Multivariate statistical analysis of Mid-Infrared Spectra of wood/polyamide composites

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This work deals with the study of the specific interactions at interface between wood and copolyamide.

Materials

- ***Pine chips***
- ***Copolyamide (coPA)***

60 wood/40 coPA

40 wood/60 coPA

30 wood/70 coPA

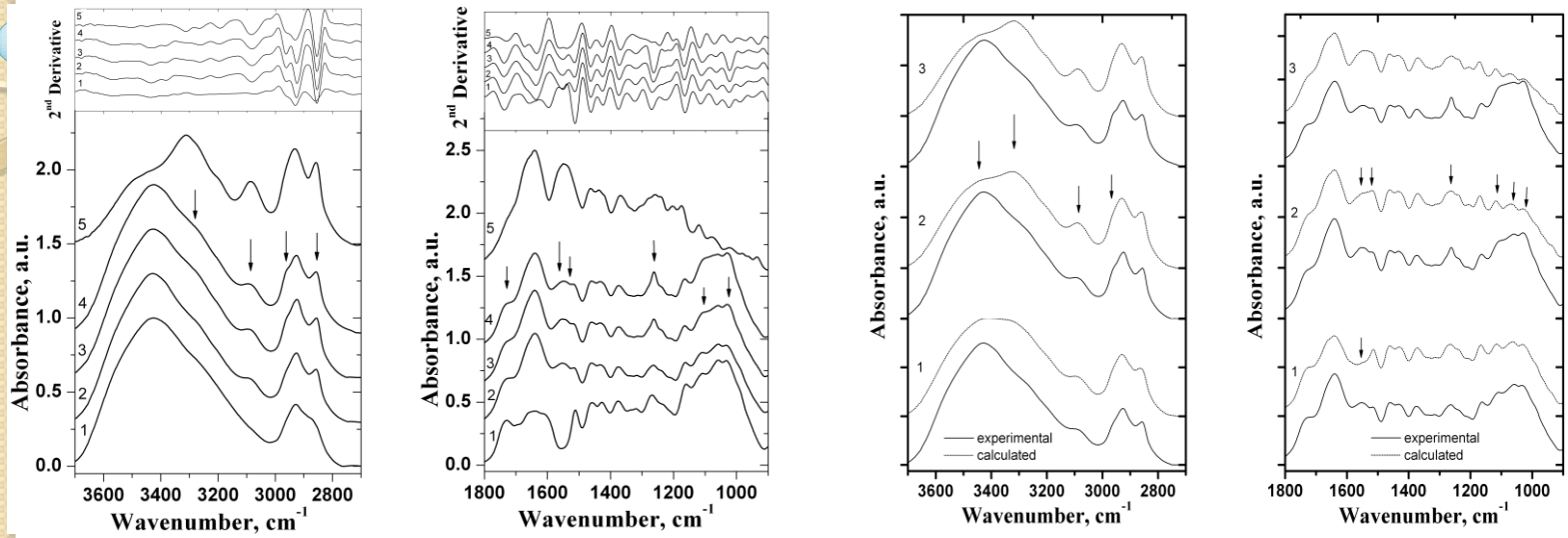
Methods

FT-IR spectroscopy

Principal Component Analysis

2D correlation spectroscopy

IR spectroscopy

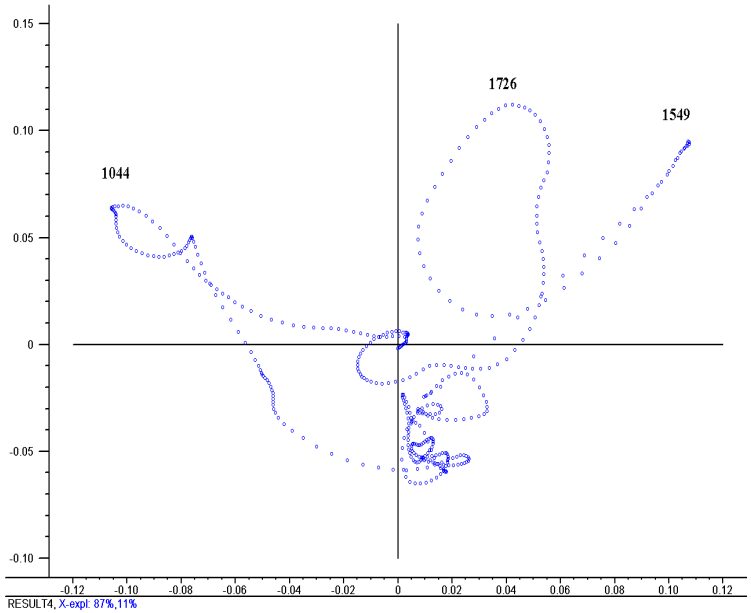


Upon increasing coPA content in the WPC, an increase of the absorbance of the bands at 3311 and 3200 cm^{-1} corresponding to the stretching vibrations (ν) of H-bonded OH groups and NH groups

In 900-1800 cm^{-1} region the band at 1549 cm^{-1} increases and the bands at 1511, 1107 and 1032 cm^{-1} decrease with increasing coPA content in WPC

With the aim of establising whether the blending determined spectral changes, the pure components spectra were taken into account and on the basis of additivity law the calculated spectra of the blends were obtained and compared with the experimental ones.

PCA



The important wavenumbers from loop apexes of the loadings plot are equally divided in importance between PC1 and PC2.

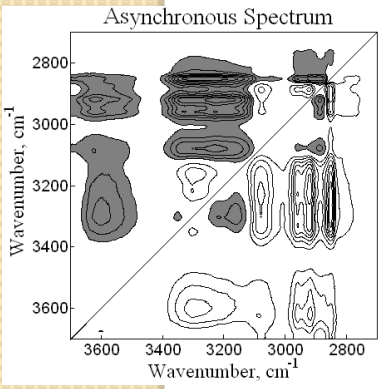
The bands located at 1044 cm^{-1} (asymmetric stretching vibration of CO groups), 1726 cm^{-1} (stretching vibration of C=O groups) and 1549 cm^{-1} (amide II) are sensitive to concentrationvariation

2D IR correlation spectroscopy

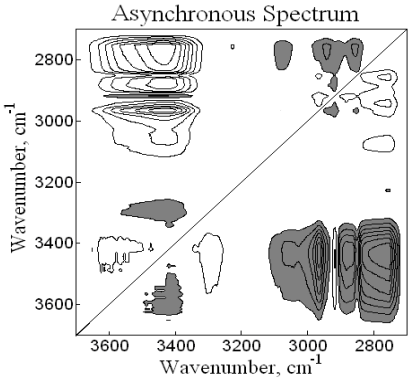
- **FT-IR spectra of wood and its composites with coPA were divided into two sets**

Set A: wood, 60% wood - 40% coPA, and 40% wood-60% coPA.

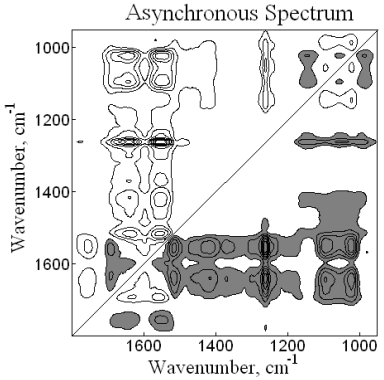
Set B: 40% wood-60% coPA, 30% wood-70% coPA and coPA.



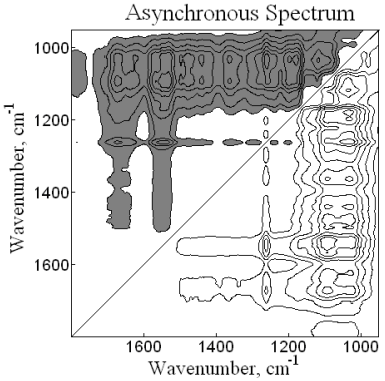
set A



set A

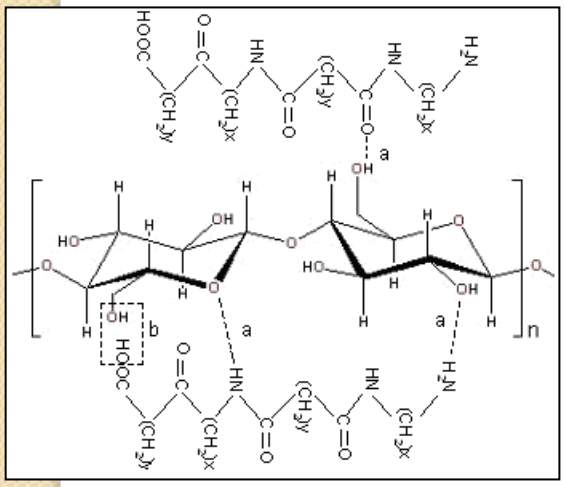


set B



set B

Conclusions



✓*There are at least two kinds of possible specific interactions:*

- ❖*Physical by hydrogen bonding between carbonyl or ester bonds and amide and hydroxyl group of lignocellulosic material (mainly cellulose).*
- ❖*Chemical interactions appearing at processing temperatures between end groups of coPA and primary –OH groups of cellulose*