romania*

Aim

To find the most convenient procedure to make an easy differentiation between various kinds of wood.

Materials

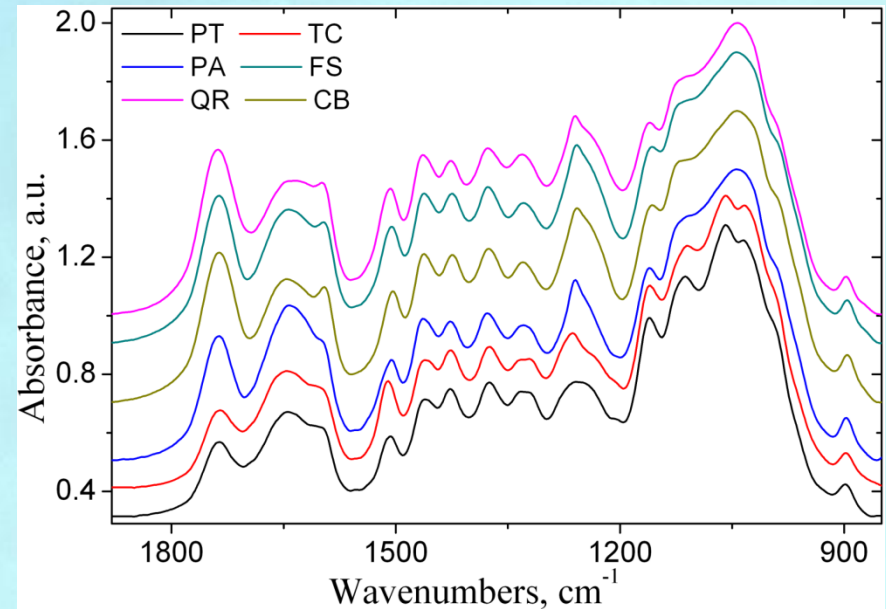
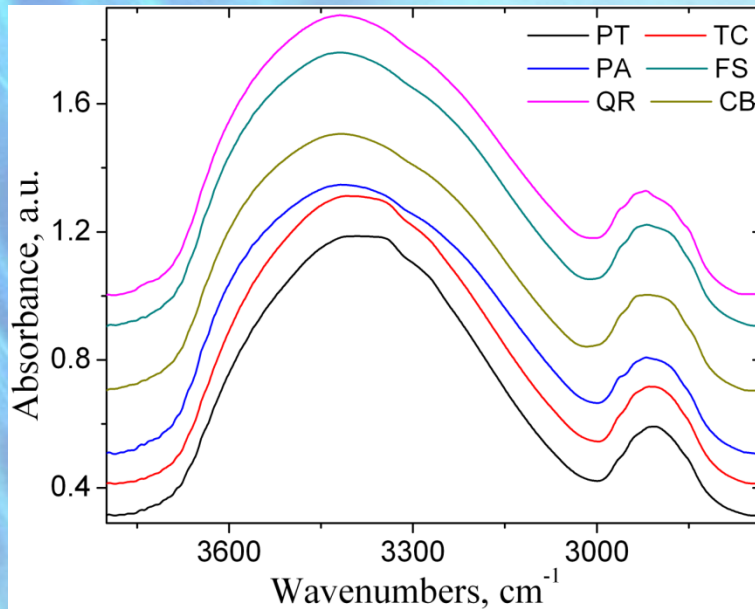


Methods

FT-IR spectroscopy

2D IR correlation spectroscopy

FT-IR spectroscopy



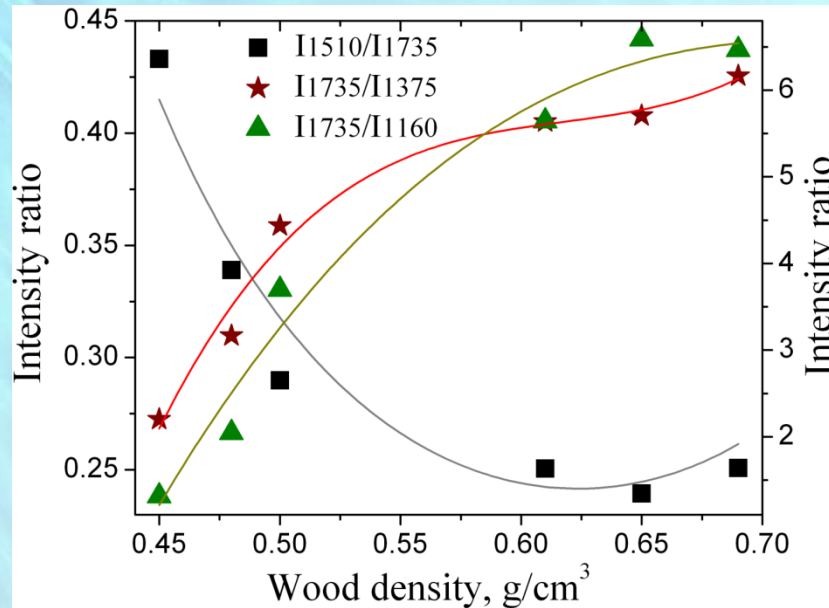
3800–2700 cm⁻¹ region → hydrogen bonds and C–H stretching absorptions

1595, 1510, 1270 cm⁻¹ → C=C, C–O stretching/bending vibrations of different groups from lignin

1460, 1425, 1335, 1220, 1110 cm⁻¹ → C–H, C–O deformation, bending or stretching vibrations of different groups from lignin and carbohydrates

1735, 1375, 1240, 1165, 1060, 1030 cm⁻¹ → C=O, C–H, C–O–C, C–O deformation or stretching vibrations of different groups from carbohydrates

The intensity ratio of lignin/carbohydrate and carbonyl/carbohydrate bands



The ratio values of lignin/carbohydrate IR bands for wood decreases with increasing the average wood density.

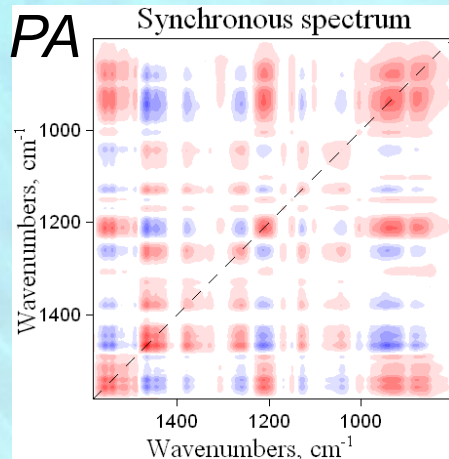
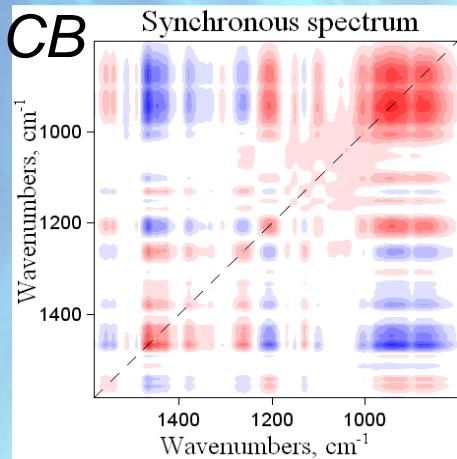
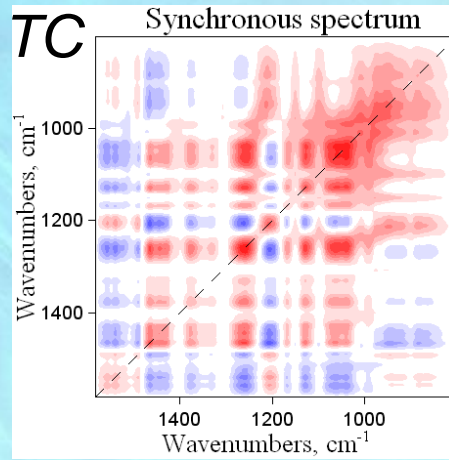
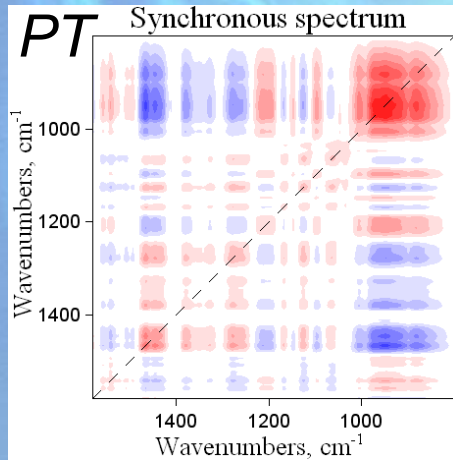
The ratio values of carbonyl/carbohydrate IR bands for wood increases with increasing the average wood density.

The lignin content calculated by FT-IR spectra

Species	Lignin content (%)	
	calculated	literature
poplar (<i>Populus tremula</i>)	22.5	21-25
lime (<i>Tilia cordata</i>)	21.2	20-22
sweet cherry (<i>Prunus avium</i>)	16.8	18-21
hornbeam (<i>Carpinus betulus</i>)	19.4	18-20
beech (<i>Fagus sylvatica</i>)	17.9	18-22
oak (<i>Quercus robur</i>)	17.5	18-22

FT-IR spectroscopy can offer the possibility of a quantitative lignin determination in wood. The intensity of the band of aromatic skeletal vibrations around 1510 cm^{-1} is a measure for the lignin content.

2D IR correlation spectroscopy



Wavenumbers, cm^{-1}	PT	TC	CB	PA
1555	+	+	+	+++
1513	-	-	-	+
1492	-	+	-	+
1463	+++	+++	+++	+++
1442	++	++	++	++
1378	+	+	+	+
1280	+	-	-	-
1263	-	+++	++	++
1207	+	+++	++	+++
1126	+	+++	+	+
1100	+	-	+	-
1058	+	+++	-	-
1037	-	+++	+	+
1004	+	++	+	+
940	++	++	+++	+++

The different wood species have particular auto-peaks in the synchronous 2D correlation spectra in 1600-800 cm^{-1} region.

Conclusions

- By FT-IR spectroscopy, was observed that the ratio values of lignin/carbohydrate IR bands for wood decreases and the ratio values of carbonyl/carbohydrate IR bands for wood increases with increasing the average wood density.
- The calculated values of lignin percentage from the FT-IR spectra are in very good correlation with the values from literature data.
- 2D correlation IR spectroscopy was able to evidence differences which were not obtained from normal IR spectra

***Thank you very much
for your attention!***