



Faculty of Forestry, Zagreb University

Department for Furniture and Wood Products LABORATORY FOR WOOD IN CONSTRUCTION



Characterization of wood surface degradation using FTIR, microtensile testing and colour measurements

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San Michele All' Adige

20th – 21st April 2016

A technical workshop

“NIR & WOOD – sounds good



The background



The background

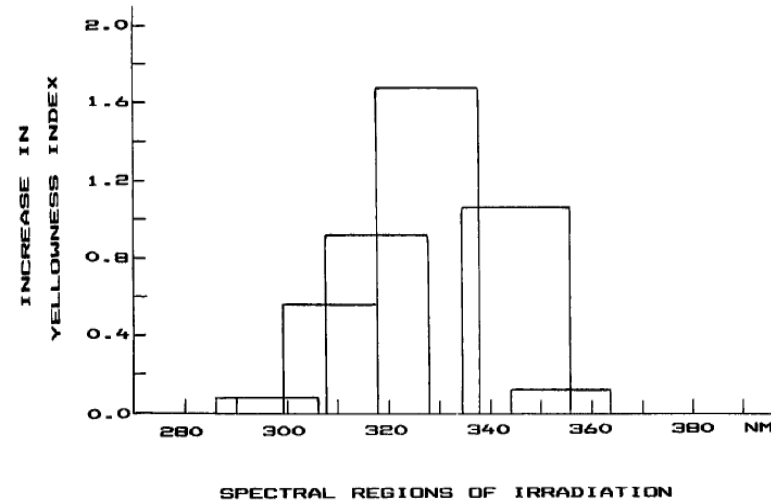


The background



Introduction

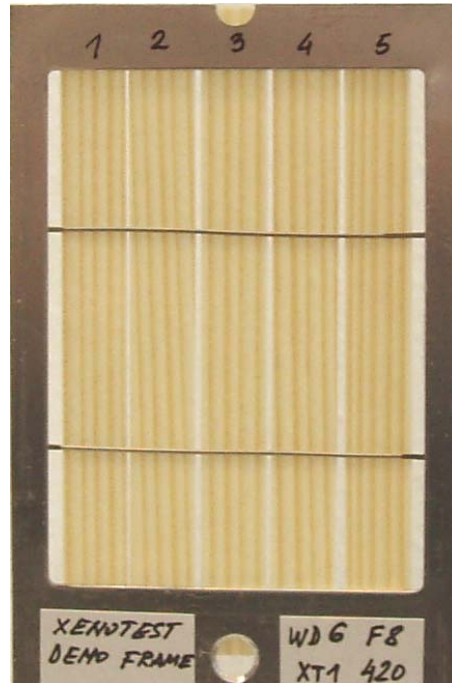
- *Activation spectra*
 - identify the wavelengths and effects on the damage to the material



Description of the problem

1. Identification of the most active wavelengths
2. Definition of a character and development changes during weathering
3. Determination of the depth of penetration of light and its consequences
4. Determination of light source dependence of these changes
5. Relations between the artificial and natural weathering regimes in studies of wood weathering

Materials and methods



- Collecting in order of slicing
- Thickness ($80 \pm 4 \mu\text{m}$)
- Initial colour
- Gluing on Aluminium frames



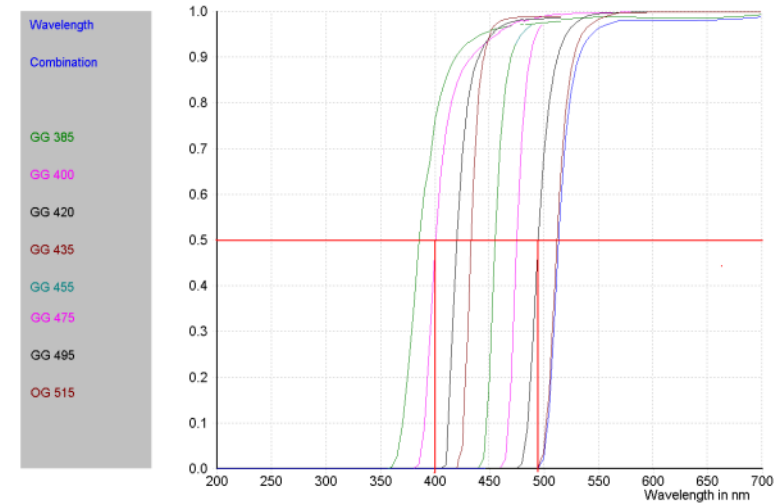
Glass filters



- 13 Schott optical long – pass filters
- Wavelengths – 295 to 515 nm + Alufoil

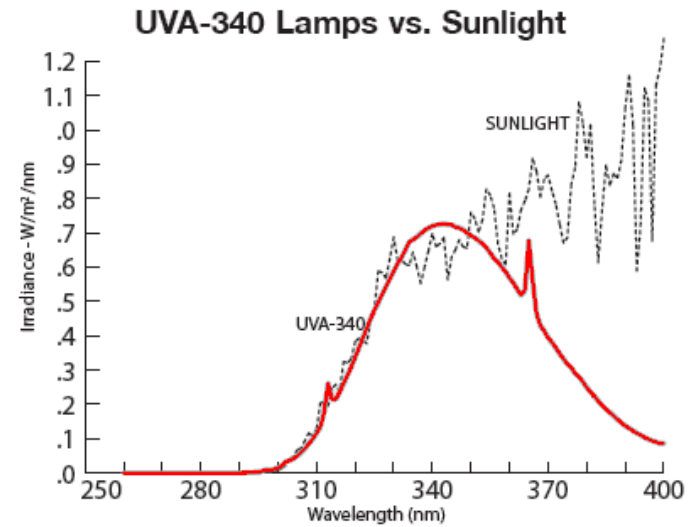
INTERNAL TRANSMITTANCE LINEAR

SCHOTT
glass made of ideas

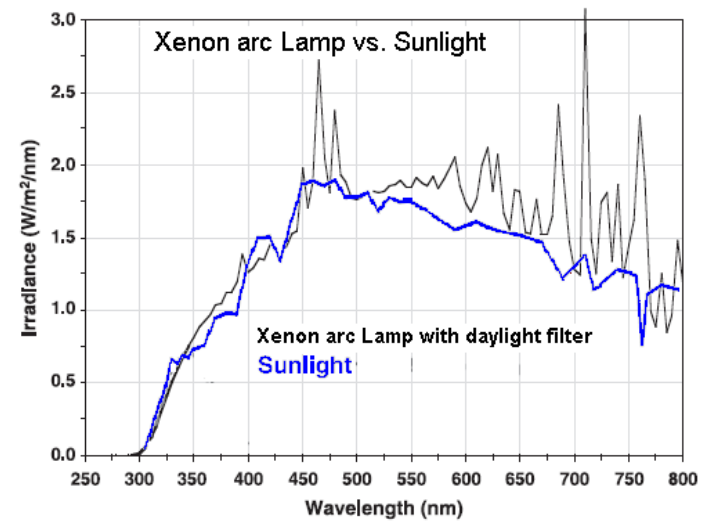


Exposures

■ UV



■ Xenon



VŽ1

reducirati tekst u bilješkama

Vjekoslav Živković, 8/13/2013

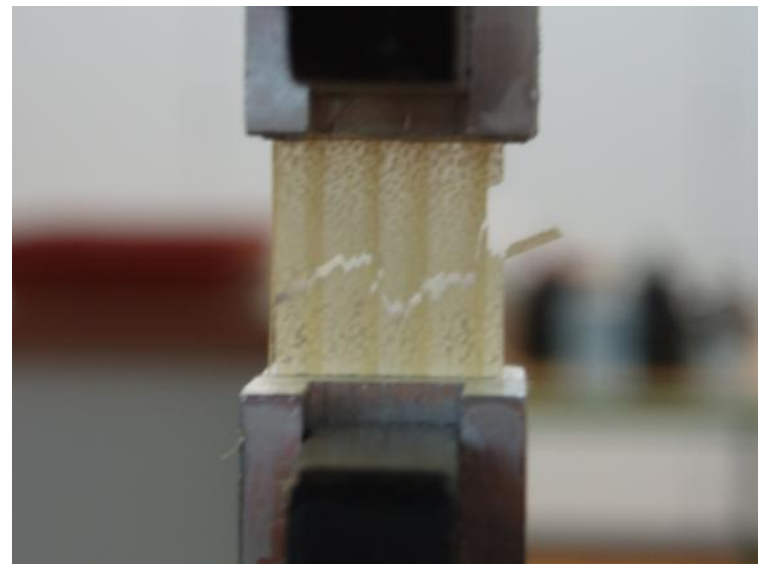
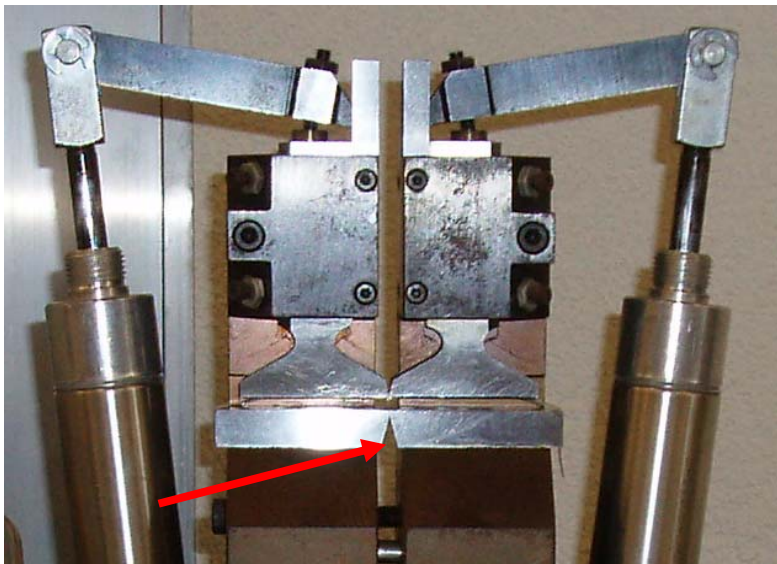
Exposures



- Natural
 - 14 Filters
 - Late spring – end of summer
(influence of the sun)
 - Withdrawals
 - After 12, 30, 60 & 90 days

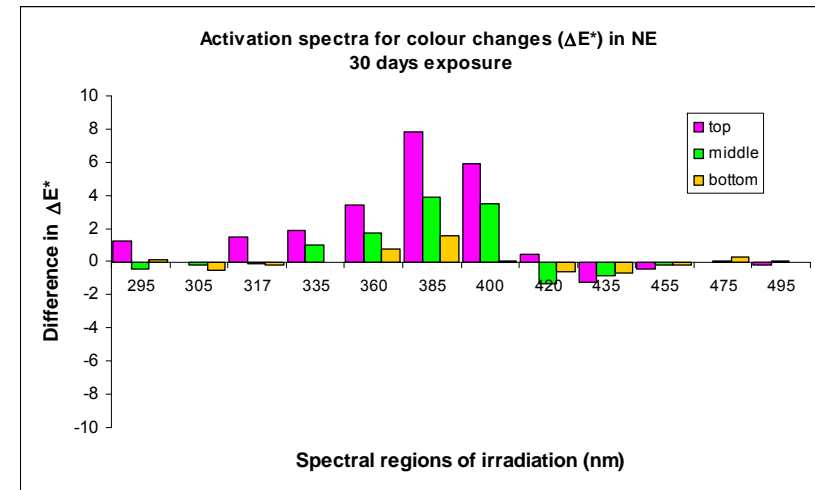
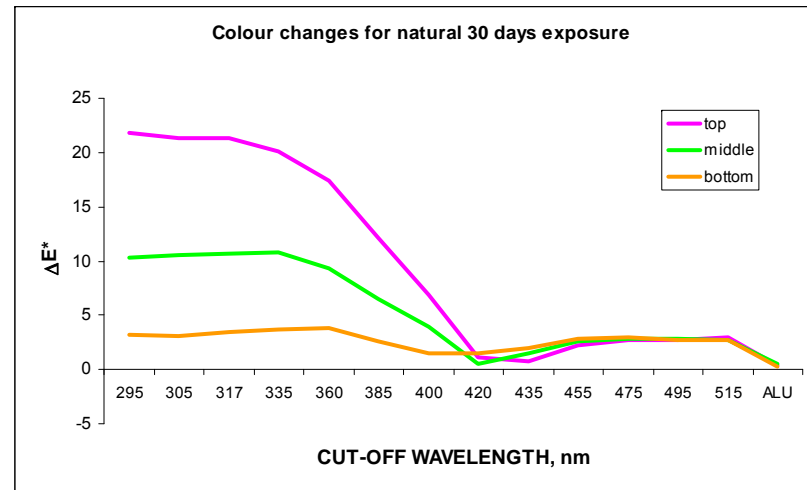
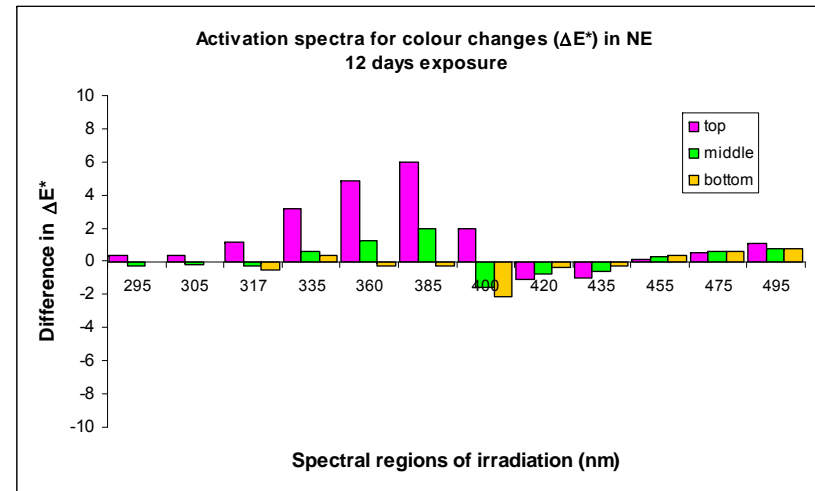
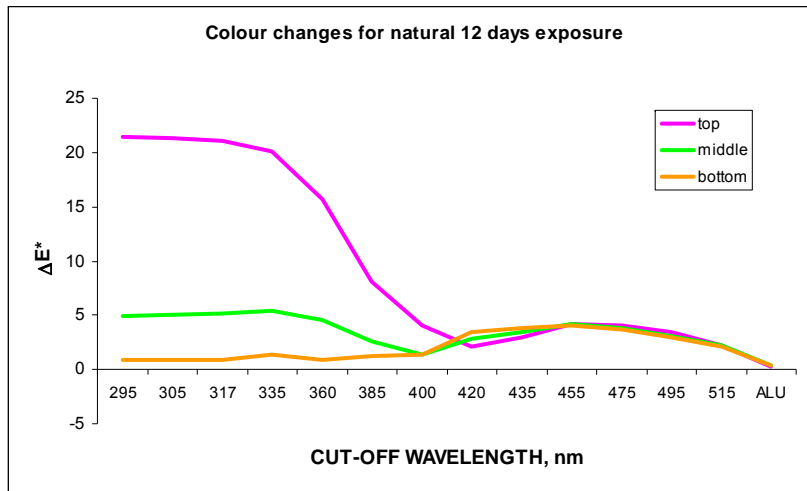
Testing

- ❑ Colour measurements on individual strips
- ❑ Zero span tensile strength
- ❑ 10 mm span tensile strength
- ❑ FTIR analysis



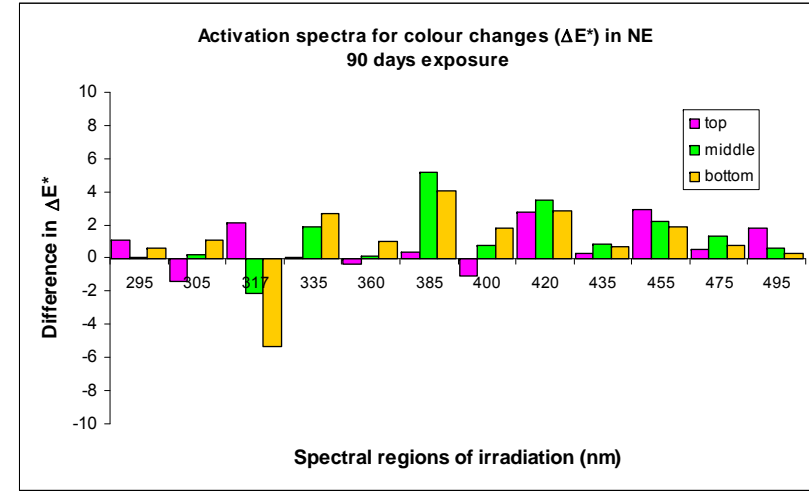
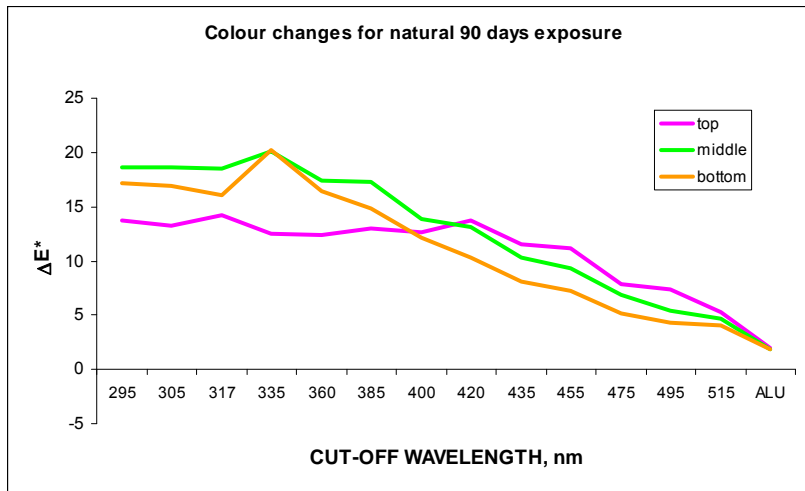
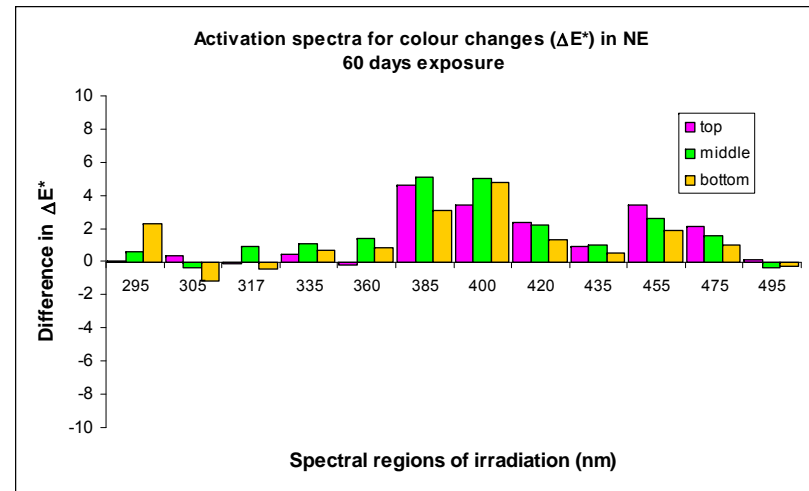
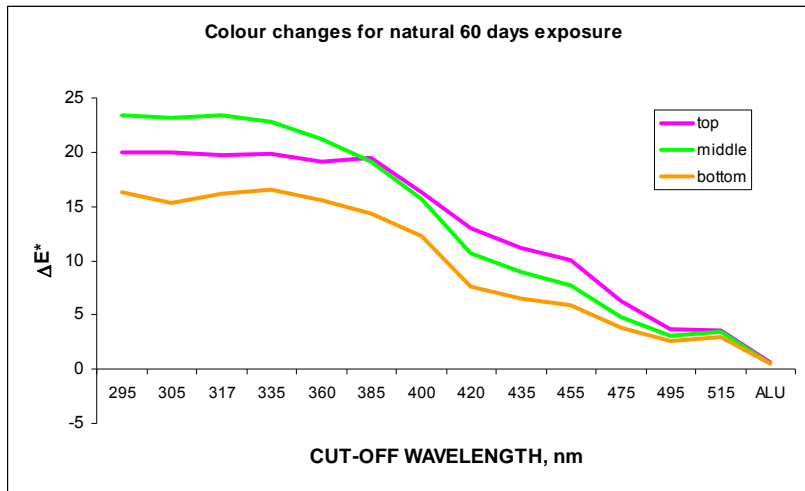
Natural exposure

COLOUR CHANGES



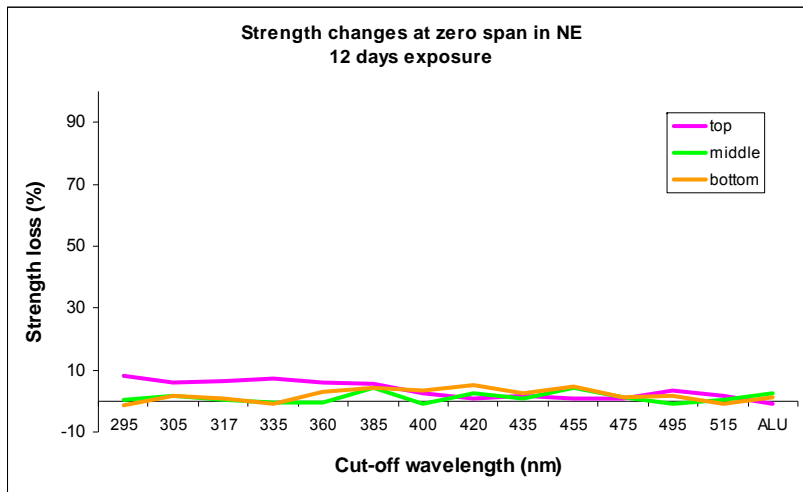
Natural exposure

COLOUR CHANGES

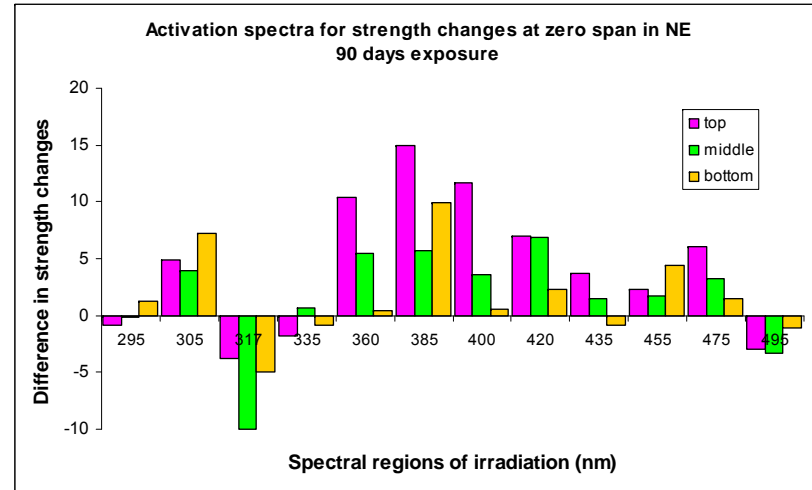
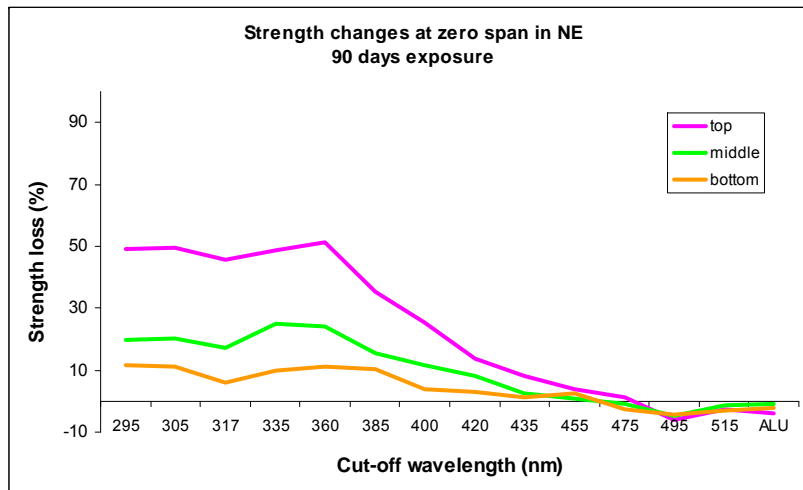
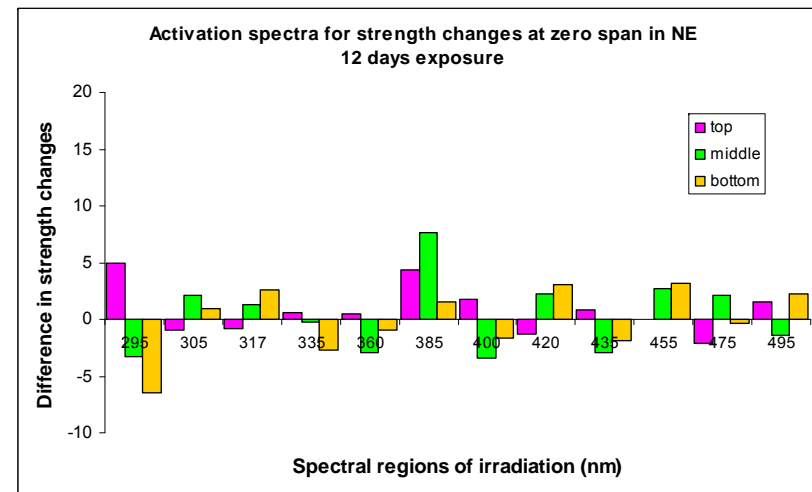


Natural exposure - ZERO SPAN STRENGTH LOSS

STRENGTH LOSS

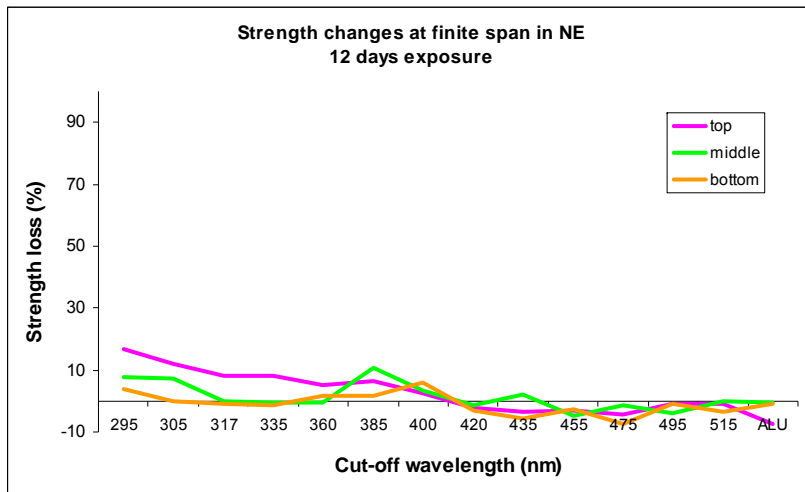


ACTIVATION SPECTRA

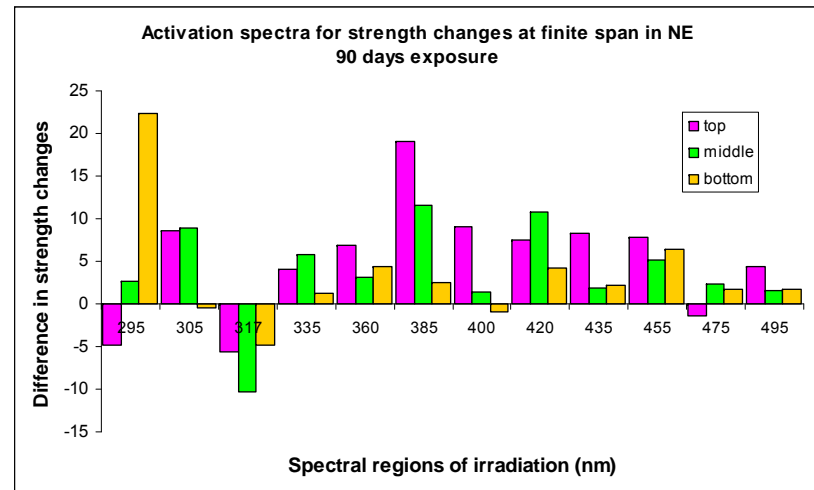
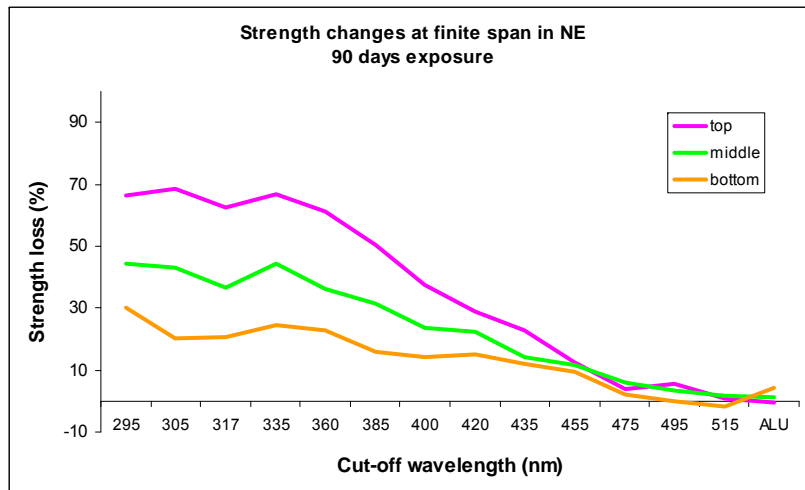
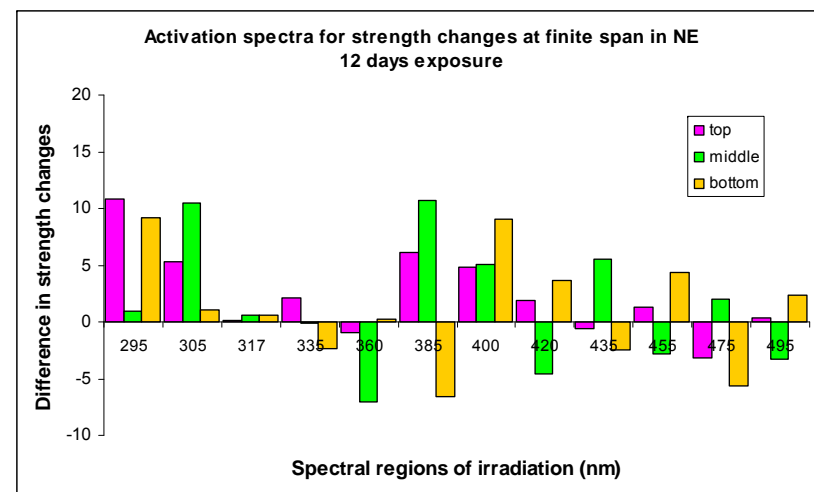


Natural exposure – 10 mm SPAN STRENGTH LOSS

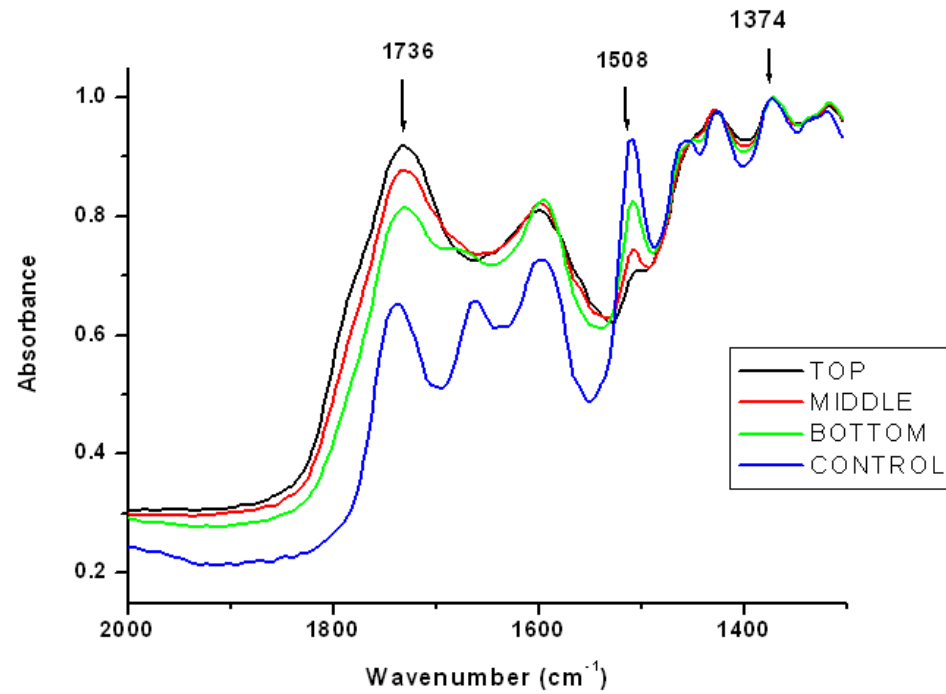
STRENGTH LOSS



ACTIVATION SPECTRA

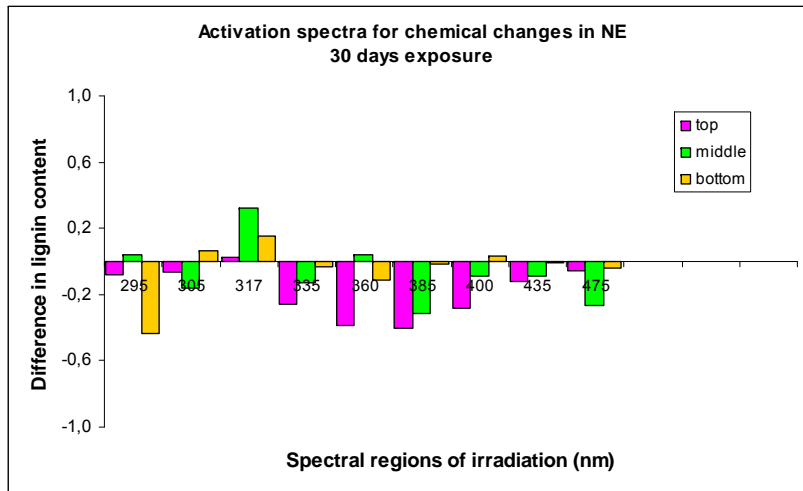


Natural exposure – CHEMICAL CHANGES – FTIR

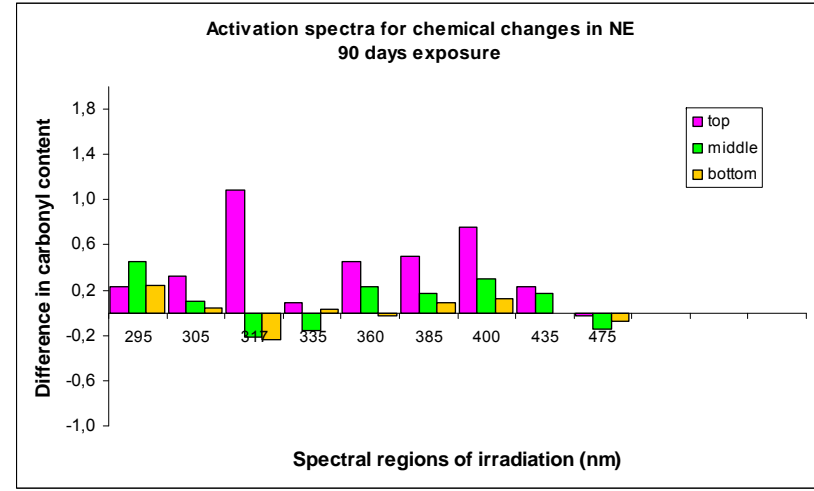
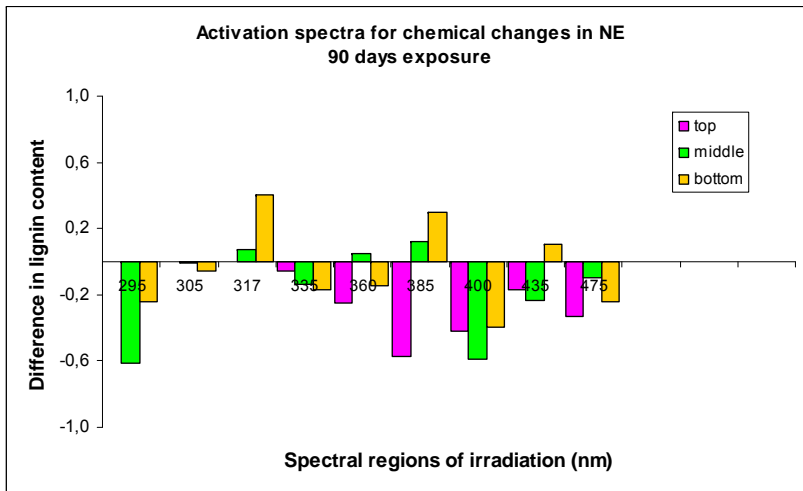
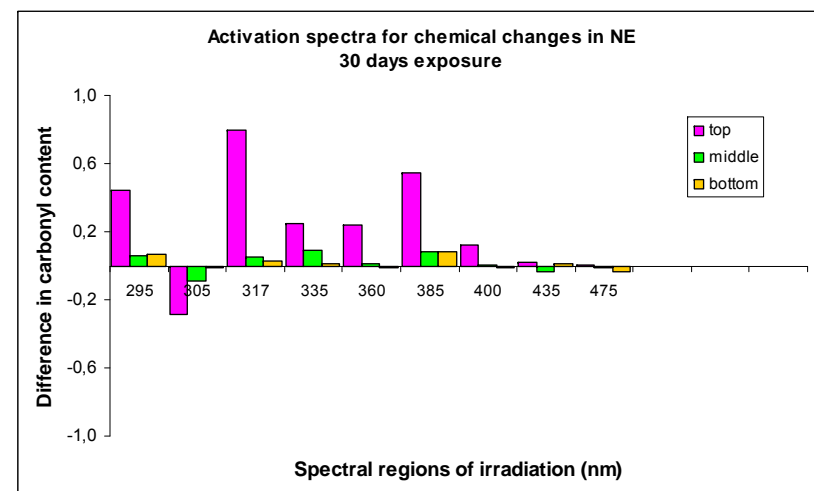


Natural exposure – CHEMICAL CHANGES

LIGNIN

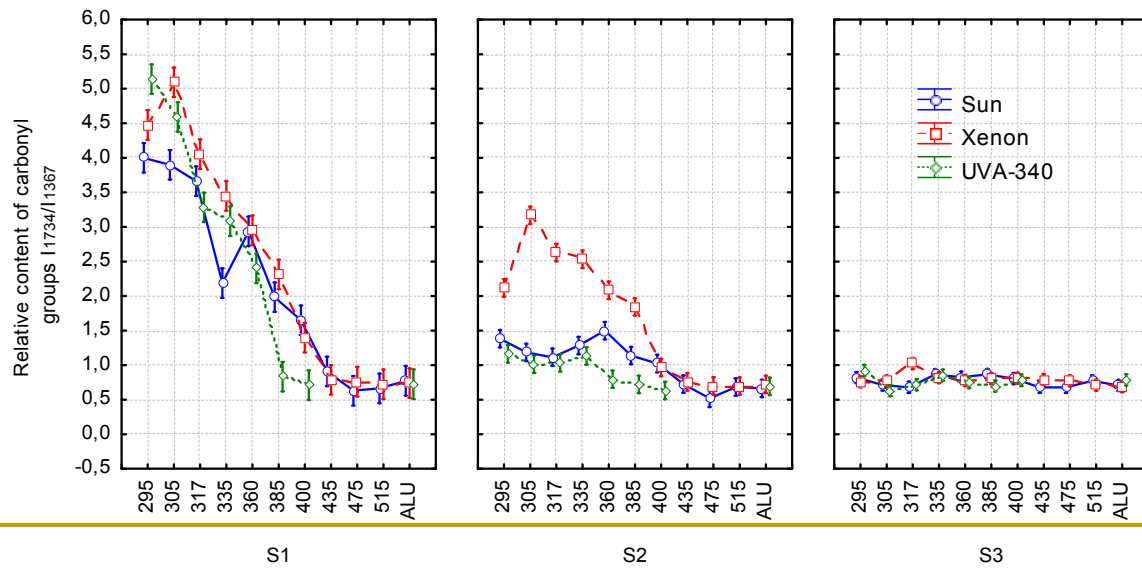
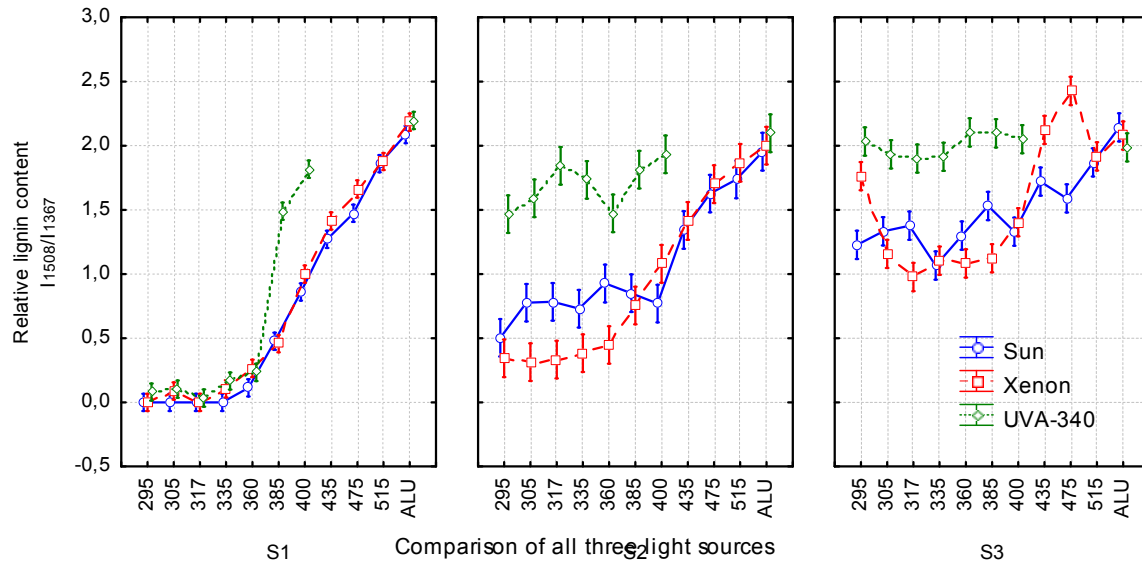


CARBONYL GROUPS



Comparison of chemical changes

Comparison of all three light sources



OPEN QUESTIONS

- exact depth of penetration of light and the consequences at that depth caused by different wavelengths
- unexpected influence of very narrow wavelength ranges to colour or micromechanical changes in only one light source, or only in deeper layers and not in the top layer
- the mechanism of surface degradation over time and in depth profile
- **THE MECHANISM OF CHEMICAL CHANGES!**

Thank you for the attention!



UNIVERSITY OF ZAGREB
FACULTY OF FORESTRY
CROATIA



27th International Conference on Wood Science and Technology - Ambienta 2016
“IMPLEMENTATION OF WOOD SCIENCE IN WOODWORKING SECTOR”
October 13th - 14th 2016

Conference topics should be related, but not limited to the following

- Properties of wood and wood based materials
- Wood processing technology
- Wood products, furniture and interior design
- Wood industry management
- Renewable energy from wooden biomass

Important dates

April 1st, 2016 – deadline for application and abstract submission

April 15th, 2016 – notification of acceptance of the abstract

June 10th, 2016 – deadline for submission of full papers